



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.

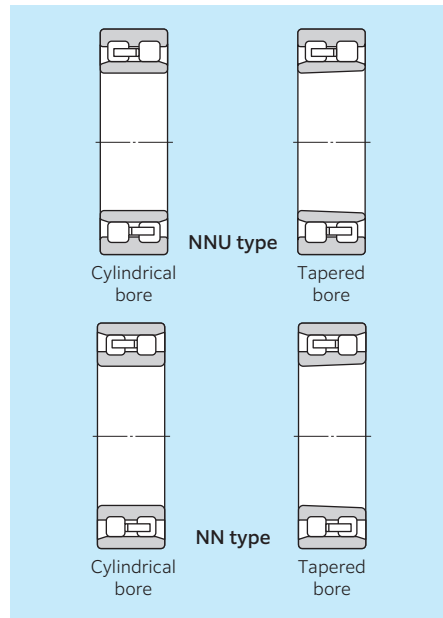


Fig. 10.1

10.2 Single-row cylindrical roller bearings

Single-row cylindrical roller bearings are available in two types, high speed N10HS type and ultra high speed N10HSRT6 type. The N10HS type bearings have high strength machined brass cages, while the N10HSR type bearings have PEEK resin cages, which can be used for both grease lubrication and air-oil lubrication. The eco-friendly N10HSLT6 type is a variation from the high speed N10HSRT6 type bearing and can be used with air-oil lubrication only.

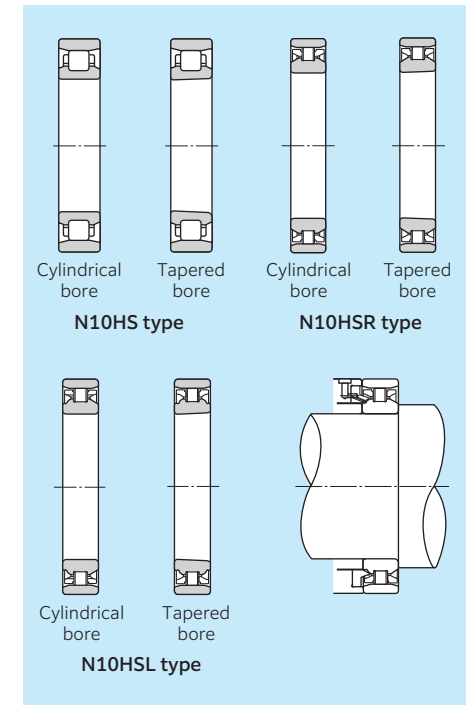


Fig. 10.2

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

N10 type

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

N10HSL 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

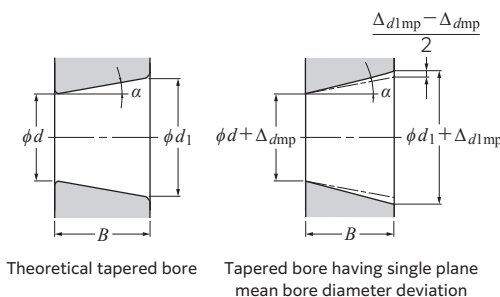
recommended for higher accuracy of the main bores. Refer to "6 Handling of Bearings, 6.8 Tapered bore cylindrical roller bearing and main spindle taper angle" in the Technical Data section for more information on taper angle.

Table 10.1 Tolerance of tapered bore bearings

Unit: μm

d (mm)		Δ_{dmp}				$\Delta_{d1mp} - \Delta_{dmp}$ (approx.)				V_{dsp}	
		Class 4 high	Class 4 low	Class 2 high	Class 2 low	Class 4 high	Class 4 low	Class 2 high	Class 2 low	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



Tolerance of 1/12 taper angle $4^{\circ}46'18.8'' \begin{smallmatrix} +24'' \\ 0 \end{smallmatrix}$
 $\alpha = 2^{\circ}23'9.4''$

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

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

Nominal bore diameter d		Deviation of mean bore diameter in a single plane Δ_{dmp}						Variation of bore diameter in a single plane V_{dsp}						Variation of mean bore diameter V_{dmp}			Radial runout of inner ring of assembled bearing K_{ia}		
mm		Class 5		Class 4 ¹⁾		Class 2 ²⁾		Diameter series 9			Diameter series 0			Class 5			Class 5		
over	incl.	high	low	high	low	high	low	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2
		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.

Table 10.3 Outer rings

Nominal outside diameter D		Deviation of mean outside diameter in a single plane Δ_{Dmp}						Variation of outside diameter in a single plane V_{Dsp}						Variation of mean outside diameter V_{Dmp}			Radial runout of outer ring of assembled bearing K_{ea}		
mm		Class 5		Class 4 ²⁾		Class 2 ²⁾		Diameter series 9			Diameter series 0			Class 5			Class 5		
over	incl.	high	low	high	low	high	low	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2
		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.

Unit: μm

Perpendicularity of inner ring face with respect to the bore S_d			Deviation of a single inner ring width Δ_{Bs}				Variation of inner ring width V_{Bs}		
			Single bearing						
Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 2
	max		high	low	high	low	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	—	—
—	—	—	—	—	—	—	—	—	—

Unit: μm

Perpendicularity of outer ring outside surface with respect to the face S_D			Deviation of a single outer ring width Δ_{Cs}		Variation of outer ring width V_{Cs}		
			All classes				
Class 5	Class 4	Class 2			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 internal clearance is "NA". Ex: N1006HSNA

Table 10.5 Tapered bore bearings

Unit: μm

Nominal bore diameter d (mm)		Tapered bore bearing									
		C9NA ²⁾		C0NA ²⁾		C1NA ²⁾		C2NA		NA ¹⁾	
		min	max	min	max	min	max	min	max	min	max
24	30	5	10	10	20	10	25	25	35	40	50
30	40	5	12	10	20	12	25	25	40	45	55
40	50	5	15	10	20	15	30	30	45	50	65
50	65	5	15	10	20	15	35	35	50	55	75
65	80	10	20	15	30	20	40	40	60	70	90
80	100	10	25	20	35	25	45	45	70	80	105
100	120	10	25	20	35	25	50	50	80	95	120
120	140	15	30	25	40	30	60	60	90	105	135
140	160	15	35	30	45	35	65	65	100	115	150
160	180	15	35	30	45	35	75	75	110	125	165
180	200	20	40	30	50	40	80	80	120	140	180
200	225	20	45	35	55	45	90	90	135	155	200
225	250	25	50	40	65	50	100	100	150	170	215
250	280	25	55	40	65	55	110	110	165	185	240
280	315	30	60	45	75	60	120	120	180	205	265
315	355	30	65	45	75	65	135	135	200	225	295
355	400	35	75	50	90	75	150	150	225	255	330
400	450	45	85	60	100	85	170	170	255	285	370
450	500	50	95	70	115	95	190	190	285	315	410

1) The code for normal internal clearance is "NA". Ex: N1006HSKNA

2) Internal clearances C9NA, C0NA and C1NA apply 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	
		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 are 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_{mn} values less than 0.75×10^6 the fits listed in **Table 10.7** and **Table 10.8** are recommended [d_{mn} : pitch circle diameter across rolling elements (mm) multiplied by speed (min^{-1})].

Table 10.7 Shaft fits Unit: μm

Nominal bore diameter d (mm)		Fit between inner ring and shaft
over	incl.	
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

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.

When the d_{mn} value is larger than 0.75×10^6 (d_{mn} 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 10.8 Housing fits Unit: μm

Nominal outside diameter D (mm)		Fit between outer ring and housing
over	incl.	
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

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

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 four 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_{mn} value ($\times 10^6$)		Oil amount per shot cm^3	Lubrication interval min	Oil consumption cm^3/h	Recommended air consumption $\text{NL}/\text{min}^{1)}$
	Over	Incl.				
NN30	—	1.0	0.02	8	0.15	30 to 40
NN30HS	1.0	1.5		5	0.24	
N10HS	1.5	2.3		5	0.24	
N10HSRT6	1.5	2.3		5	0.24	
NN30HST6	—	1.7		15	0.08	20 to 40
NN30HSRT6	—	1.7		15	0.08	
N10HSL	—	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.

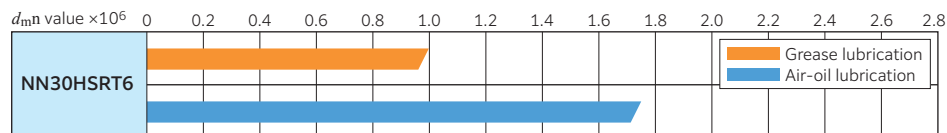
10.9 **ULTAGE** Ultra high speed double-row cylindrical roller bearings NN30HSRT6 type

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.

■ 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

■ Bearing specification

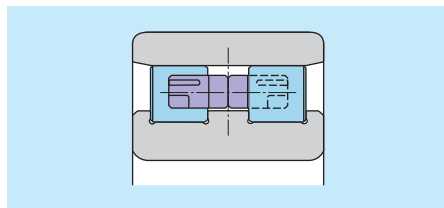


Fig. 10.4 NN30HSRT6 type

■ Data/Operation test

d_{mn} value of 1.0×10^6 under grease lubrication and 1.75×10^6 under air-oil lubrication are realized by the optimized internal design (see **Fig. 10.5**, **Fig. 10.6**).

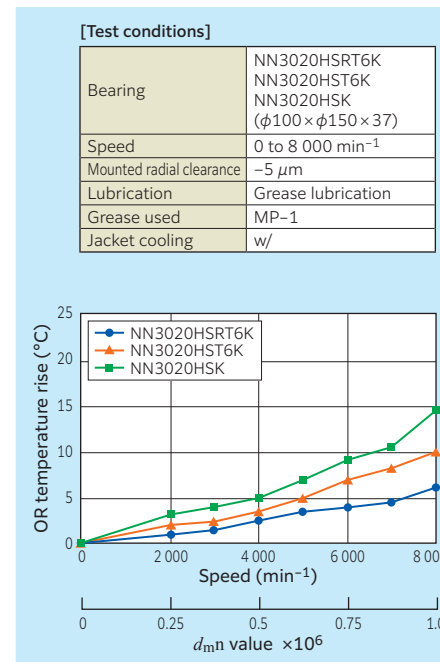


Fig. 10.5 Operation test results (grease lubrication with jacket cooling)

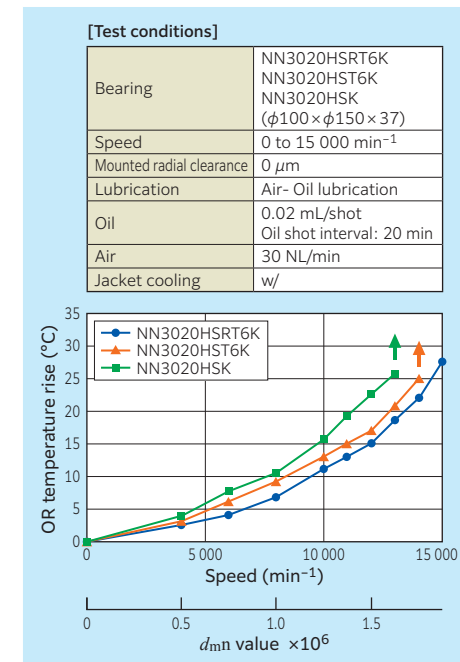


Fig. 10.6 Operation test results (air-oil lubrication with jacket cooling)

■ 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 1.0×10^6 (see **Fig. 10.7**).

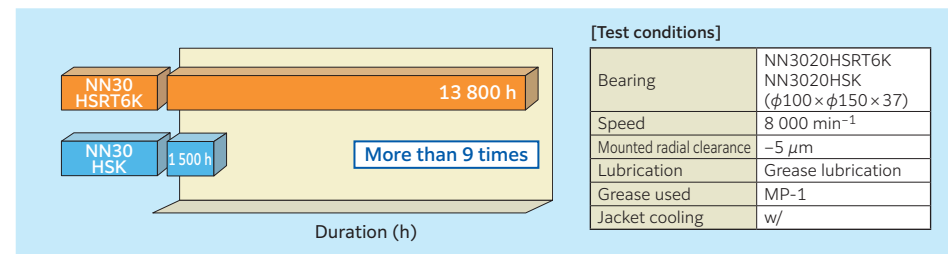


Fig. 10.7 Durability test results

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

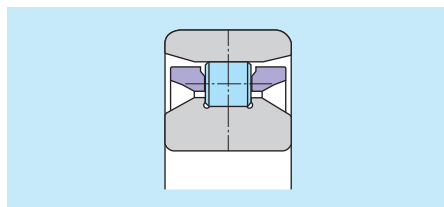
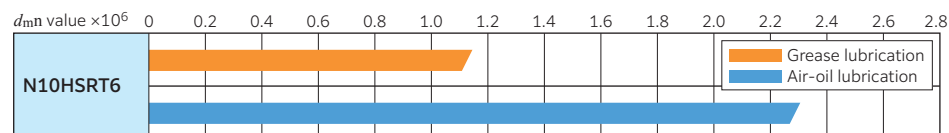


Fig. 10.8 N10HSRT6 type

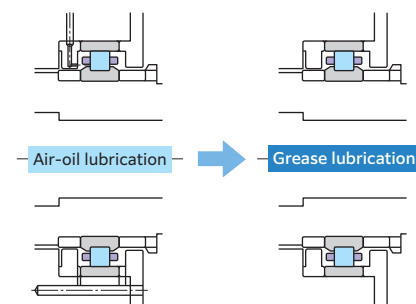
■ Permissible speed range



Notes) Permissible speed of each bearing (d_{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.

■ 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).

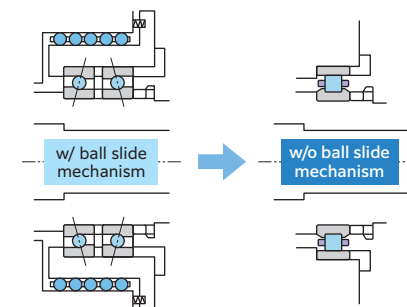


Capable of replacing air-oil lubricated bearings up to d_{mn} value of 1.15×10^6 .

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_{mn} 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_{mn} value of 1.15×10^6 [grease lubrication] or 2.3×10^6 [air-oil lubrication] (see Fig. 10.11, Fig. 10.12, Fig. 10.13, Fig. 10.14).

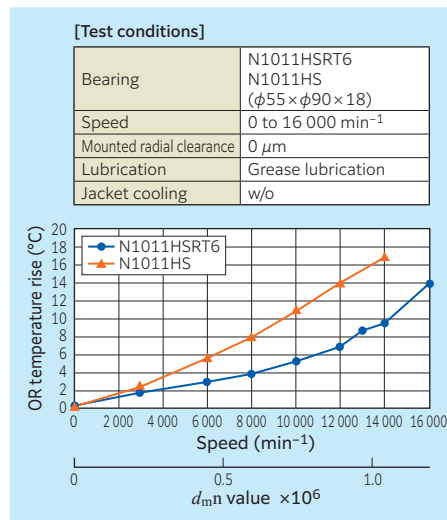


Fig. 10.11 High speed test results (grease lubrication without jacket cooling)

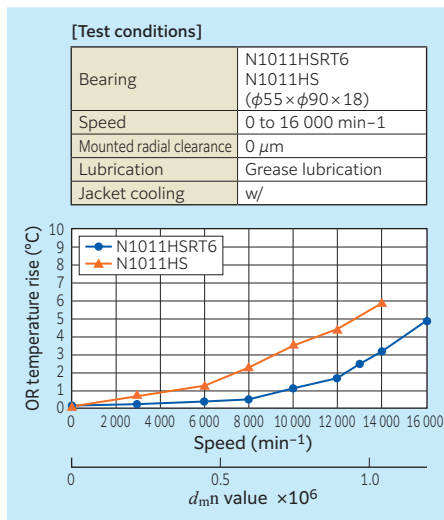


Fig. 10.12 High speed test results (grease lubrication with jacket cooling)

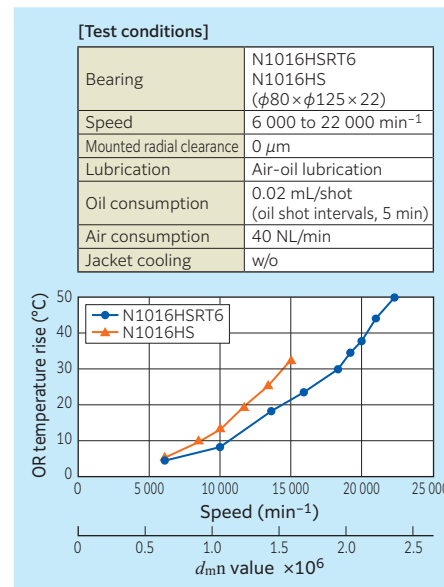


Fig. 10.13 High speed test results (air-oil lubrication without jacket cooling)

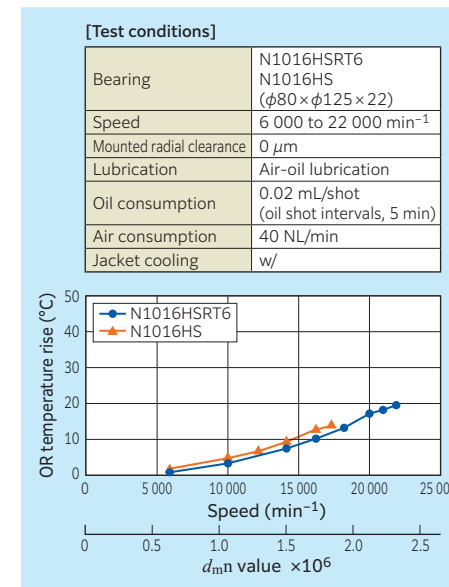


Fig. 10.14 High speed test results (air-oil lubrication with jacket cooling)

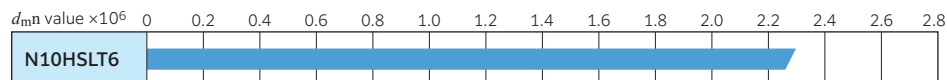
10.11 **ULTAGE** Eco-friendly air-oil lubricated ultra high speed single-row cylindrical roller bearings N10HSLT6 type

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.

■ 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.

■ Bearing specification

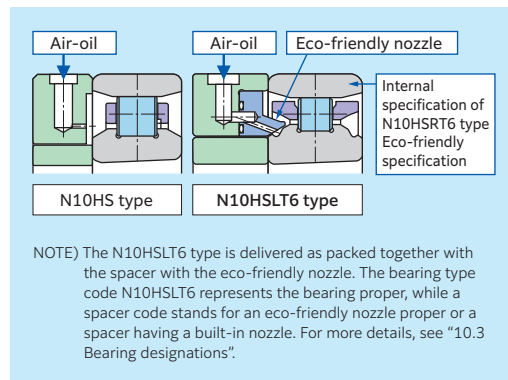


Fig. 10.15 N10HSLT6 type

■ 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 2.3×10^6 (see Fig. 10.16, Fig. 10.17).

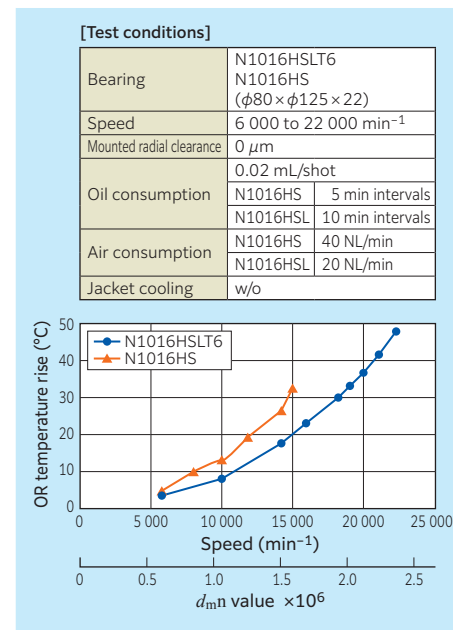


Fig. 10.16 High speed test results (without Jacket cooling)

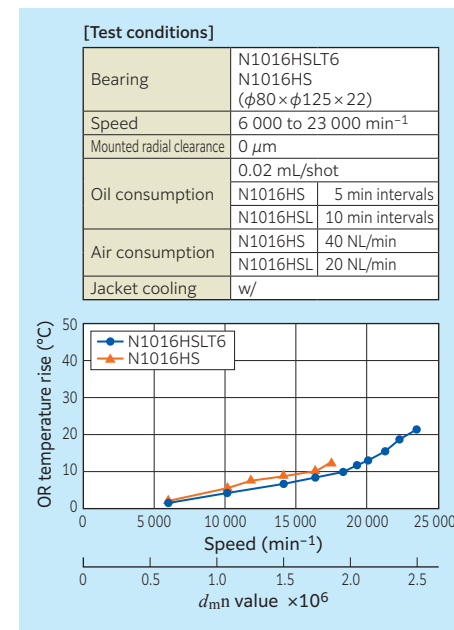
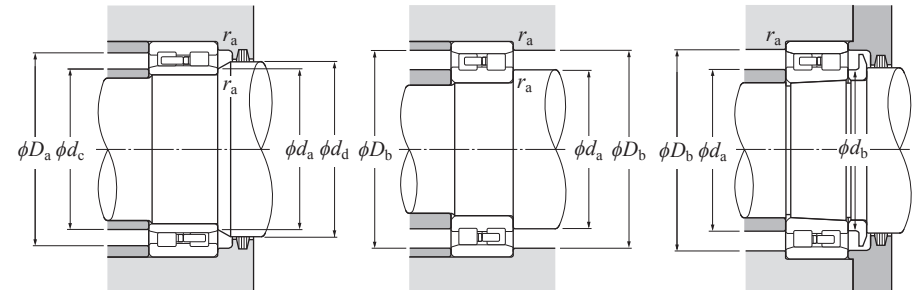
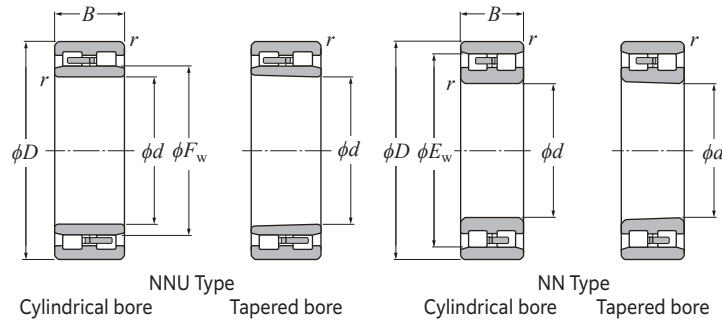


Fig. 10.17 High speed test results (with Jacket cooling)

ULTAGE Double-row cylindrical roller bearings

Dynamic equivalent
radial load
 $P_r = F_r$

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



d 25–95 mm

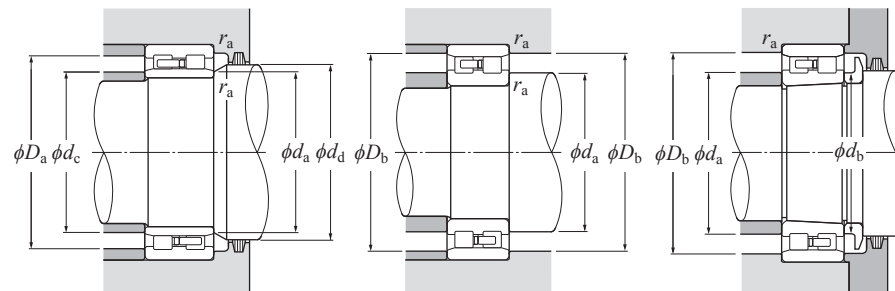
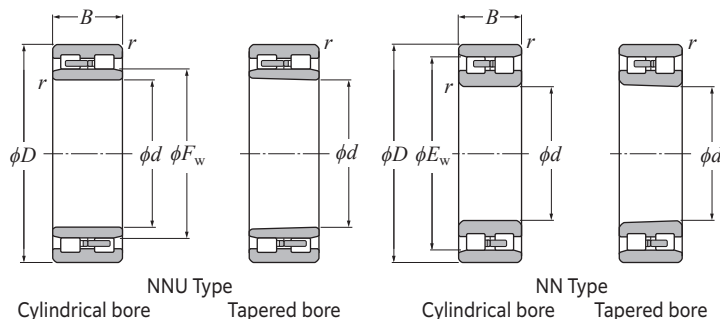
Part number				Boundary dimensions				Basic load ratings				Allowable speed		Dimensions		Abutment and fillet dimensions								Mass				Internal free space
NNU Type		NN Type		mm				dynamic	static	dynamic	static	grease	oil	mm		mm								kg (approx.)		NN Type		cm ³
cylindrical bore	tapered bore ¹⁾	cylindrical bore	tapered bore ¹⁾	d	D	B	r _{s min} ²⁾	C _r	C _{0r}	C _r	C _{0r}	lubrication	lubrication	F _w	E _w	d _a	d _b	d _c	d _d	D _a	D _b	r _{as}	cylindrical bore	tapered bore	cylindrical bore	tapered bore	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
 $P_{0r} = F_r$



d 100–180 mm

Part number				Boundary dimensions			Basic load ratings					Allowable speed		Dimensions		Abutment and fillet dimensions							Mass				Internal free space cm ³	
NNU Type		NN Type		mm			dynamic	static	dynamic	static	grease lubrication	oil lubrication	mm		mm							kg (approx.)		NN Type				
cylindrical bore	tapered bore ¹⁾	cylindrical bore	tapered bore ¹⁾	d	D	B	r _{s min} ²⁾	C _r	C _{0r}	C _r	C _{0r}			F _w	E _w	d _a min	d _b min	d _c max	d _d min	D _a max	D _b max	r _{as} max	NNU Type cylindrical bore	tapered bore	NN Type cylindrical bore	tapered bore		
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).

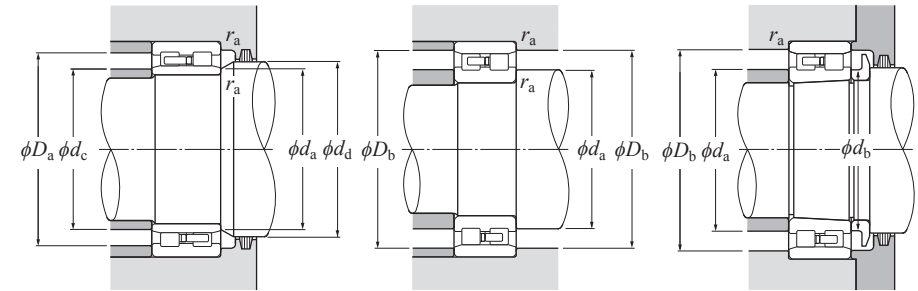
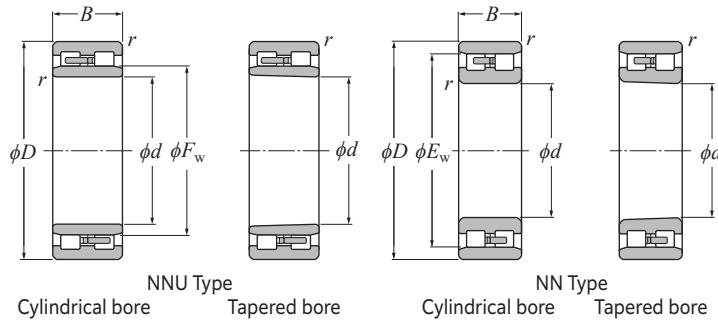
2) Minimum allowable value for corner radius dimension r.

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
 $P_{0r} = F_r$

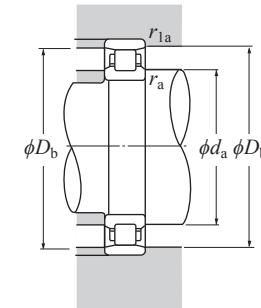
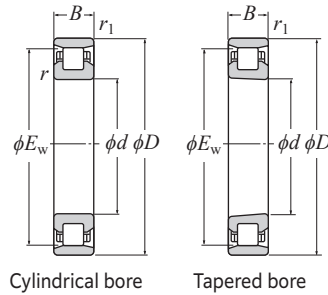


d 190–500 mm

Part number				Boundary dimensions				Basic load ratings				Allowable		Dimensions		Abutment and fillet dimensions								Mass				Internal free space cm ³
NNU Type		NN Type		mm				dynamic kN	static	dynamic kgf	static	grease min ⁻¹	oil	mm		mm								kg (approx.)				
cylindrical bore	tapered bore ¹⁾	cylindrical bore	tapered bore ¹⁾	d	D	B	r _{s min} ²⁾	C _r	C _{0r}	C _r	C _{0r}			F _w	E _w	d _a min	d _b min	d _c max	d _d min	D _a max	D _b max	r _{as} min	NNU Type cylindrical bore	NN Type tapered bore	cylindrical bore	tapered bore		
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 .

High speed single-row cylindrical roller bearings



Dynamic equivalent radial load
 $P_r = F_r$

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

d 30–80 mm

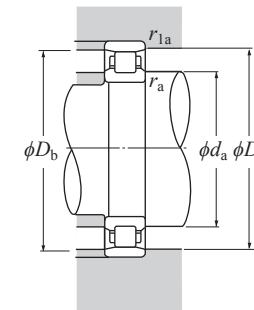
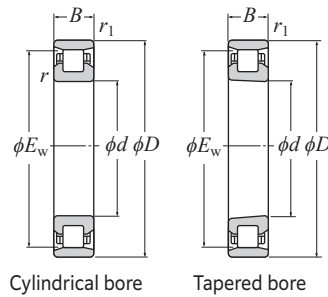
Part number ^{1) 3)}		Boundary dimensions							Basic load ratings				Allowable speed		Abutment and fillet dimensions					Mass (approx.) kg	Internal free space cm ³	Part number	
cylindrical bore	tapered bore	mm							dynamic kN	static	dynamic kgf	static	min ⁻¹		mm							cylindrical bore	tapered bore
		d	D	B	r _s min ²⁾	r _{1s} min ²⁾	E _w						grease lubrication	oil lubrication	d _a min	D _b max	r _{as} min	r _{1as} max	cylindrical 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 r₁.

3) N10HS differs from standard N10 in internal construction.

High speed single-row cylindrical roller bearings



Dynamic equivalent radial load
 $P_r = F_r$

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

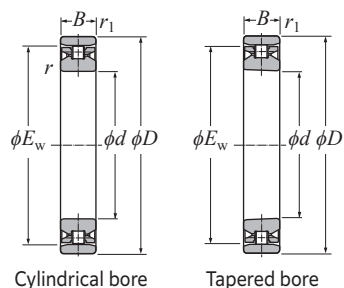
d 85–160 mm

Part number ^{1) 3)}		Boundary dimensions						Basic load ratings				Allowable speed		Abutment and fillet dimensions						Mass	Internal	Part number	
cylindrical bore	tapered bore	mm						dynamic kN	static	dynamic	static	min ⁻¹		mm						(approx.) kg	free space cm ³	cylindrical bore	tapered bore
		<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> _{s min⁻²⁾}	<i>r</i> _{ls min⁻²⁾}	<i>E</i> _w	<i>C</i> _T	<i>C</i> _{0r}	<i>C</i> _T	<i>C</i> _{0r}	grease lubrication	oil lubrication	<i>d</i> _a min	<i>D</i> _b max	min	<i>r</i> _{as} max	<i>r</i> _{las} max	cylindrical 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.



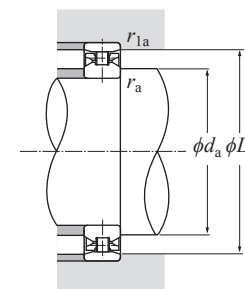
Cylindrical bore

Tapered bore

d 45–100 mm

Part number		Boundary dimensions						Basic load ratings				Allowable speed		Abutment and fillet dimensions					Internal free space cm ³	Part number		
cylindrical bore	tapered bore	mm						dynamic	static	dynamic	static	min ⁻¹		<i>d</i> _a min	mm			<i>r</i> _{as} max		<i>r</i> _{1as} max	cylindrical bore	tapered bore
		<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> _{s min⁽¹⁾}	<i>r</i> _{1s min⁽¹⁾}	<i>E</i> _w	<i>C</i> _r	<i>C</i> _{0r}	<i>C</i> _r	<i>C</i> _{0r}	grease lubrication	oil lubrication		<i>D</i> _b max	min	<i>r</i> _{as} max					
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) Minimum allowable value for corner radius dimension r or r₁.



Dynamic equivalent
radial load
 $P_r = F_r$

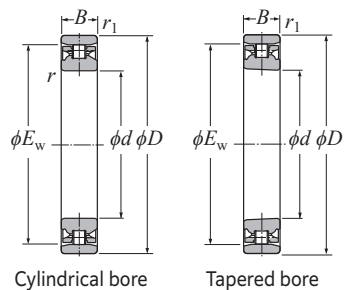
Static equivalent
radial load
 $P_{0r} = F_r$

Cylindrical Roller Bearings

Dimension Tables

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

NTN

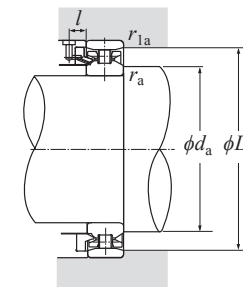


Cylindrical bore

Tapered bore

d 55–100 mm

Part number		Boundary dimensions						Basic load ratings				Allowable speed min ⁻¹ oil lubrication	Abutment and fillet dimensions						Part number	
cylindrical bore	tapered bore	mm						dynamic kN	static	dynamic	static		mm						cylindrical bore	tapered bore
		<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> _{s min⁽¹⁾}	<i>r</i> _{ls min⁽¹⁾}	<i>E</i> _w	<i>C</i> _r	<i>C</i> _{0r}	<i>C</i> _r	<i>C</i> _{0r}		<i>d</i> _a min	<i>D</i> _b max	<i>r</i> _{as} max	<i>r</i> _{las} max	<i>l</i> ⁽²⁾ min			
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



Dynamic equivalent
radial load
 $P_r = F_r$

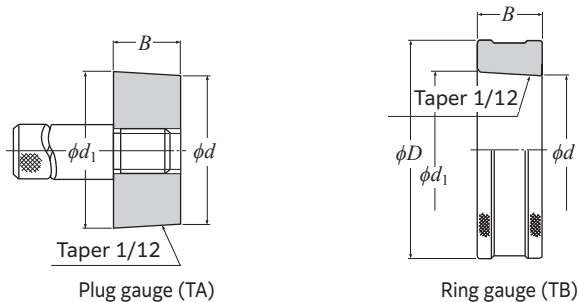
Static equivalent
radial load
 $P_{0r} = F_r$

1) Minimum allowable value for corner radius dimension r or r_1 .
2) For the details of spacer dimensions, please contact **NTN** Engineering.

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

Dimension table for taper gauge

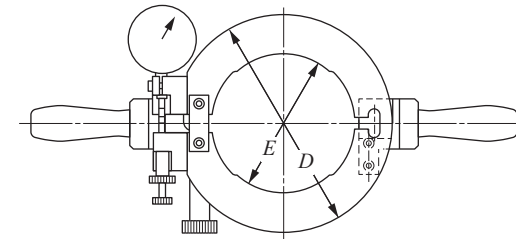


Part number		Applicable bearing		Boundary dimensions				Mass (approx.) kg	
Plug gauge	Ring gauge			mm				TA type	TB type
				d	d ₁	D	B		
TANN3006K	TBNN3006K	N1006HSK	NN3006K	30	31.583	70	19	0.2	0.5
TANN3007K	TBNN3007K	N1007HSK	NN3007K	35	36.667	75	20	0.3	0.6
TANN3008K	TBNN3008K	N1008HSK	NN3008K	40	41.750	80	21	0.3	0.7
TANN3009K	TBNN3009K	N1009HSK	NN3009K	45	46.917	85	23	0.4	0.7
TANN3010K	TBNN3010K	N1010HSK	NN3010K	50	51.917	90	23	0.5	0.8
TANN3011K	TBNN3011K	N1011HSK	NN3011K	55	57.167	95	26	0.7	0.9
TANN3012K	TBNN3012K	N1012HSK	NN3012K	60	62.167	100	26	0.8	1.0
TANN3013K	TBNN3013K	N1013HSK	NN3013K	65	67.167	105	26	0.9	1.1
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	1.7	1.9
TANN3017K	TBNN3017K	N1017HSK	NN3017K	85	87.833	130	34	1.9	2.0
TANN3018K	TBNN3018K	N1018HSK	NN3018K	90	93.083	140	37	2.4	2.6
TANN3019K	TBNN3019K	N1019HSK	NN3019K	95	98.083	145	37	2.6	2.7
TANN3020K	TBNN3020K	N1020HSK	NN3020K	100	103.083	150	37	2.8	2.8
TANN3021K	TBNN3021K	N1021HSK	NN3021K	105	108.417	160	41	3.5	3.6
TANN3022K	TBNN3022K	N1022HSK	NN3022K	110	113.750	165	45	4.0	4.1
TANN3024K	TBNN3024K	N1024HSK	NN3024K	120	123.833	170	46	4.7	4.1
TANN3026K	TBNN3026K	N1026HSK	NN3026K	130	134.333	180	52	6.4	4.8
TANN3028K	TBNN3028K	N1028HSK	NN3028K	140	144.417	190	53	7.4	5.2
TANN3030K	TBNN3030K	N1030HSK	NN3030K	150	154.667	210	56	8.4	7.2
TANN3032K	TBNN3032K	N1032HSK	NN3032K	160	165.000	220	60	10	8.1

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 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