



## Main Spindle Bearings

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## 10. Cylindrical Roller Bearings

In a cylindrical roller bearing, the rollers and raceways are in linear contact. Consequently this type of bearing can support a larger radial load than a point-contact ball bearing. Also, its structure 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.

### 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 type (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.

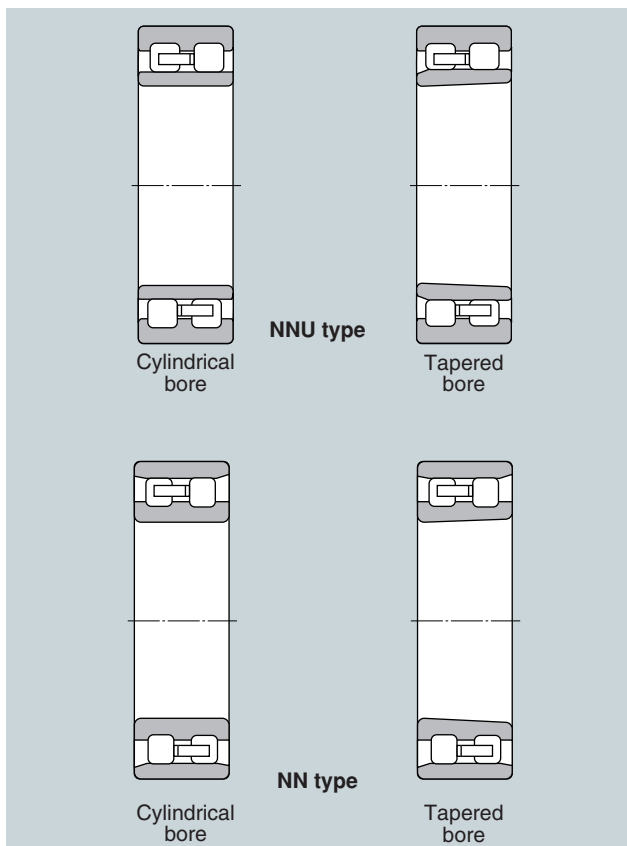


Fig. 10.1

### 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 special molded 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.

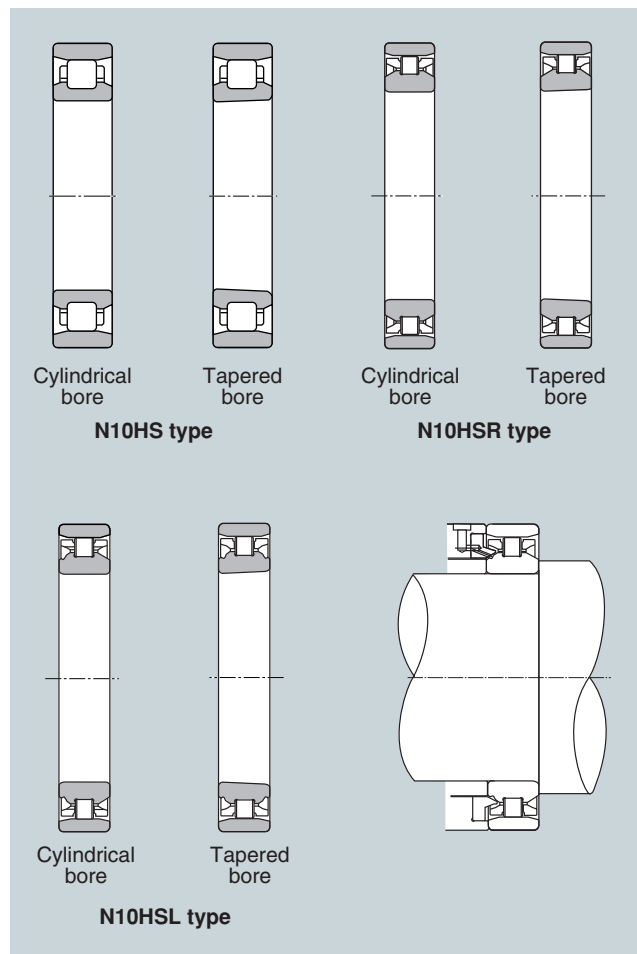


Fig. 10.2

③ Bearing designations

**NN49, 30, NNU49 type**

**NN 30 20 HS RT6 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 10.4~10.6**

**External configuration code** K : Tapered inner ring bore, taper ratio1/12  
No code : Cylindrical inner ring bore

No code : Machined brass bore  
T6 : Molded PEEK 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 with ribbed inner ring  
NNU : Double row with ribbed outer ring

**N10HS, N10HSR type**

**N 10 20 HSR T6 K C0NA P4**

**Cage code**  
T6 : Molded PEEK 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 with ribbed inner ring

**N10HSL type**

**N 10 20 HSL T6 K C0NA P4 +TKZ**

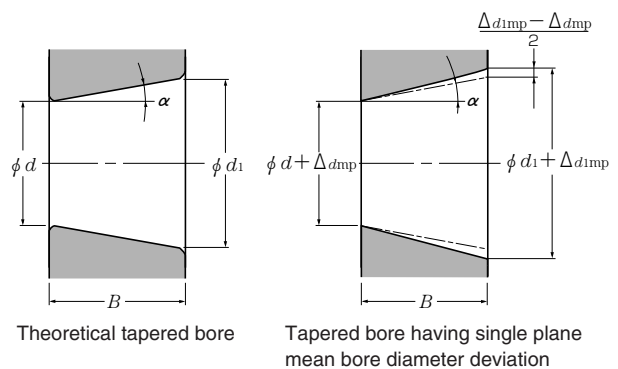
**Spacer code**  
(Eco-friendly nozzle)

**Cage code**  
T6 : PEEK resin mold cage

**Internal modification code**

④ Accuracy of tapered bore

NTN specifies the accuracies of tapered bores conforming with JIS Classes 4 and 2 as shown below. Poor accuracies of the tapered bore lead to misalignment of the inner ring, causing poor performance, premature seizure and flaking. Use of a taper gauge is recommended for higher accuracy of the main spindle. Refer to "6 Handling of Bearings, ⑧ Tapered bore cylindrical roller bearing and main spindle taper angle" in the Technical Data section for more information on taper angle.



Tolerance of 1/12 taper angle  $4^{\circ}46'18.8''^{+24}_0$

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

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

$V_{dp}$  : Single radial plane bore diameter variation  
 $\Delta d_{mp}$  : Single plane mean bore diameter deviation (at theoretical small end on tapered bore)  
 $\Delta d_{1mp}$  : Single plane mean bore diameter deviation (at theoretical large end on tapered bore)  
 $B$  : Nominal inner ring width

Fig. 10.3

Table 10.1 Tolerance of taper-bored bearings

Unit:  $\mu\text{m}$

d mm	$\Delta d_{mp}$	Class 4		Class 2		$\Delta d_{1mp} - \Delta d_{mp}$ (approx.)				$V_{dp}$	
		high	low	high	low	high	low	high	low	Class 4	Class 2
over	incl.										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 specification

⑤ Accuracy of cylindrical roller bearings

Table 10.2 Inner rings

Nominal bore diameter <i>d</i> mm over incl.		Deviation of mean bore diameter in a single plane $\Delta d_{mp}$						Variation of bore diameter in a single plane $V_{dsp}$						Variation of mean bore diameter $V_{dmp}$			Inner ring radial runout $K_{ia}$		
		Class 5		Class 4 ①		Class 2 ①		Diameter series 9			Diameter series 0			Class 5	Class 4	Class 2	Class 5	Class 4	Class 2
		high	low	high	low	high	low	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	max	max	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 tolerance of bore diameter deviation  $\Delta d_s$  applicable to classes 4 and 2 is the same as the tolerance of single plane mean bore diameter deviation  $\Delta d_{mp}$ .

Table 10.3 Outer rings

Nominal bore diameter <i>D</i> mm over incl.		Deviation of mean outside diameter in a single plane $\Delta D_{mp}$						Variation of outside diameter in a single plane $V_{Dsp}$						Variation of mean outside diameter $V_{Dmp}$			Outer ring radial runout $K_{ea}$		
		Class 5		Class 4 ②		Class 2 ②		Diameter series 9			Diameter series 0			Class 5	Class 4	Class 2	Class 5	Class 4	Class 2
		high	low	high	low	high	low	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	max	max	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 tolerance of outside diameter deviation  $\Delta D_s$  applicable to classes 4 and 2 is the same as the tolerance of mean single plane outside diameter deviation  $\Delta D_{mp}$ .

Unit:  $\mu\text{m}$

Perpendicularity of inner ring face with respect to the bore $S_d$			Width deviation $\Delta B_s$ Single bearing				Width variation $VB_s$		
Class 5	Class 4 max	Class 2	Class 5 high	Class 4 low	Class 2 high	Class 2 low	Class 5	Class 4	Class 2
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	-300	8	5	4
11	7	5	0	-300	0	-350	10	6	5
13	—	—	0	-350	—	—	13	—	—
15	—	—	0	-400	—	—	15	—	—
—	—	—	—	—	—	—	—	—	—

Unit:  $\mu\text{m}$

Perpendicularity of outer ring outside surface with respect to the face $S_D$			Width deviation $\Delta C_s$	Width variation $VC_s$		
Class 5	Class 4 max	Class 2	All classes	Class 5	Class 4	Class 2
8	4	1.5	Identical to $\Delta B_s$ relative to $d$ on 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	—	—	

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 combination. 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 double-low tapered bore bearing is used and the desired mounted internal clearance is close to zero, use of clearance in the range between C9NA and C1NA is recommended. Cylindrical bore bearings with non-interchangeable radial internal clearance are also available. For details, contact NTN Engineering.

Table 10.4 Cylindrical bore bearings

Unit:  $\mu\text{m}$

Nominal bore diameter $d$ mm		Cylindrical bore bearing					
		C1NA		C2NA		NA ①	
		over	incl.	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:  $\mu\text{m}$

Nominal bore diameter $d$ mm		Tapered bore bearing									
		C9NA ②		C0NA ②		C1NA ②		C2NA		NA ①	
		over	incl.	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:  $\mu\text{m}$

Nominal bore diameter <i>d</i> 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 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, ⑦ Clearance adjustment for cylindrical roller bearing, measurement with mounted internal clearance gage" in the Technical Data section.

## ⑦ Recommended fit of high-precision cylindrical roller bearings

In order to maintain the high precision of a precision bearing under  $d_{m\Omega}$  value is lower than  $0.75 \times 10^6$  the fits listed in **Tables 10.7** and **10.8** are recommended ( $d_{m\Omega}$ : pitch circle diameter across rolling elements [mm] multiplied by speed [ $\text{min}^{-1}$ ]).

When the  $d_{m\Omega}$  value is larger than  $0.75 \times 10^6$  ( $d_{m\Omega}$  value  $\geq 0.75 \times 10^4$ ), 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 Fit with shaft**

Unit:  $\mu\text{m}$

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

**Table 10.8 Fit with housing**

Unit:  $\mu\text{m}$

Nominal bore 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

### ■ Fit 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, ⑤ Cylindrical roller bearing and main spindle taper angle" in the Technical Data section.

## 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, ① Grease lubrication" in the Technical Data section.

#### ● Recommended grease fill

10% of the capacity shown in the dimension tables

#### ● Recommended grease packing method

Refer to "6. Handling of Bearings, ① Cleaning and filling with grease" in the Technical Data section.

### ■ Air-oil lubrication

#### ● Recommended location of nozzle

Refer to "7. Lubrication of Bearings, 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 $\text{cm}^3$	Lubrication interval min	Oil consumption $\text{cm}^3/\text{h}$	Recommended air consumption * $\text{N } \ell / \text{min}$
	Over	Incl.				
NN30	~ 1.0		0.02	8	0.15	30~40
NN30HS	1.0 ~ 1.5			5	0.24	
N10HS	1.5 ~ 2.3			5	0.24	
N10HSRT6						
NN30HST6	~ 1.7			15	0.08	20~40
NN30HSRT6						
N10HSL	~ 2.3			10	0.12	

\*  $\text{N } \ell / \text{min}$  (Normal liter/minute) ...  $\text{N } \ell$  means the volume of air at  $0^\circ\text{C}$  and 1 atmosphere.

⑨ Ultra high speed double row cylindrical roller bearings NN30HSRT6 type

NN30HSRT6 ultra high speed double row cylindrical roller bearings have higher operating speed 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. Molded PEEK cage is used for high speed under grease & air-oil lubrication and grease life.

**Bearing design**

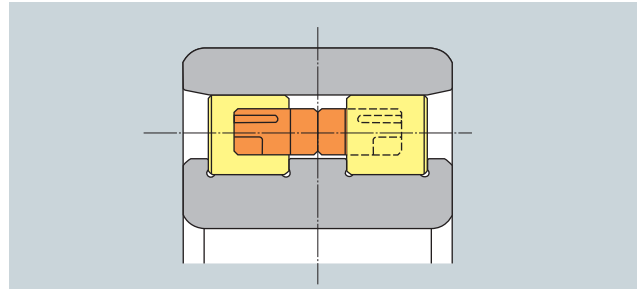
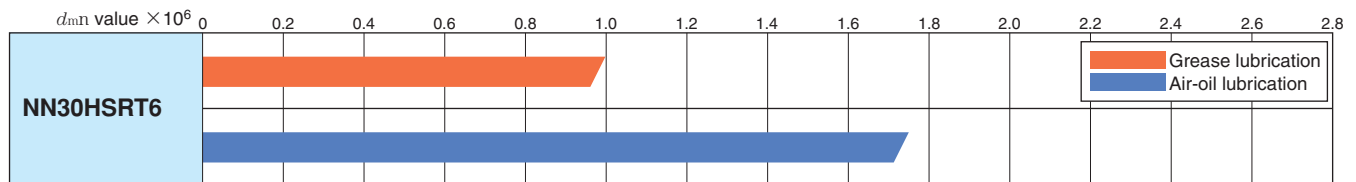


Fig. 10.4 NN30HSRT6 type

**Permissible speed range**



Notes) Permissible speed of each bearing ( $d_{min}$  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 contact NTN.

**Cage design**

Cage is made of PEEK which is very light and strong.

**(Photo 10.1)**

Smaller deformation by the centrifugal force is realized by the lighten cage material and unproved design High speed operation is by the cage design improvement. Grease life is extended by grease pocket in the cage.



Photo 10.1 PEEK cage

**High speed test**

$d_{mn}$  value of 1.0 million under grease lubrication and 1.75 million under air-oil lubrication are realized by the optimized internal design. (Fig 10.5, 10.6)

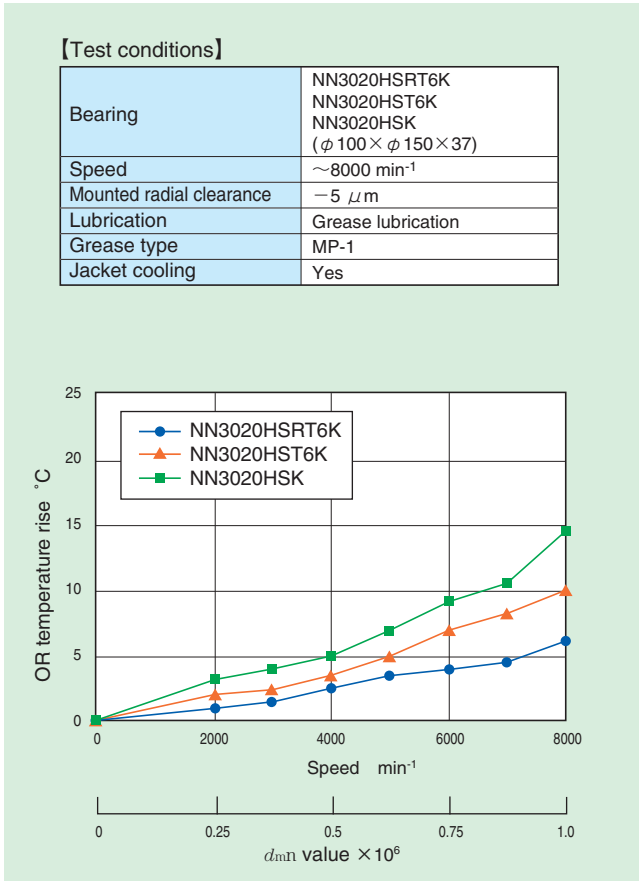


Fig. 10.5 Comparison of temperature rise (grease)

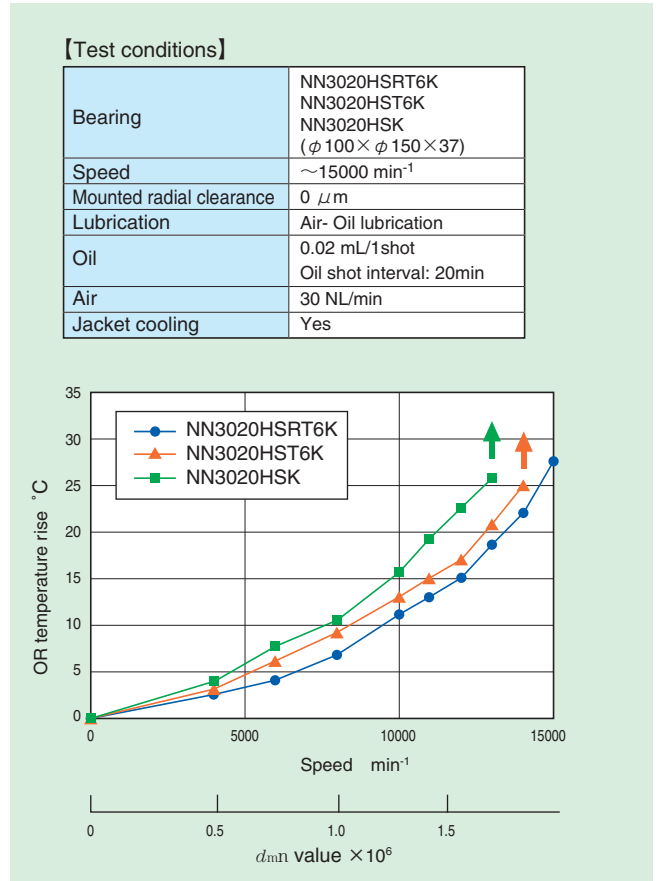


Fig. 10.6 Comparison of temperature rise (air- oil)

**Grease life**

Over 8500 hours continuous operation under grease lubrication is realized by the improved cage design at  $d_{mn}$  value of 1.0 million. (Fig. 10.7)

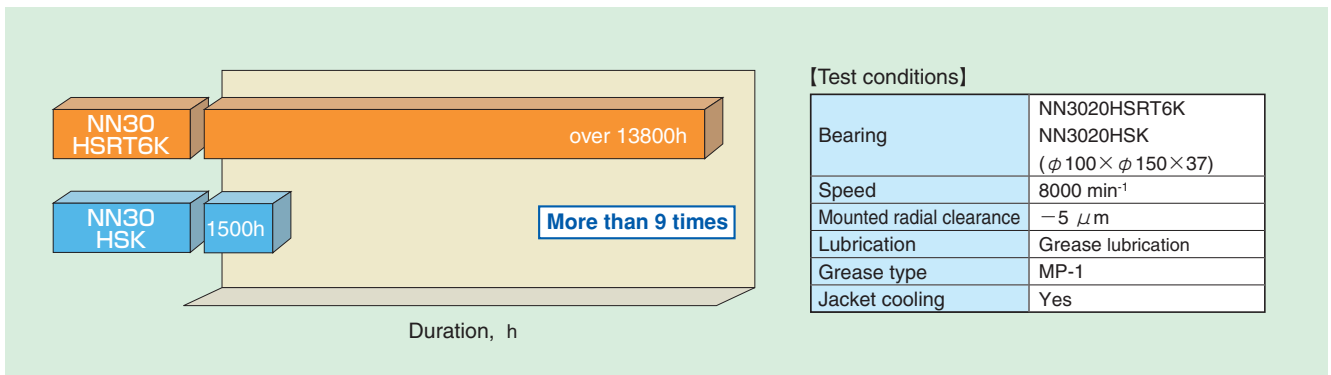


Fig. 10.7 Comparison of grease life

⑩ 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 increase.
2. Special resin cage is suitable for high-speed operation.

**Bearing specification**

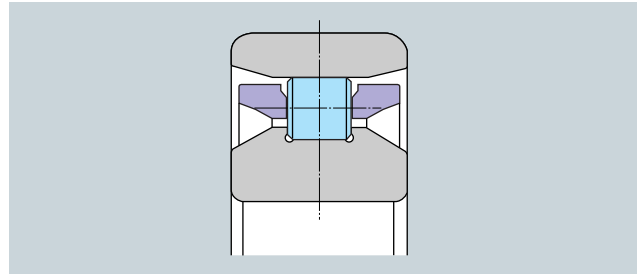
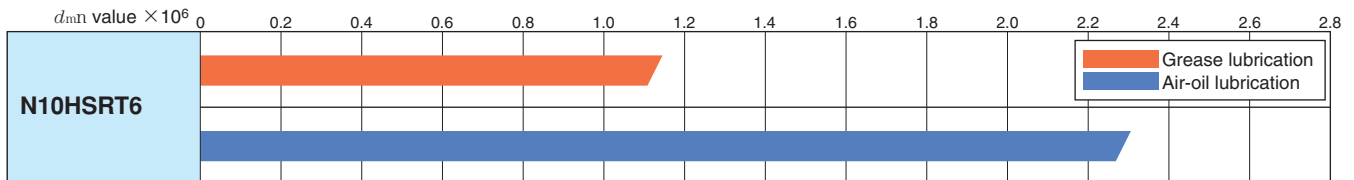


Fig. 10.8 N10HSRT6 type

**Permissible speed range**



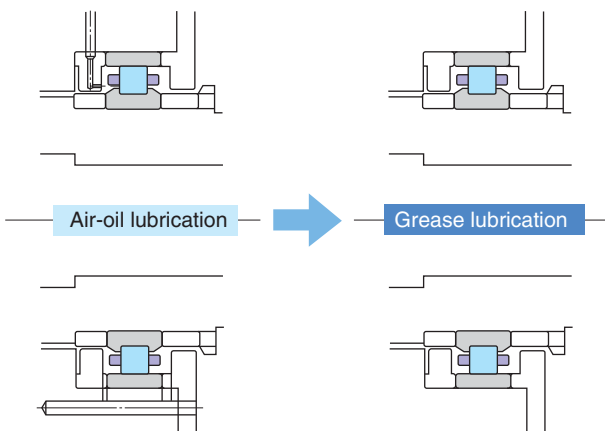
Notes) Permissible speed of each bearing ( $d_{mn}$  value) varies depending on the specifications of the machine for which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline and contact NTN.

**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 (Fig. 10.9).

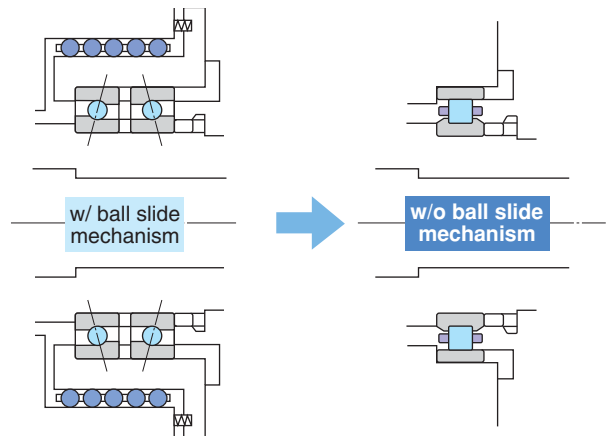
**Simplified main spindle configuration / simplified main spindle rear structure**

N10HSR (N10HSL) type high-speed cylindrical roller bearings can replace angular contact ball bearing 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 (Fig. 10.10).



Capable of replacing air-oil lubricated bearings up to  $d_{mn}$  value of 1,150,000.

Fig. 10.9 Modification of lubrication system



Capable of replacing angular contact ball bearings up to  $d_{mn}$  value of 2,300,000 [air-oil lubrication] or 1,150,000 [grease lubrication].

Fig. 10.10 Simplified main spindle rear structure

### High-speed operation test with grease lubrication

Due to an optimized internal design, the N10HSR type is capable of high-speed operation with  $d_{mn}$  value of 1.15 million [grease lubrication] or 2.3 million [air-oil lubrication] (Figs. 10.11, 10.12, 10.13, 10.14).

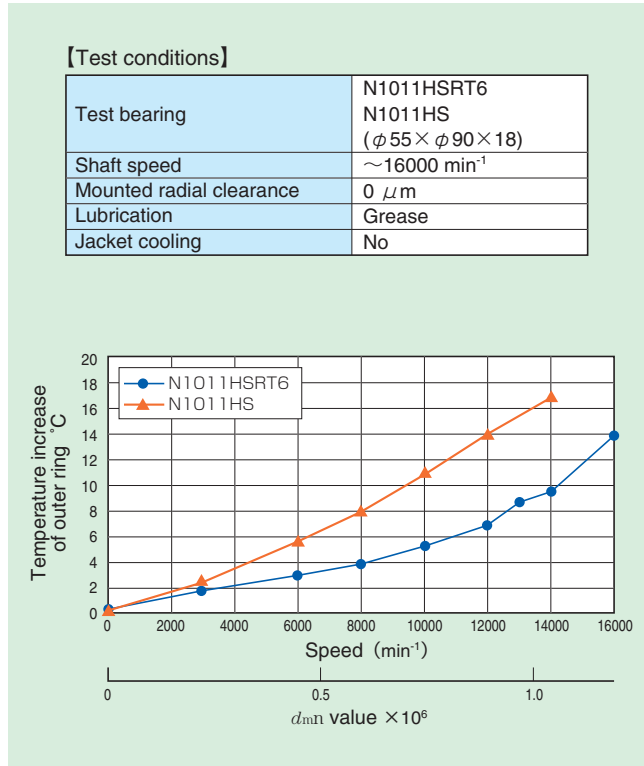


Fig. 10.11 High-speed test results (grease lubrication without outer case cooling)

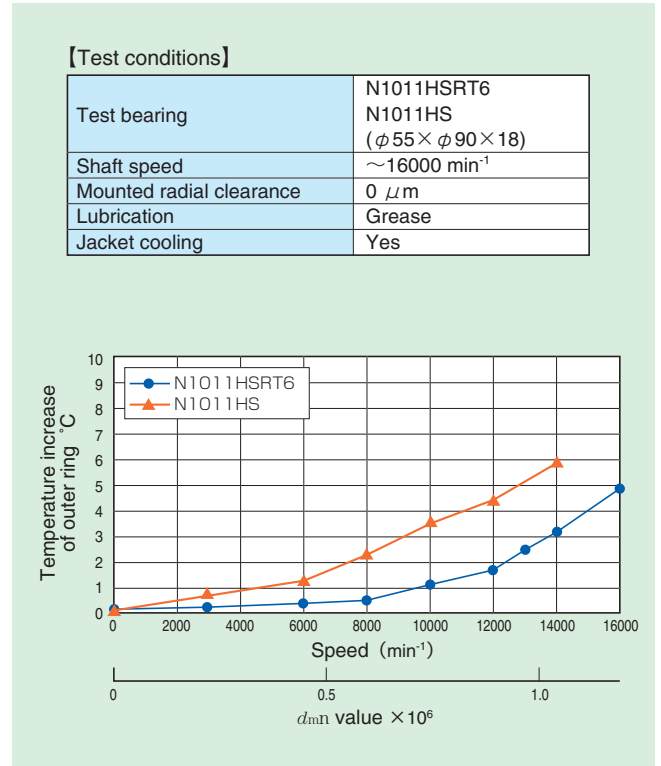


Fig. 10.12 High-speed test results (grease lubrication with outer case cooling)

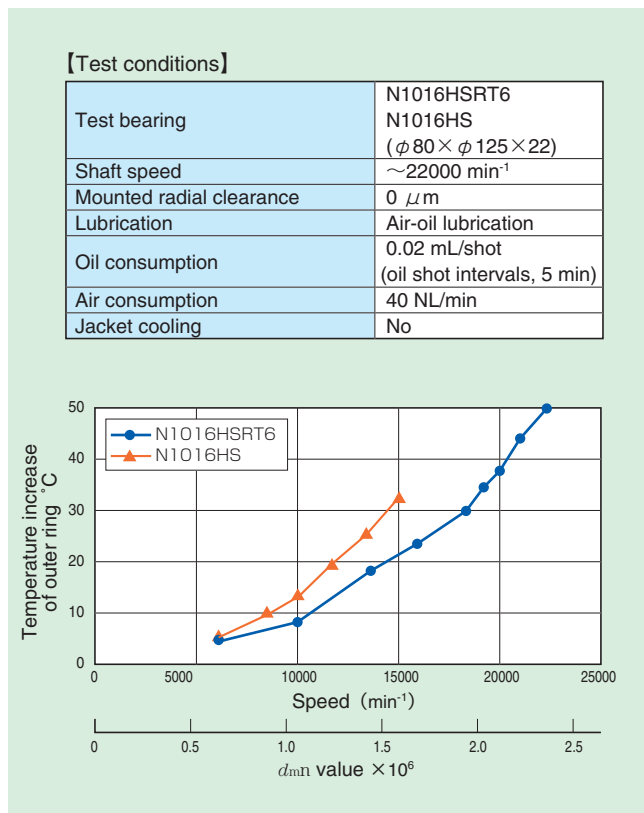


Fig. 10.13 High-speed test results (air-oil lubrication without jacket cooling)

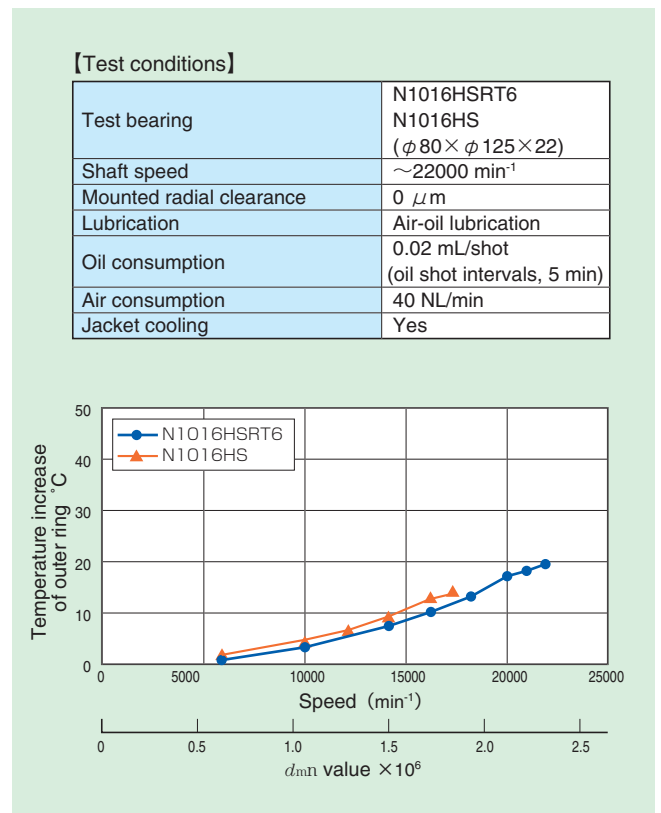


Fig. 10.14 High-speed test results (air-oil lubrication with jacket cooling)

11 Eco-friendly air-oil lubricated 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

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

Bearing specification

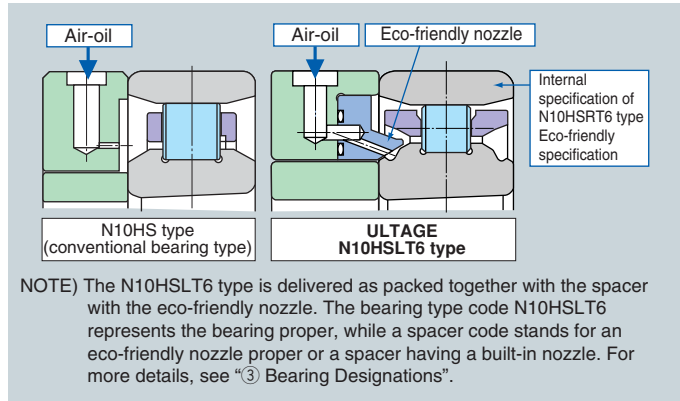
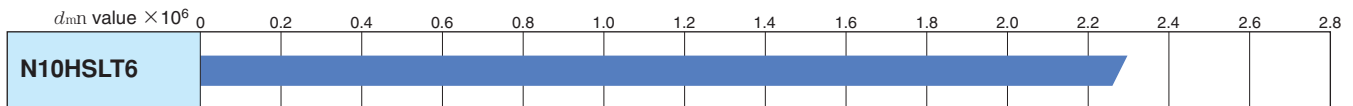


Fig. 10.15 N10HSLT6 type

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 contact NTN.

High-speed running test

Even with decreased air consumption and oil consumption, the N10HSL type bearings can reliably operate at high speed of  $d_{mn} 2.3 \times 10^6$  (Fig. 10.16, 10.17).

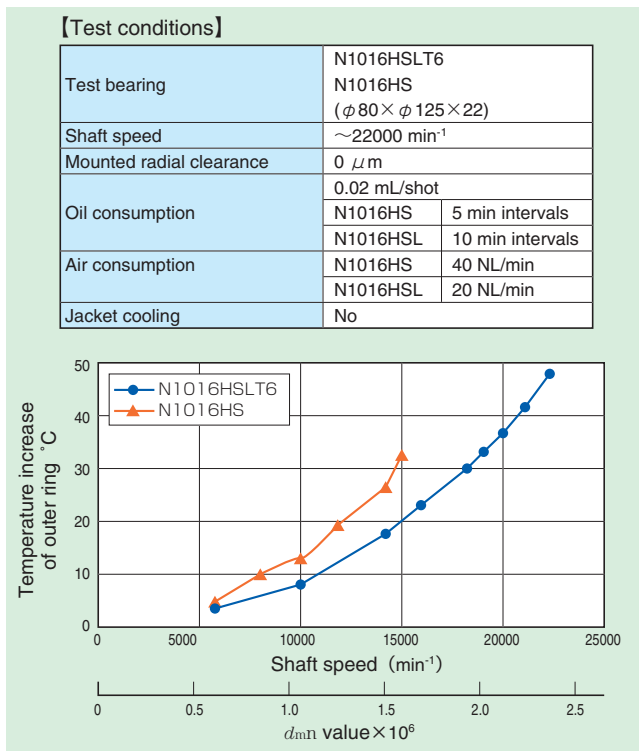


Fig. 10.16 High-speed test results (without Jacket cooling)

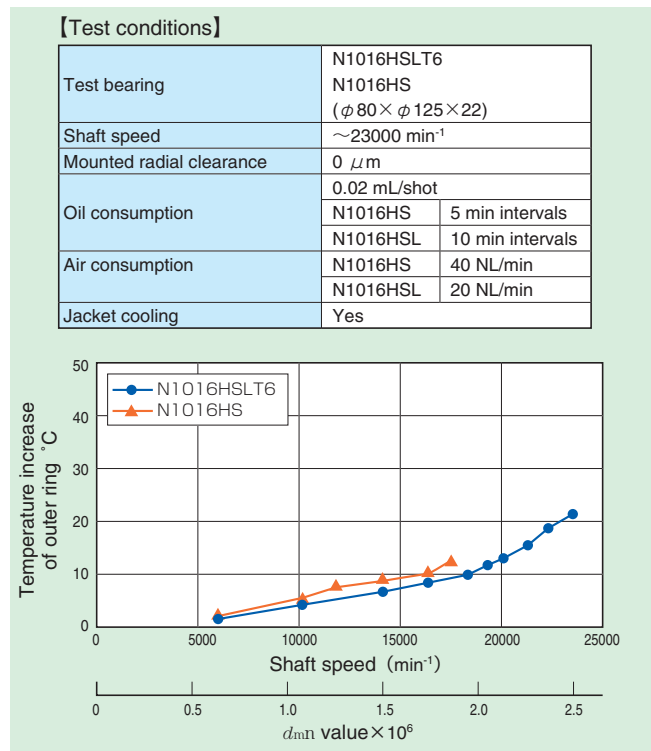


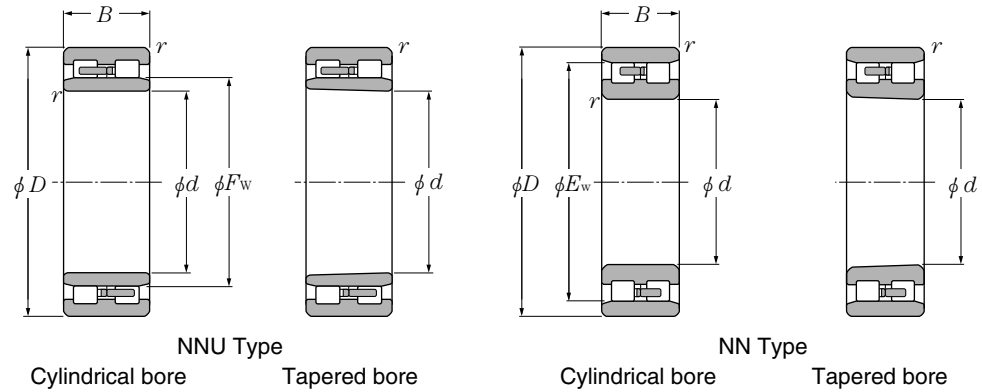
Fig. 10.17 High-speed test results (with Jacket cooling)



## ⑫ Dimension tables for double row cylindrical roller bearings

### Double row cylindrical roller bearings

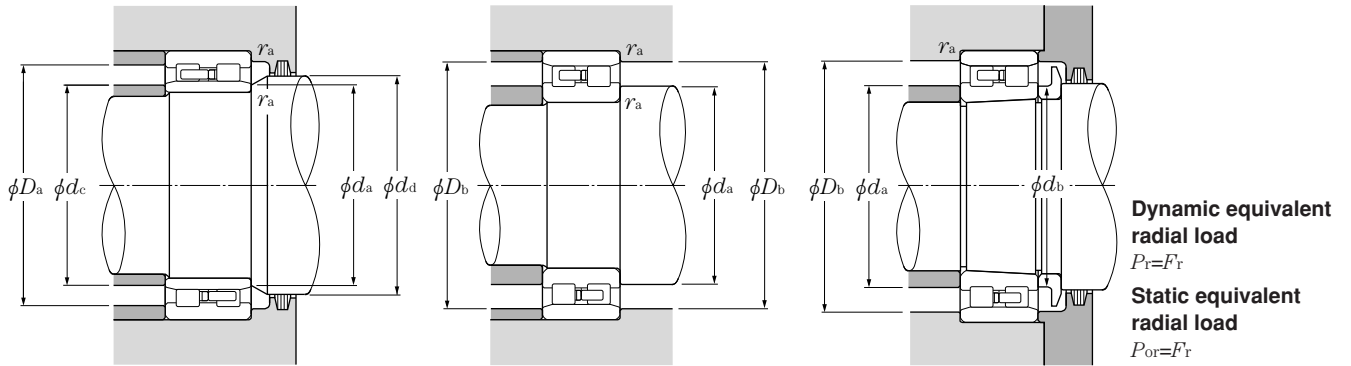
$d$  25~95mm



Part number				Boundary dimensions mm				Basic load ratings				Limiting speeds	
NNU Type		NN Type		$d$	$D$	$B$	$r$ 's min <sup>②</sup>	dynamic	static	dynamic	static	grease lubrication	oil lubrication
cylindrical bore	tapered bore <sup>①</sup>	cylindrical bore	tapered bore <sup>①</sup>					kN	kN	kgf	kgf		
—	—	NN3005	NN3005K	25	47	16	0.6	25.8	30.0	2 630	3 050	19 300	23 400
—	—	NN3005HS	NN3005HSK	25	47	16	0.6	25.8	30.0	2 630	3 050	22 600	31 100
—	—	NN3006	NN3006K	30	55	19	1	31.0	37.0	3 150	3 800	16 300	19 800
—	—	NN3006HS	NN3006HSK	30	55	19	1	31.0	37.0	3 150	3 800	19 100	26 300
—	—	NN3007	NN3007K	35	62	20	1	38.0	47.5	3 850	4 850	14 300	17 300
—	—	NN3007HS	NN3007HSK	35	62	20	1	38.0	47.5	3 850	4 850	16 700	23 100
—	—	NN3008	NN3008K	40	68	21	1	43.5	55.5	4 400	5 650	12 800	15 600
—	—	NN3008HS	NN3008HSK	40	68	21	1	43.5	55.5	4 400	5 650	15 000	20 700
—	—	NN3009	NN3009K	45	75	23	1	52.0	68.5	5 300	7 000	11 600	14 000
—	—	NN3009HS	NN3009HSK	45	75	23	1	52.0	68.5	5 300	7 000	13 600	18 700
—	—	NN3010	NN3010K	50	80	23	1	53.0	72.5	5 400	7 400	10 700	13 000
—	—	NN3010HS	NN3010HSK	50	80	23	1	53.0	72.5	5 400	7 400	12 500	17 300
—	—	NN3011	NN3011K	55	90	26	1.1	69.5	96.5	7 050	9 850	9 600	11 600
—	—	NN3011HS	NN3011HSK	55	90	26	1.1	69.5	96.5	7 050	9 850	11 200	15 500
—	—	NN3012	NN3012K	60	95	26	1.1	71.0	102	7 250	10 400	9 000	10 900
—	—	NN3012HS	NN3012HSK	60	95	26	1.1	71.0	102	7 250	10 400	10 500	14 500
—	—	NN3013	NN3013K	65	100	26	1.1	75.0	111	7 650	11 400	8 400	10 200
—	—	NN3013HST6	NN3013HST6K	65	100	26	1.1	72.5	107	7 400	10 900	9 900	13 600
—	—	NN3013HSRT6	NN3013HSRT6K	65	100	26	1.1	72.5	107	7 400	10 900	12 100	21 200
—	—	NN3014	NN3014K	70	110	30	1.1	94.5	143	9 650	14 600	7 700	9 300
—	—	NN3014HST6	NN3014HST6K	70	110	30	1.1	92.0	137	9 350	14 000	9 000	12 400
—	—	NN3014HSRT6	NN3014HSRT6K	70	110	30	1.1	92.0	137	9 350	14 000	11 000	19 300
—	—	NN3015	NN3015K	75	115	30	1.1	96.5	149	9 850	15 200	7 300	8 900
—	—	NN3015HST6	NN3015HST6K	75	115	30	1.1	96.5	149	9 850	15 200	8 500	11 800
—	—	NN3015HSRT6	NN3015HSRT6K	75	115	30	1.1	96.5	149	9 850	15 200	10 400	18 300
—	—	NN3016	NN3016K	80	125	34	1.1	116	179	11 800	18 200	6 800	8 300
—	—	NN3016HST6	NN3016HST6K	80	125	34	1.1	112	172	11 500	17 500	8 000	11 000
—	—	NN3016HSRT6	NN3016HSRT6K	80	125	34	1.1	112	172	11 500	17 500	9 700	17 100
—	—	NN3017	NN3017K	85	130	34	1.1	122	194	12 400	19 800	6 500	7 900
—	—	NN3017HST6	NN3017HST6K	85	130	34	1.1	118	187	12 100	19 100	7 600	10 500
—	—	NN3017HSRT6	NN3017HSRT6K	85	130	34	1.1	118	187	12 100	19 100	9 300	16 300
—	—	NN3018	NN3018K	90	140	37	1.5	143	228	14 600	23 200	6 000	7 300
—	—	NN3018HST6	NN3018HST6K	90	140	37	1.5	143	228	14 600	23 200	7 100	9 700
—	—	NN3018HSRT6	NN3018HSRT6K	90	140	37	1.5	143	228	14 600	23 200	8 600	15 200
—	—	NN3019	NN3019K	95	145	37	1.5	146	238	14 900	24 200	5 800	7 000

① A bearing number with suffix K indicates a tapered-bore bearing (taper ratio 1/12).

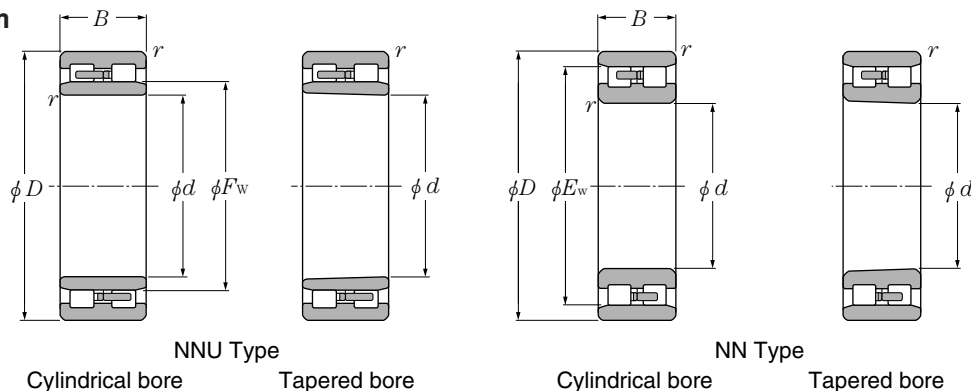
② Minimum allowable value for corner radius dimension  $r$ .



Dimensions		Abutment and fillet dimensions								Mass kg (approx.)				Internal free space
mm		mm								NNU Type		NN Type		cm <sup>3</sup>
<i>F</i> <sub>w</sub>	<i>E</i> <sub>w</sub>	<i>d</i> <sub>a</sub> min	<i>d</i> <sub>b</sub> min	<i>d</i> <sub>c</sub> max	<i>d</i> <sub>d</sub> min	<i>D</i> <sub>a</sub> max	<i>D</i> <sub>b</sub> max		<i>r</i> <sub>as</sub> max	cylindrical bore	tapered bore	cylindrical bore	tapered bore	NN Type
—	41.3	29	30	—	—	—	43	42	0.6	—	—	0.124	0.121	3.72
—	41.3	29	30	—	—	—	43	42	0.6	—	—	0.124	0.121	3.72
—	48.5	35	36.5	—	—	—	50	49	1	—	—	0.199	0.193	6.38
—	48.5	35	36.5	—	—	—	50	49	1	—	—	0.199	0.193	6.38
—	55	40	41.5	—	—	—	57	56	1	—	—	0.242	0.235	8.09
—	55	40	41.5	—	—	—	57	56	1	—	—	0.242	0.235	8.09
—	61	45	47	—	—	—	63	62	1	—	—	0.312	0.303	9.68
—	61	45	47	—	—	—	63	62	1	—	—	0.312	0.303	9.68
—	67.5	50	52	—	—	—	70	69	1	—	—	0.405	0.393	13.3
—	67.5	50	52	—	—	—	70	69	1	—	—	0.405	0.393	13.3
—	72.5	55	57	—	—	—	75	74	1	—	—	0.433	0.419	14.6
—	72.5	55	57	—	—	—	75	74	1	—	—	0.433	0.419	14.6
—	81	61.5	63.5	—	—	—	83.5	82	1	—	—	0.651	0.631	20.5
—	81	61.5	63.5	—	—	—	83.5	82	1	—	—	0.651	0.631	20.5
—	86.1	66.5	68.5	—	—	—	88.5	87	1	—	—	0.704	0.683	21.1
—	86.1	66.5	68.5	—	—	—	88.5	87	1	—	—	0.704	0.683	21.1
—	91	71.5	73.5	—	—	—	93.5	92	1	—	—	0.76	0.74	22.2
—	91	71.5	73.5	—	—	—	93.5	92	1	—	—	0.69	0.66	21.4
—	91	71.5	73.5	—	—	—	93.5	92	1	—	—	0.69	0.66	21.4
—	100	76.5	79	—	—	—	103.5	101	1	—	—	1.04	1.01	33.0
—	100	76.5	79	—	—	—	103.5	101	1	—	—	0.99	0.96	30.4
—	100	76.5	79	—	—	—	103.5	101	1	—	—	0.99	0.96	30.4
—	105	81.5	84	—	—	—	108.5	106	1	—	—	1.14	1.11	35.0
—	105	81.5	84	—	—	—	108.5	106	1	—	—	1.05	1.02	31.2
—	105	81.5	84	—	—	—	108.5	106	1	—	—	1.05	1.02	31.2
—	113	86.5	89.5	—	—	—	118.5	114	1	—	—	1.52	1.47	45.0
—	113	86.5	89.5	—	—	—	118.5	114	1	—	—	1.43	1.38	43.0
—	113	86.5	89.5	—	—	—	118.5	114	1	—	—	1.43	1.38	43.0
—	118	91.5	84.5	—	—	—	123.5	119	1	—	—	1.61	1.56	48.8
—	118	91.5	84.5	—	—	—	123.5	119	1	—	—	1.51	1.46	44.4
—	118	91.5	84.5	—	—	—	123.5	119	1	—	—	1.51	1.46	44.4
—	127	98	101	—	—	—	132	129	1.5	—	—	2.07	2.01	64.1
—	127	98	101	—	—	—	132	129	1.5	—	—	1.97	1.91	57.6
—	127	98	101	—	—	—	132	129	1.5	—	—	1.97	1.91	57.6
—	132	103	106	—	—	—	137	134	1.5	—	—	2.17	2.10	67.0

## Double row cylindrical roller bearings

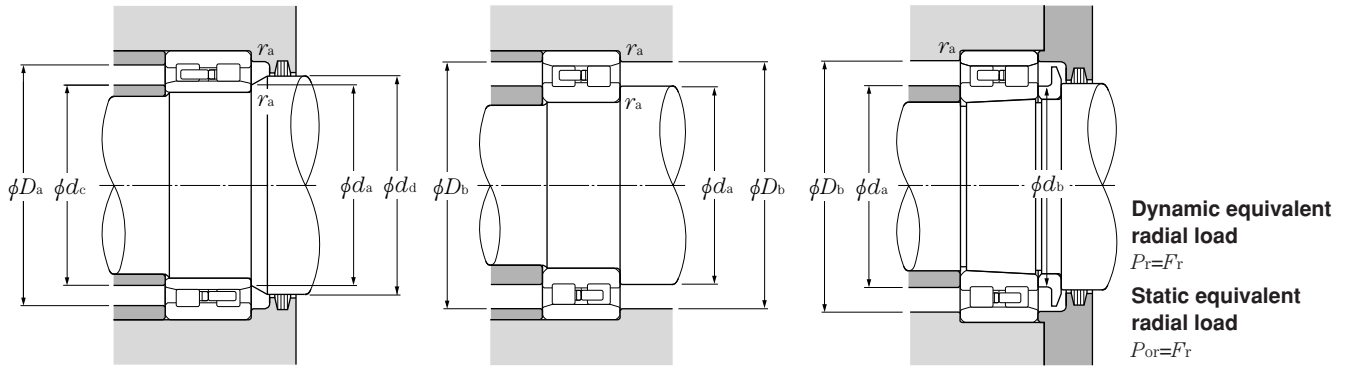
$d$  100~190mm



Part number				Boundary dimensions mm				Basic load ratings				Limiting speeds	
NNU Type		NN Type		$d$	$D$	$B$	$r$ 's min <sup>②</sup>	dynamic	static	dynamic	static	min <sup>-1</sup>	
cylindrical bore	tapered bore <sup>①</sup>	cylindrical bore	tapered bore <sup>①</sup>					kN	$C_{or}$	kN	$C_{or}$	grease lubrication	oil lubrication
NNU4920	NNU4920K	NN4920	NN4920K	100	140	40	1.1	131	260	13 300	26 500	6 000	7 200
—	—	NN3020	NN3020K	100	150	37	1.5	153	256	15 600	26 100	5 600	6 700
—	—	NN3020HST6	NN3020HST6K	100	150	37	1.5	149	247	15 200	25 200	6 500	9 000
—	—	NN3020HSRT6	NN3020HSRT6K	100	150	37	1.5	149	247	15 200	25 200	8 000	14 000
NNU4921	NNU4921K	NN4921	NN4921K	105	145	40	1.1	133	268	13 500	27 400	5 700	6 900
—	—	NN3021	NN3021K	105	160	41	2	198	320	20 200	33 000	5 300	6 400
—	—	NN3021HST6	NN3021HST6K	105	160	41	2	198	320	20 200	33 000	6 200	8 500
—	—	NN3021HSRT6	NN3021HSRT6K	105	160	41	2	198	320	20 200	33 000	7 100	11 300
NNU4922	NNU4922K	NN4922	NN4922K	110	150	40	1.1	137	284	14 000	28 900	5 500	6 600
—	—	NN3022	NN3022K	110	170	45	2	229	375	23 300	38 000	5 000	6 000
—	—	NN3022HST6	NN3022HST6K	110	170	45	2	229	375	23 300	38 000	5 800	8 000
—	—	NN3022HSRT6	NN3022HSRT6K	110	170	45	2	229	375	23 300	38 000	6 700	10 600
NNU4924	NNU4924K	NN4924	NN4924K	120	165	45	1.1	183	360	18 700	37 000	5 000	6 000
—	—	NN3024	NN3024K	120	180	46	2	233	390	23 700	40 000	4 600	5 600
—	—	NN3024HST6	NN3024HST6K	120	180	46	2	226	380	23 100	38 500	5 400	7 500
—	—	NN3024HSRT6	NN3024HSRT6K	120	180	46	2	226	380	23 100	38 500	6 200	9 900
NNU4926	NNU4926K	NN4926	NN4926K	130	180	50	1.5	220	440	22 400	45 000	4 600	5 500
—	—	NN3026	NN3026K	130	200	52	2	284	475	29 000	48 500	4 200	5 100
—	—	NN3026HST6	NN3026HST6K	130	200	52	2	284	475	29 000	48 500	4 900	6 800
—	—	NN3026HSRT6	NN3026HSRT6K	130	200	52	2	284	475	29 000	48 500	5 700	9 000
NNU4928	NNU4928K	NN4928	NN4928K	140	190	50	1.5	227	470	23 100	48 000	4 300	5 200
—	—	NN3028	NN3028K	140	210	53	2	298	515	30 500	52 500	4 000	4 800
—	—	NN3028HS	NN3028HSK	140	210	53	2	298	515	30 500	52 500	4 700	6 400
NNU4930	NNU4930K	NN4930	NN4930K	150	210	60	2	345	690	35 000	70 500	3 900	4 800
—	—	NN3030	NN3030K	150	225	56	2.1	335	585	34 000	60 000	3 700	4 500
—	—	NN3030HS	NN3030HSK	150	225	56	2.1	335	585	34 000	60 000	4 300	6 000
NNU4932	NNU4932K	NN4932	NN4932K	160	220	60	2	355	740	36 500	75 500	3 700	4 500
—	—	NN3032	NN3032K	160	240	60	2.1	375	660	38 000	67 500	3 500	4 200
—	—	NN3032HS	NN3032HSK	160	240	60	2.1	375	660	38 000	67 500	4 100	5 600
NNU4934	NNU4934K	NN4934	NN4934K	170	230	60	2	360	765	37 000	78 000	3 600	4 300
—	—	NN3034	NN3034K	170	260	67	2.1	440	775	45 000	79 000	3 200	3 900
NNU4936	NNU4936K	NN4936	NN4936K	180	250	69	2	460	965	46 500	98 500	3 200	3 800
—	—	NN3036	NN3036K	180	280	74	2.1	565	995	57 500	102 000	3 000	3 600
NNU4938	NNU4938K	NN4938	NN4938K	190	260	69	2	475	1 030	48 500	105 000	3 000	3 600
—	—	NN3038	NN3038K	190	290	75	2.1	580	1 040	59 000	106 000	2 800	3 300

① A bearing number with suffix K indicates a tapered-bore bearing (taper ratio 1/12).

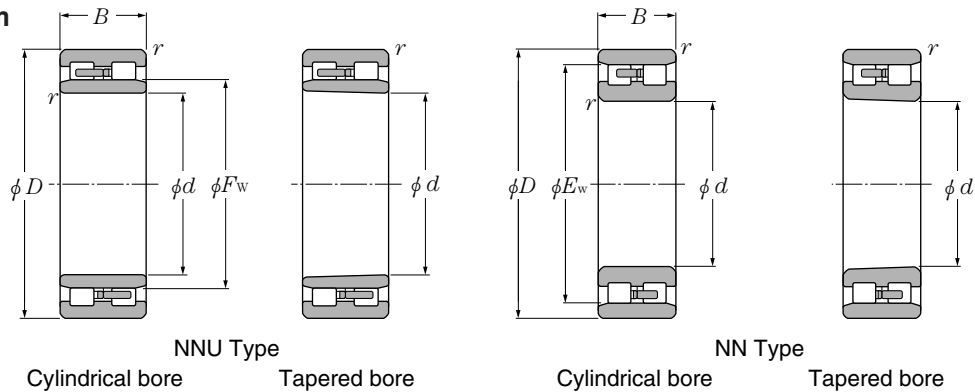
② Minimum allowable value for corner radius dimension  $r$ .



Dimensions		Abutment and fillet dimensions								Mass kg (approx.)				Internal free space
mm		$d_a$	$d_b$	$d_c$	mm		$D_b$		$r_{as}$	NNU Type		NN Type		cm <sup>3</sup>
$F_w$	$E_w$	min	min	max	min	max	max	min	max	cylindrical bore	tapered bore	cylindrical bore	tapered bore	NN Type
113	129	106.5	110	111	115	133.5	133.5	131	1	1.83	1.75	1.75	1.67	49.8
—	137	108	111	—	—	—	142	139	1.5	—	—	2.26	2.19	67.5
—	137	108	111	—	—	—	142	139	1.5	—	—	2.14	2.07	61.6
—	137	108	111	—	—	—	142	139	1.5	—	—	2.14	2.07	61.6
118	134	111.5	115	116	120	138.5	138.5	136	1	1.91	1.82	1.82	1.73	50.2
—	146	114	117	—	—	—	151	148	2	—	—	2.89	2.80	91.9
—	146	114	117	—	—	—	151	148	2	—	—	2.75	2.66	82.7
—	146	114	117	—	—	—	151	148	2	—	—	2.75	2.66	82.7
123	139	116.5	120	121	125	143.5	143.5	141	1	1.99	1.90	1.90	1.81	53.9
—	155	119	123	—	—	—	161	157	2	—	—	3.69	3.56	115
—	155	119	123	—	—	—	161	157	2	—	—	3.50	3.37	103
—	155	119	123	—	—	—	161	157	2	—	—	3.50	3.37	103
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
—	165	129	133	—	—	—	171	167	2	—	—	3.98	3.83	130
—	165	129	133	—	—	—	171	167	2	—	—	3.76	3.61	117
—	165	129	133	—	—	—	171	167	2	—	—	3.76	3.61	117
146	168	138	142	144	148	172	172	170	1.5	3.69	3.52	3.52	3.35	112
—	182	139	143	—	—	—	191	183	2	—	—	5.92	5.71	182
—	182	139	143	—	—	—	191	183	2	—	—	5.55	5.34	164
—	182	139	143	—	—	—	191	183	2	—	—	5.55	5.34	164
156	178	148	152	154	158	182	182	180	1.5	3.94	3.76	3.76	3.58	117
—	192	149	153	—	—	—	201	194	2	—	—	6.44	6.21	199
—	192	149	153	—	—	—	201	194	2	—	—	6.44	6.21	199
168.5	196.5	159	164	166	171	201	201	198.5	2	6.18	5.90	5.90	5.62	192
—	206	161	166	—	—	—	214	208	2	—	—	7.81	7.53	237
—	206	161	166	—	—	—	214	208	2	—	—	7.81	7.53	237
178.5	206.5	169	174	176	182	211	211	208.5	2	6.53	6.23	6.24	5.94	199
—	219	171	176	—	—	—	229	221	2	—	—	8.92	8.59	287
—	219	171	176	—	—	—	229	221	2	—	—	8.92	8.59	287
188.5	216.5	179	184	186	192	221	221	218.5	2	6.87	6.55	6.56	6.24	212
—	236	181	187	—	—	—	249	238	2	—	—	12.6	12.2	379
202	234	189	195	199	205	241	241	236	2	9.90	9.46	9.45	9.01	299
—	255	191	197	—	—	—	269	257	2	—	—	16.6	16.0	478
212	244	199	205	209	215	251	251	246	2	10.4	9.94	9.93	9.47	303
—	265	201	207	—	—	—	279	267	2	—	—	18.0	17.4	504

## Double row cylindrical roller bearings

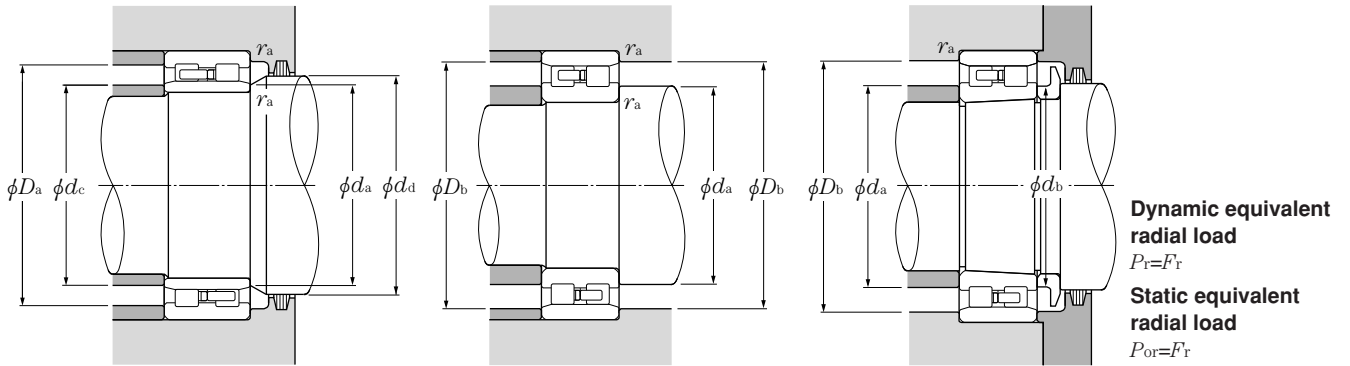
$d$  200~500mm



Part number				Boundary dimensions mm				Basic load ratings				Limiting speeds	
NNU Type		NN Type		$d$	$D$	$B$	$r$ 's min <sup>②</sup>	dynamic kN		static kgf		min <sup>-1</sup>	
cylindrical bore	tapered bore <sup>①</sup>	cylindrical bore	tapered bore <sup>①</sup>					$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease lubrication	oil lubrication
NNU4940	NNU4940K	NN4940	NN4940K	200	280	80	2.1	555	1 180	56 500	120 000	2 900	3 500
—	—	NN3040	NN3040K	200	310	82	2.1	655	1 170	66 500	119 000	2 600	3 100
NNU4944	NNU4944K	NN4944	NN4944K	220	300	80	2.1	585	1 300	59 500	132 000	2 600	3 100
—	—	NN3044	NN3044K	220	340	90	3	815	1 480	83 000	151 000	2 300	2 800
NNU4948	NNU4948K	NN4948	NN4948K	240	320	80	2.1	610	1 410	62 500	144 000	2 300	2 800
—	—	NN3048	NN3048K	240	360	92	3	855	1 600	87 000	163 000	2 200	2 600
NNU4952	NNU4952K	NN4952	NN4952K	260	360	100	2.1	900	2 070	92 000	211 000	2 200	2 600
—	—	NN3052	NN3052K	260	400	104	4	1 060	1 990	108 000	203 000	2 100	2 500
NNU4956	NNU4956K	NN4956	NN4956K	280	380	100	2.1	925	2 200	94 500	224 000	1 900	2 300
—	—	NN3056	NN3056K	280	420	106	4	1 080	2 080	110 000	212 000	1 800	2 100
NNU4960	NNU4960K	NN4960	NN4960K	300	420	118	3	1 200	2 800	122 000	285 000	1 800	2 100
—	—	NN3060	NN3060K	300	460	118	4	1 330	2 560	135 000	261 000	1 600	2 000
NNU4964	NNU4964K	NN4964	NN4964K	320	440	118	3	1 240	2 970	126 000	305 000	1 600	2 000
—	—	NN3064	NN3064K	320	480	121	4	1 350	2 670	138 000	272 000	1 500	1 800
NNU4968	NNU4968K	—	—	340	460	118	3	1 270	3 150	130 000	320 000	1 500	1 800
—	—	NN3068	NN3068K	340	520	133	5	1 620	3 200	165 000	325 000	1 500	1 800
NNU4972	NNU4972K	—	—	360	480	118	3	1 290	3 250	131 000	330 000	1 500	1 800
—	—	NN3072	NN3072K	360	540	134	5	1 650	3 300	169 000	340 000	1 400	1 600
NNU4976	NNU4976K	—	—	380	520	140	4	1 630	4 050	167 000	415 000	1 400	1 600
—	—	NN3076	NN3076K	380	560	135	5	1 690	3 450	172 000	355 000	1 300	1 500
NNU4980	NNU4980K	—	—	400	540	140	4	1 690	4 300	172 000	435 000	1 300	1 500
—	—	NN3080	NN3080K	400	600	148	5	2 040	4 150	208 000	420 000	1 200	1 400
NNU4984	NNU4984K	—	—	420	560	140	4	1 740	4 500	177 000	460 000	1 200	1 500
—	—	NN3084	NN3084K	420	620	150	5	2 080	4 300	212 000	440 000	1 100	1 400
NNU4988	NNU4988K	—	—	440	600	160	4	2 150	5 550	219 000	565 000	1 100	1 400
—	—	NN3088	NN3088K	440	650	157	6	2 420	5 100	247 000	520 000	1 100	1 300
NNU4992	NNU4992K	—	—	460	620	160	4	2 220	5 850	226 000	595 000	1 100	1 300
—	—	NN3092	NN3092K	460	680	163	6	2 550	5 350	260 000	545 000	1 000	1 200
NNU4996	NNU4996K	—	—	480	650	170	5	2 280	5 900	233 000	600 000	1 000	1 200
NNU49/500	NNU49/500K	—	—	500	670	170	5	2 360	6 200	240 000	635 000	1 000	1 200

① A bearing number with suffix **K** indicates a tapered-bore bearing (taper ratio 1/12).

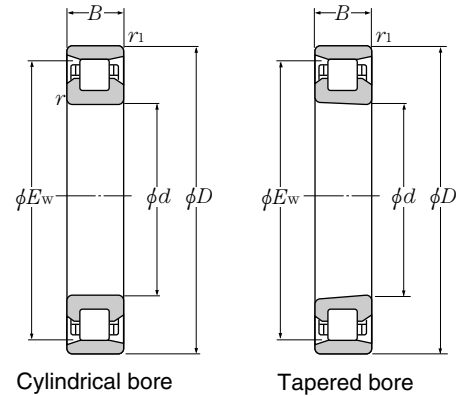
② Minimum allowable value for corner radius dimension  $r$ .



Dimensions		Abutment and fillet dimensions								Mass kg (approx.)				Internal free space
mm		mm								NNU Type      NN Type				cm <sup>3</sup>
<i>F<sub>w</sub></i>	<i>E<sub>w</sub></i>	<i>d<sub>a</sub></i> min	<i>d<sub>b</sub></i> min	<i>d<sub>c</sub></i> max	<i>d<sub>d</sub></i> min	<i>D<sub>a</sub></i> max	<i>D<sub>b</sub></i> max      min		<i>r<sub>as</sub></i> max	cylindrical bore	tapered bore	cylindrical bore	tapered bore	NN Type
225	261	211	218	222	228	269	269	264	2	14.7	14.0	14.0	13.3	437
—	282	211	218	—	—	—	299	285	2	—	—	21.6	20.8	649
245	281	231	238	242	248	289	289	284	2	15.9	15.2	15.2	14.5	485
—	310	233	240	—	—	—	327	313	2.5	—	—	29.3	28.2	877
265	301	251	258	262	269	309	309	304	2	17.2	16.4	16.4	15.6	518
—	330	253	261	—	—	—	347	333	2.5	—	—	32.8	31.6	973
292	336	271	279	288	296	349	349	339	2	29.6	28.3	28.3	27.0	850
—	364	276	285	—	—	—	384	367	3	—	—	47.4	45.8	1 370
312	356	291	299	308	316	369	369	359	2	31.6	30.2	30.2	28.8	897
—	384	296	305	—	—	—	404	387	3	—	—	51.1	49.3	1 500
339	391	313	323	335	343	407	407	394	2.5	48.6	46.4	46.4	44.2	1 360
—	418	316	326	—	—	—	444	421	3	—	—	70.8	68.6	2 000
359	411	333	343	355	363	427	427	414	2.5	51.4	49.1	49.0	46.7	1 450
—	438	336	346	—	—	—	464	441	3	—	—	76.2	73.5	2 200
379	—	353	363	375	383	447	—	—	2.5	54.2	51.7	—	—	—
—	473	360	371	—	—	—	500	477	4	—	—	102	98.5	2 950
398	—	373	383	394	402	467	—	—	2.5	57.0	54.4	—	—	—
—	493	380	391	—	—	—	520	497	4	—	—	107	103	3 600
425	—	396	408	420	430	504	—	—	3	84.5	80.6	—	—	—
—	512	400	411	—	—	—	540	516	4	—	—	113	109	3 340
445	—	416	428	440	450	524	—	—	3	88.2	84.1	—	—	—
—	547	420	432	—	—	—	580	551	4	—	—	146	141	4 230
465	—	436	448	460	470	544	—	—	3	92.0	87.7	—	—	—
—	567	440	452	—	—	—	600	571	4	—	—	154	148	4 520
492	—	456	469	487	497	584	—	—	3	127	121	—	—	—
—	596	464	477	—	—	—	626	601	5	—	—	178	172	5 000
512	—	476	489	507	517	604	—	—	3	132	126	—	—	—
—	622	484	498	—	—	—	656	627	5	—	—	202	195	6 030
534	—	500	514	531	541	630	—	—	4	156	149	—	—	—
556	—	520	534	551	561	650	—	—	4	162	155	—	—	—

## High speed single row cylindrical roller bearings

$d$  30~80mm

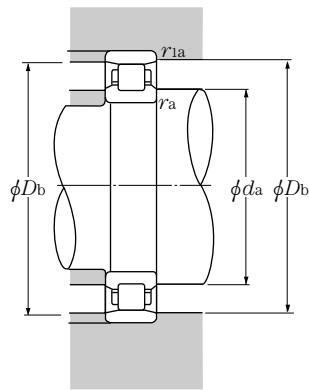


Part number <sup>①</sup> ③		Boundary dimensions						Basic load ratings				Limiting speeds	
cylindrical bore	tapered bore	$d$	$D$	$B$	$r$ s min <sup>②</sup>	$r_1$ s min <sup>②</sup>	$E_w$	dynamic kN		dynamic kgf		min <sup>-1</sup>	
								$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease lubrication	oil lubrication
N1006HS	N1006HSK	30	55	13	1	0.6	48.5	17.2	17.6	1 750	1 790	20 500	32 100
N1007HS	N1007HSK	35	62	14	1	0.6	55	21.2	22.5	2 160	2 300	18 000	28 200
N1008HS	N1008HSK	40	68	15	1	0.6	61	24.3	26.3	2 480	2 680	16 100	25 300
N1009HS	N1009HSK	45	75	16	1	0.6	67.5	29.1	32.5	2 970	3 350	14 500	22 800
N1010HS	N1010HSK	50	80	16	1	0.6	72.5	29.9	34.5	3 050	3 550	13 400	21 100
N1011HS	N1011HSK	55	90	18	1.1	1	81	39.0	46.0	4 000	4 700	12 100	18 900
N1012HS	N1012HSK	60	95	18	1.1	1	86.1	40.0	48.6	4 100	4 950	11 300	17 700
N1013HS	N1013HSK	65	100	18	1.1	1	91	42.5	53.5	4 300	5 450	10 600	16 600
N1014HS	N1014HSK	70	110	20	1.1	1	100	52.0	65.5	5 300	6 700	9 700	15 200
N1015HS	N1015HSK	75	115	20	1.1	1	105	53.0	69.0	5 400	7 050	9 200	14 400
N1016HS	N1016HSK	80	125	22	1.1	1	113	63.5	82.0	6 450	8 400	8 500	13 400

① A bearing number with suffix **K** indicates a tapered-bore bearing (taper ratio 1/12).

② Minimum allowable value for chamfer dimension  $r$  or  $r_1$ .

③ N10HS differs from standard N10 in internal construction.



**Dynamic equivalent radial load**

$$P_r = F_r$$

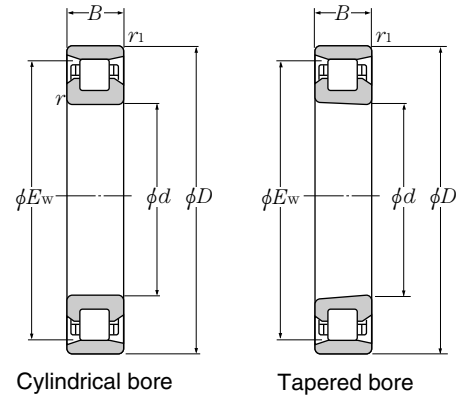
**Static equivalent radial load**

$$P_{0r} = F_r$$

Abutment and fillet dimensions mm					Mass cylindrical bore kg (approx.)	Internal free space cm <sup>3</sup>	Part number	
$d_a$ min	$D_b$ max	$r_{as}$ min	$r_{1as}$ max	cylindrical bore			tapered bore	
35	50	49	1	0.6	0.143	4.33	N1006HS	N1006HSK
40	57	56	1	0.6	0.190	5.06	N1007HS	N1007HSK
45	63	62	1	0.6	0.235	7.10	N1008HS	N1008HSK
50	70	69	1	0.6	0.298	8.85	N1009HS	N1009HSK
55	75	74	1	0.6	0.323	10.8	N1010HS	N1010HSK
61.5	83.5	82	1	1	0.473	15.0	N1011HS	N1011HSK
66.5	88.5	87	1	1	0.505	15.3	N1012HS	N1012HSK
71.5	93.5	92	1	1	0.538	19.0	N1013HS	N1013HSK
76.5	103.5	101	1	1	0.745	22.0	N1014HS	N1014HSK
81.5	108.5	106	1	1	0.787	26.5	N1015HS	N1015HSK
86.5	118.5	114	1	1	1.05	31.1	N1016HS	N1016HSK

## High speed single row cylindrical roller bearings

$d$  85~160mm

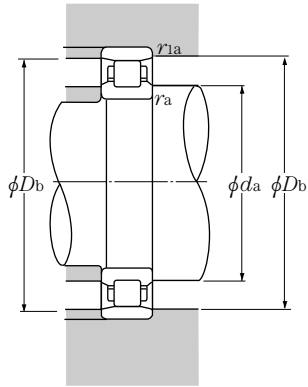


Part number <sup>①</sup> <sup>③</sup>		Boundary dimensions						Basic load ratings				Limiting speeds	
cylindrical bore	tapered bore	$d$	$D$	$B$	$r$ 's min <sup>②</sup>	$r_1$ 's min <sup>②</sup>	$E_w$	dynamic		static		min <sup>-1</sup>	
								$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease lubrication	oil lubrication
N1017HS	N1017HSK	85	130	22	1.1	1	118	65.0	86.0	6 650	8 800	8 100	12 800
N1018HS	N1018HSK	90	140	24	1.5	1.1	127	78.5	105	8 000	10 700	7 600	11 900
N1019HS	N1019HSK	95	145	24	1.5	1.1	132	80.5	110	8 200	11 200	7 300	11 400
N1020HS	N1020HSK	100	150	24	1.5	1.1	137	82.0	115	8 400	11 700	7 000	11 000
N1021HS	N1021HSK	105	160	26	2	1.1	146	109	149	11 100	15 200	6 600	10 400
N1022HS	N1022HSK	110	170	28	2	1.1	155	126	173	12 800	17 700	6 200	9 800
N1024HS	N1024HSK	120	180	28	2	1.1	165	128	182	13 100	18 500	5 800	9 100
N1026HS	N1026HSK	130	200	33	2	1.1	182	156	220	15 900	22 400	5 300	8 300
N1028HS	N1028HSK	140	210	33	2	1.1	192	164	240	16 800	24 400	5 000	7 800
N1030HS	N1030HSK	150	225	35	2.1	1.5	206	185	273	18 800	27 800	4 700	7 300
N1032HS	N1032HSK	160	240	38	2.1	1.5	219	206	305	21 000	31 500	4 400	6 900

① A bearing number with suffix **K** indicates a tapered-bore bearing (taper ratio 1/12).

② Minimum allowable value for chamfer dimension  $r$  or  $r_1$ .

③ N10HS differs from standard N10 in internal construction.



**Dynamic equivalent radial load**

$$P_r = F_r$$

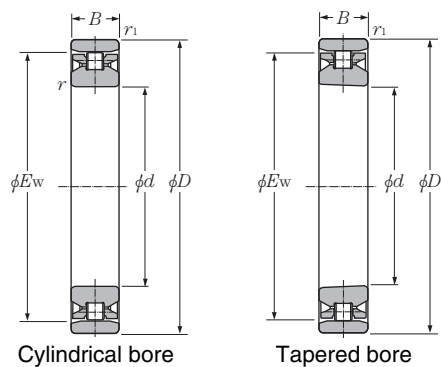
**Static equivalent radial load**

$$P_{0r} = F_r$$

Abutment and fillet dimensions mm					Mass cylindrical bore kg (approx.)	Internal free space cm <sup>3</sup>	Part number	
$d_a$ min	$D_b$ max	$r_{as}$ min	$r_{1as}$ max	cylindrical bore			tapered bore	
91.5	123.5	119	1	1	1.10	33.4	N1017HS	N1017HSK
98	132	129	1.5	1	1.43	40.0	N1018HS	N1018HSK
103	137	134	1.5	1	1.50	46.5	N1019HS	N1019HSK
108	142	139	1.5	1	1.55	53.5	N1020HS	N1020HSK
114	151	148	2	1	1.96	56.2	N1021HS	N1021HSK
119	161	157	2	1	2.44	68.8	N1022HS	N1022HSK
129	171	167	2	1	2.61	87.5	N1024HS	N1024HSK
139	191	183	2	1	3.95	118	N1026HS	N1026HSK
149	201	194	2	1	4.19	130	N1028HS	N1028HSK
161	214	208	2	1.5	5.10	151	N1030HS	N1030HSK
171	229	221	2	1.5	6.30	172	N1032HS	N1032HSK

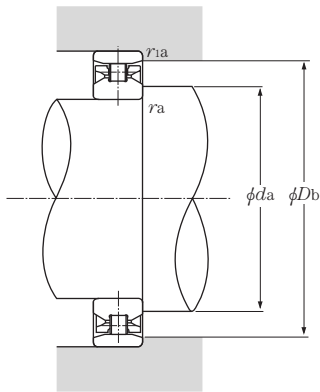
## Ultra high-speed single row cylindrical roller bearings (ULTAGE series)

$d$  55~100mm



Part number <sup>①</sup> <sup>②</sup>		Boundary dimensions						Basic load ratings				Limiting speeds	
cylindrical bore	tapered bore	$d$	$D$	$B$	$r$ s min <sup>②</sup>	$r_1$ s min <sup>②</sup>	$E_w$	dynamic kN		dynamic kgf		min <sup>-1</sup>	
								$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease lubrication	oil lubrication
N1011HSR	N1011HSRK	55	90	18	1.1	1	81	24.1	28.7	2 460	2 930	15 400	30 900
N1012HSR	N1012HSRK	60	95	18	1.1	1	86.1	23.8	28.9	2 430	2 950	14 400	28 900
N1013HSR	N1013HSRK	65	100	18	1.1	1	91	25.3	32	2 580	3 250	13 600	27 200
N1014HSR	N1014HSRK	70	110	20	1.1	1	100	29.2	37.5	2 980	3 850	12 400	24 700
N1016HSR	N1016HSRK	80	125	22	1.1	1	113	38	50	3 900	5 100	11 000	21 900
N1018HSR	N1018HSRK	90	140	24	1.5	1.1	127	48	64.5	4 900	6 550	9 700	19 500
N1020HSR	N1020HSRK	100	150	24	1.5	1.1	137	50.5	70.5	5 150	7 200	9 000	18 000

① Minimum allowable value for chamfer dimension  $r$  or  $r_1$ .



**Dynamic equivalent radial load**

$$P_r = F_r$$

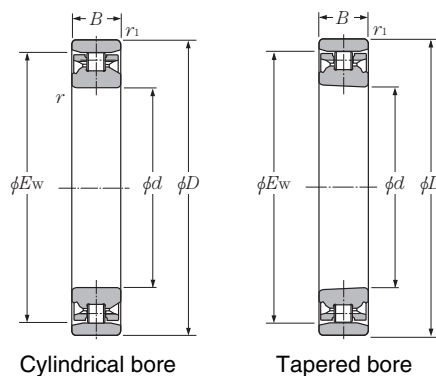
**Static equivalent radial load**

$$P_{0r} = F_r$$

Abutment and fillet dimensions mm					Internal free space cm <sup>3</sup>	Part number	
$d_a$ min	$D_b$ max	min	$r_{as}$ max	$r_{1as}$ max		cylindrical bore	tapered bore
61.5	83.5	82	1	1	15.7	N1011HSR	N1011HSRK
66.5	88.5	87	1	1	17.0	N1012HSR	N1012HSRK
71.5	93.5	92	1	1	17.9	N1013HSR	N1013HSRK
76.5	103.5	101	1	1	23.3	N1014HSR	N1014HSRK
86.5	118.5	114	1	1	31.6	N1016HSR	N1016HSRK
98	132	129	1.5	1	41.1	N1018HSR	N1018HSRK
108	142	139	1.5	1	45.1	N1020HSR	N1020HSRK

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

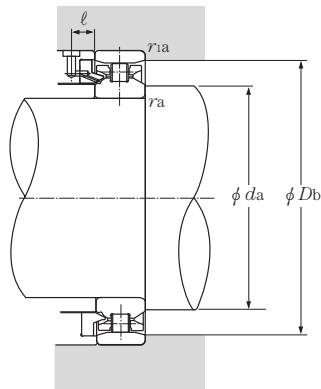
$d$  55~100mm



Part number		Boundary dimensions						Basic load ratings				Limiting speeds
cylindrical bore	tapered bore	$d$	$D$	$B$	$r_{1s} \text{ min}^{\text{①}}$	$r_{1s} \text{ min}^{\text{①}}$	$E_w$	dynamic kN		dynamic kgf		$\text{min}^{-1}$ grease lubrication
								$C_r$	$C_{or}$	$C_r$	$C_{or}$	
N1011HSL	N1011HSLK	55	90	18	1.1	1	81	24.1	28.7	2 460	2 930	30 900
N1012HSL	N1012HSLK	60	95	18	1.1	1	86.1	23.8	28.9	2 430	2 950	28 900
N1013HSL	N1013HSLK	65	100	18	1.1	1	91	25.3	32	2 580	3 250	27 200
N1014HSL	N1014HSLK	70	110	20	1.1	1	100	29.2	37.5	2 980	3 850	24 700
N1016HSL	N1016HSLK	80	125	22	1.1	1	113	38	50	3 900	5 100	21 900
N1018HSL	N1018HSLK	90	140	24	1.5	1.1	127	48	64.5	4 900	6 550	19 500
N1020HSL	N1020HSLK	100	150	24	1.5	1.1	137	50.5	70.5	5 150	7 200	18 000

① Minimum allowable value for chamfer dimension  $r$  or  $r_1$ .

② For the details of spacer dimensions, please contact NTN Engineering.



**Dynamic equivalent radial load**

$$P_r = F_r$$

**Static equivalent radial load**

$$P_{0r} = F_r$$

Abutment and fillet dimensions mm						Part number	
$d_a$ min	$D_b$ max	min	$r_{as}$ max	$r_{1as}$ max	$l$ <sup>②</sup> min	cylindrical bore	tapered bore
61.5	83.5	82	1	1	8.5	N1011HSL	N1011HSLK
66.5	88.5	87	1	1	8.5	N1012HSL	N1012HSLK
71.5	93.5	92	1	1	8.5	N1013HSL	N1013HSLK
76.5	103.5	101	1	1	10	N1014HSL	N1014HSLK
86.5	118.5	114	1	1	10	N1016HSL	N1016HSLK
98	132	129	1.5	1	10	N1018HSL	N1018HSLK
108	142	139	1.5	1	10	N1020HSL	N1020HSLK

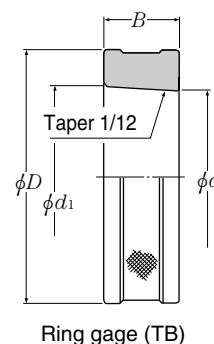
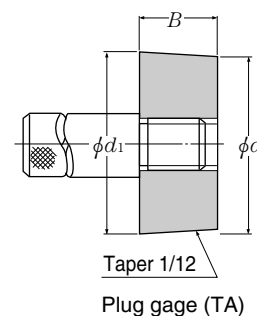
## 13 Taper gage and internal clearance adjustment gage for NTN precision cylindrical roller bearings

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 gage 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.

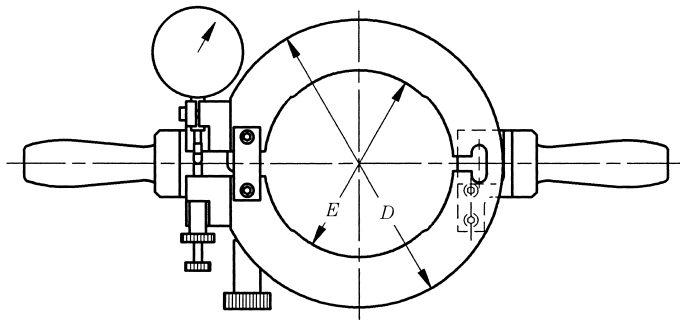
NTN also offers a plug gage that permits verification of the precision of the ring gage. Remember that the radial internal clearance of a cylindrical roller bearing needs to be correctly adjusted. Too large a radial clearance can diminish the precision of the main spindle, while too small a radial clearance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

## 14 Dimension table for taper gage

Part number		Applicable bearing	Boundary dimensions				Mass	
Plug gage	Ring gage		mm				(approx.) kg	
			$d$	$d_1$	$D$	$B$	type TB	type TA
TANN3006K	TBNN3006K	N1006HS NN3006K	30	31.583	70	19	0.5	0.2
TANN3007K	TBNN3007K	N1007HS NN3007K	35	36.667	75	20	0.6	0.3
TANN3008K	TBNN3008K	N1008HS NN3008K	40	41.750	80	21	0.7	0.3
TANN3009K	TBNN3009K	N1009HS NN3009K	45	46.917	85	23	0.7	0.4
TANN3010K	TBNN3010K	N1010HS NN3010K	50	51.917	90	23	0.8	0.5
TANN3011K	TBNN3011K	N1011HS NN3011K	55	57.167	95	26	0.9	0.7
TANN3012K	TBNN3012K	N1012HS NN3012K	60	62.167	100	26	1.0	0.8
TANN3013K	TBNN3013K	N1013HS NN3013K	65	67.167	105	26	1.1	0.9
TANN3014K	TBNN3014K	N1014HS NN3014K	70	72.500	110	30	1.3	1.3
TANN3015K	TBNN3015K	N1015HS NN3015K	75	77.500	115	30	1.4	1.4
TANN3016K	TBNN3016K	N1016HS NN3016K	80	82.833	125	34	1.9	1.7
TANN3017K	TBNN3017K	N1017HS NN3017K	85	87.833	130	34	2.0	1.9
TANN3018K	TBNN3018K	N1018HS NN3018K	90	93.083	140	37	2.6	2.4
TANN3019K	TBNN3019K	N1019HS NN3019K	95	98.083	145	37	2.7	2.6
TANN3020K	TBNN3020K	N1020HS NN3020K	100	103.083	150	37	2.8	2.8
TANN3021K	TBNN3021K	N1021HS NN3021K	105	108.417	160	41	3.6	3.5
TANN3022K	TBNN3022K	N1022HS NN3022K	110	113.750	165	45	4.1	4.0
TANN3024K	TBNN3024K	N1024HS NN3024K	120	123.833	170	46	4.1	4.7
TANN3026K	TBNN3026K	N1026HS NN3026K	130	134.333	180	52	4.8	6.4
TANN3028K	TBNN3028K	N1028HS NN3028K	140	144.417	190	53	5.2	7.4
TANN3030K	TBNN3030K	N1030HS NN3030K	150	154.667	210	56	7.2	8.4
TANN3032K	TBNN3032K	N1032HS NN3032K	160	165.000	220	60	8.1	10



15 Dimension table for mounted internal clearance adjustment gage



Part number	Applicable bearing	Boundary dimensions mm		
		<i>E</i>	<i>D</i>	width <i>B</i>
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