For New Technology Network

NTN®

General Catalog for Office Equipment Products

CAT. No. 8701-Ⅱ/E

NTN General Catalog for Office Equipment Products

— Introduction to Copy Machine and Printer Compatible Products —

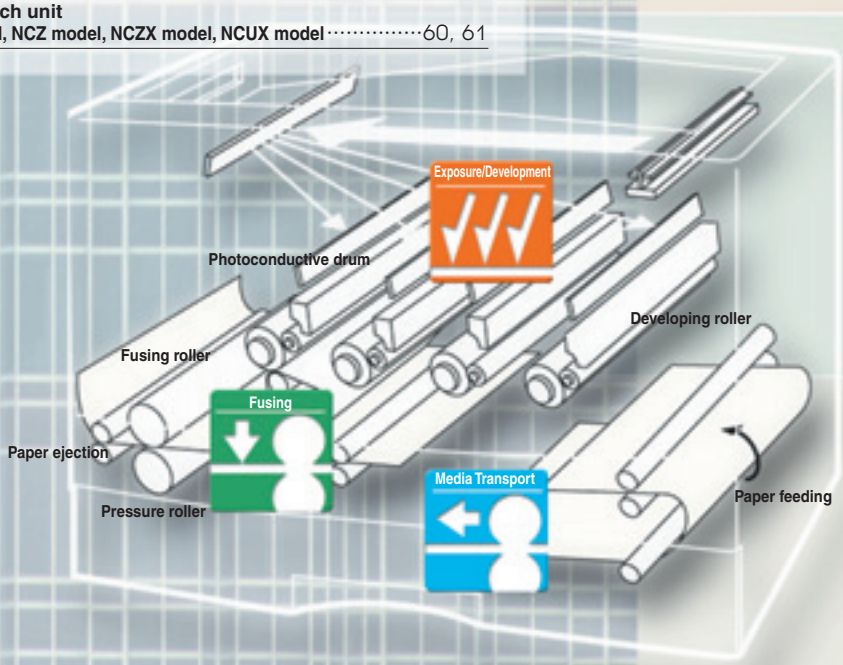
Because of the expanded use of personal computers, Internet and other digital equipment, multi-function copy machine and printers are now used around the world as image outputting equipment. Such office equipment have many different bearings built into them to meet various needs.
In order to concentrate many different functions in a small space, NTN has been providing products that save space and are easy to maintain. These are made possible by the creation of key technology that helps us to realize highly reliable products.

■Usage Locations and Compatible NTN Products

		Page
Ball bearings	· Conductive bearings	9
	· Chemical attack preventing bearings	10
	· Thin-type ball bearings	12
Resin products	· Bearings for cartridges	24
	· Bearing units with seals	25
Sintered products	· Hybrid BEARPHITE	33
Torque limiters	· Torque limiter unit (NTS type)	47, 48
	· Torque limiter unit (NTB type)	49
Clutches	· One-way clutch unit NCU model, NCZC model, NCZ model, NCZX model, NCUX model	60, 61

Ball bearings	· Conductive bearings	9
	· Chemical attack preventing bearings	10
	· Miniature and extra small ball bearings	14
Resin products	· Blades	24
Sintered products	· NTN BEARPHITE	36~45
Torque limiters	· Torque limiter unit (NTS type)	47, 48
	· Torque limiter unit (NTB type)	49
Clutches	· One-way clutch unit NCU model, NCZC model, NCZ model, NCZX model, NCUX model	60, 61

Ball bearings	· High temperature, long life bearings	8
	· Conductive bearings	9
	· Chemical attack preventing bearings	10
	· Thin-type ball bearings	12
Resin products	· Separating pins	21
	· Separating plates, sliding bearings	21, 22
	· Insulation sleeves	22
	· Fusing gears	23
	· Paper Ejection Parts (rollers, ribs)	23
Clutches	· One-way clutch unit NCZC model, NCZ model, NCZX model, NCUX model	60, 61



CONTENTS

Ball Bearings

67 series

Ⅰ Ball bearings

1. Description of Ball Bearings ····· 3
2. High-temperature, Long-life Bearings ····· 8
3. Conductive Bearings ····· 9
4. Chemical Attack Preventing Bearings ····· 10
5. Integrated Rotation Sensor Bearings ····· 11
6. Thin-type Ball Bearings (Series 67) ····· 12
7. Miniature and Extra Small Ball Bearings ····· 14
8. Deep Groove Ball Bearings ····· 16
9. Bearings with Snap Ring Grooves and Snap Rings ····· 18

BEAREE

BEAREE AS5021

BEAREE AS5054

Ⅱ Resin products

1. Separating Pins ····· 21
2. Separating Plates ····· 21
3. Slide Bearings ····· 22
4. Insulation Sleeves ····· 22
5. Fusing Gears ····· 23
6. Paper Output Parts(roller, rib) ····· 23
7. Cleaning Blades ····· 24
8. Bearings for Cartridges ····· 24
9. Bearing Units with Seals ····· 25
10. BEAREE Selection Guidelines ····· 26
11. Base Resins and Characteristics of Major Grades ····· 27

BEARPHITE

HYBRID BEARPHITE

Ⅲ Sintered products

1. Oil-impregnated Sintered Bearings “NTN BEARPHITE” ····· 29
2. Hybrid BEARPHITE Bearings ····· 33
3. Hydrodynamic BEARPHITE Bearings ····· 34
4. Products under Development ····· 35
5. NTN BEARPHITE Standard Products ····· 36

Torque Limitter

NTS Type

Ⅳ Torque limiters

1. Torque Limiter Units (NTS Type) ····· 47
2. Torque Limiter Unit (NTB 14 Type) ····· 49

Clutches

One-way Clutch

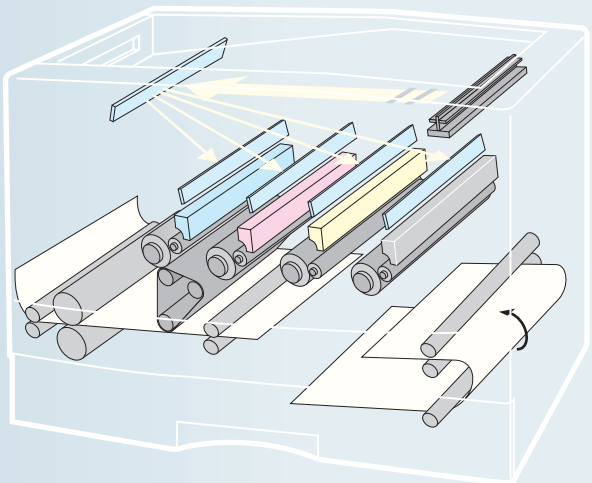
One-way Clutch Unit

Ⅴ Clutches

1. NTN One-way Clutch ····· 51
2. One-way Clutch Unit Specifications ····· 55
3. Technical Data ····· 55
4. One-way Clutch ····· 56
5. One-way Clutch Units ····· 60
6. Torque Diodes ····· 62
7. Introduction to Products Being Developed ····· 64

I Ball Bearings

1. Description of Ball Bearings 3
2. High-temperature, Long-life Bearings 8
3. Conductive Bearings 9
4. Chemical Attack Preventing Bearings 10
5. Integrated Sensor Bearings 11
6. Thin-type Ball Bearings (Series 67) 12
7. Miniature and Extra Small Ball Bearings 14
8. Deep Groove Ball Bearings 16
9. Bearings with Snap Ring Grooves and Snap Rings ... 18



1. Description of Ball Bearings

1.1 Main dimensions and numbering conventions

Table 1 Bearing Number Composition and Arrangement

Supplementary prefix code Special application/material/heat treatment code	Basic number				
	Bearing series			Bore diameter	
	Bearing series code	Dimension series code		Code	Bore diameter mm
		Width/height series [1]	Diameter series		
F- Stainless steel bearings (～120˚C) TS2- Dimension stabilized bearings for high temperature use to 160˚C TS3- Dimension stabilized bearings for high temperature use to 200˚C TS4- Dimension stabilized bearings for high temperature use to 250˚C	Deep groove ball bearings (type code 6)			/0.6	0.6
				/1.5	1.5
	68	(1)	8	/2.5	2.5
	69	(1)	9		
	60	(1)	0	1	1
	62	(0)	2		
	63	(0)	3	9	9
				00	10
				01	12
				02	15
				03	17
				/22	22
				/28	28
				/32	32
				04	20
				05	25
				06	30
				07	35
				08	40
				09	45

Supplementary suffix codes						
Cage code [1]	Seal/Shield code	External configuration code	Duplex arrangement code	Internal clearance/preload code [1]	Tolerance code	Lubrication code
(J) Pressed steel cage T2 Plastic mold cage	LLB Synthetic rubber seal (non-contact type) LLU Synthetic rubber seal (contact type) LLH Synthetic rubber seal (low-torque type) ZZ Steel shield	N With snap ring groove NR With snap ring	D2 Two matched, paired bearings	C2 Internal clearance less than normal (CN) Normal clearance C3 Internal clearance greater than normal C4 Internal clearance greater than C3 C5 Internal clearance greater than C4 CM Radial internal clearance for electric motor use	P6 JIS Class 6 P5 JIS Class 5 P4 JIS Class 4 P2 JIS Class 2	/2AS Shell Alvania S2 grease /3AS Shell Alvania S3 grease /8A Shell Alvania EP2 grease /5K Multemp SRL /LX11 Barrierta JFE552

Note 1) The characters in parentheses will not be shown in the bearing numbers.
Remark: Please consult with **NTN** regarding any bearing number codes, prefixes and suffixes not shown in the tables above.

1.2 Basic bearing numbers and supplementary symbols (Miniature and Extra small ball bearings)

Table 2

Supplementary symbols to be placed before the basic numbers		
Symbol for materials	**Without symbol**	High carbon chrome bearing steel
	F-	Stainless steel
Basic number	**67, 68, 69, 60, 62, 63, BC**	Radial ball bearings, Metric series
	W	Radial ball bearings, wider than standard width (shielded type)
	WA	Radial ball bearings, other sizes than standard ones
	FL	Flanged outer rings
	FLA	Flanged outer rings, provided non-standard flange dimensions

F－FL685

Supplementary symbols to be placed after the basic numbers											
Cage symbol	Stainless steel cage	**J1**									
	Synthetic resin cage	**T2**									
Shield/seal symbol	Steel shield plate	**Z, ZZ**									
	Steel shield plate (with snap ring)	**ZA, ZZA**									
	Stainless steel shield plate	**Z1, ZZ1**									
	Stainless steel shield plate (with snap ring)	**ZA1, ZZA1**									
	Non-contact rubber (miniature ball bearings)	**LF, LLF**									
	Non-contact nylon	**SA, SSA**									
	Non-contact type rubber	**LB, LLB**									
	Contact type rubber	**LU, LLU**									
Clearance symbol	JIS CN clearance (normal clearance)	**Without symbol**									
	JIS C2 clearance (clearance smaller than CN)	**C2**									
	JIS C3 clearance (clearance greater than CN)	**C3**									
	JIS C4 clearance (clearance greater than C3)	**C4**									
	Low group of JIS C2 clearance (MIL tight clearance)	**C2S**									
	Low group of JIS CN clearance (MIL tight clearance)	**CNS**									
	Medium group of JIS CN clearance (MIL standard clearance)	**CNM**									
	High group of JIS CN clearance (MIL standard clearance)	**CNL**									
	Low group of JIS C3 clearance (MIL standard clearance)	**C3S**									
	Medium group of JIS C3 clearance (MIL loose clearance)	**C3M**									
	High group of JIS C3 clearance (MIL extra loose clearance)	**C3L**									
Precision grade symbol	JIS class 0	**Without symbol**									
	JIS class 6	**P6**									
	JIS class 5	**P5**									
	JIS class 4	**P4**									
	JIS class 2	**P2**									
	NTN PS class 5	**PS5**	Special precision	**PX1…n**							
	NTN PS class 4	**PS4**									
Sealed lubricant symbol	Multemp PS No. 2 (Kyodo Yushi)	**1K**									
	Alvania S2(SHELL)MIL-G-18709	**2AS**									
	Beacon 325(ESSO)MIL-G-23827A	**3E**									
	Isoflex Super LDS18(KLÜBER)	**6K**									
	Multemp SRL (Kyodo Yushi)	**5K**									
	Winsor Lube L-245X(ANDERSON)MIL-L-6085	**1W**									
Special symbol	Special specifications	**V1…Vn**									

T2 ZZ1 CNS P5 ／ 1K

1.3 Bearing tolerances

Table 3 Tolerance of Radial Bearings Inner rings

Units: μm

Nominal bore diameter d mm		Dimensional tolerance of mean bore diameter within plane Δ_{dmp}										Bore diameter variation V_{dp}														
												Diameter series 9					Diameter series 0, 1					Diameter series 2, 3, 4				
		Class 0		Class 6		Class 5		Class 4 [1]		Class 2 [1]		Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2
over	incl.	high	low	high	low	high	low	high	low	high	low	max					max					max				
0.6 [2]	2.5	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
2.5	10	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
10	18	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
18	30	0	−10	0	−8	0	−6	0	−5	0	−2.5	13	10	6	5	2.5	10	8	5	4	2.5	8	6	5	4	2.5
30	50	0	−12	0	−10	0	−8	0	−6	0	−2.5	15	13	8	6	2.5	12	10	6	5	2.5	9	8	6	5	2.5
50	80	0	−15	0	−12	0	−9	0	−7	0	−4	19	15	9	7	4	19	15	7	5	4	11	9	7	5	4

Note 1) The dimensional difference Δ_{ds} of the bore diameter to be applied to Class 4 and 2 is the same as the tolerance of the dimensional difference Δ_{dmp} of the mean bore diameter. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 for Class 4, and to all the diameter series for Class 2.

Units: μm

Nominal bore diameter d mm		Mean bore diameter variation V_{dmp}					Radial runout K_{ia}					Side runout S_d			Axial runout S_{ia}			Width deviation Δ_{Bs}								Width variation V_{Bs}				
																		Normal						Modified						
		Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2		Class 0	Class 6	Class 5	Class 4		Class 0	Class 6	Class 5	Class 4	Class 2
over	incl.	max					max					max			max			high	low	high	low	high	low	high	low	high	low	max				
0.6 [2]	2.5	6	5	3	2	1.5	10	5	4	2.5	1.5	7	3	1.5	7	3	1.5	0	−40	0	−40	0	−40	—	—	0	−250		12	12	5	2.5	1.5
2.5	10	6	5	3	2	1.5	10	6	4	2.5	1.5	7	3	1.5	7	3	1.5	0	−120	0	−40	0	−40	0	−250	0	−250		15	15	5	2.5	1.5
10	18	6	5	3	2	1.5	10	7	4	2.5	1.5	7	3	1.5	7	3	1.5	0	−120	0	−80	0	−80	0	−250	0	−250		20	20	5	2.5	1.5
18	30	8	6	3	2.5	1.5	13	8	4	3	2.5	8	4	1.5	8	4	2.5	0	−120	0	−120	0	−120	0	−250	0	−250		20	20	5	2.5	1.5
30	50	9	8	4	3	1.5	15	10	5	4	2.5	8	4	1.5	8	4	2.5	0	−120	0	−120	0	−120	0	−250	0	−250		20	20	5	3	1.5
50	80	11	9	5	3.5	2	20	10	5	4	2.5	8	5	1.5	8	5	2.5	0	−150	0	−150	0	−150	0	−380	0	−250		25	25	6	4	1.5

Note 2) Bearings with nominal bore diameters of 0.6 mm are included in this dimensional category.

Table 4 Tolerance of Radial Bearings Outer rings

Units: μm

Nominal outer diameter D mm		Dimensional tolerance of mean outer diameter within plane Δ_{Dmp}										Outer diameter variation [4] V_{Dp}														
												Diameter series 9					Diameter series 0, 1					Diameter series 2, 3, 4				
		Class 0		Class 6		Class 5		Class 4 [3]		Class 2 [3]		Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2
over	incl.	high	low	high	low	high	low	high	low	high	low	max					max					max				
2.5 [5]	6	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
6	18	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
18	30	0	−9	0	−8	0	−6	0	−5	0	−4	12	10	6	5	4	9	8	5	4	4	7	6	5	4	4
30	50	0	−11	0	−9	0	−7	0	−6	0	−4	14	11	7	6	4	11	9	5	5	4	8	7	5	5	4
50	80	0	−13	0	−11	0	−9	0	−7	0	−4	16	14	9	7	4	13	11	7	5	4	10	8	7	5	4
80	120	0	−15	0	−13	0	−10	0	−8	0	−5	19	16	10	8	5	19	16	8	6	5	11	10	8	6	5

Note 3) The dimensional difference Δ_{ds} of the bore diameter to be applied to Class 4 and 2 is the same as the tolerance of the dimensional difference Δ_{dmp} of the mean bore diameter. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 for Class 4, and to all the diameter series for Class 2.

Units: μm

Nominal outer diameter D mm		Outer diameter variation [4] V_{Dp} Sealed/shield bearings diameter series		Mean outer diameter variation V_{Dmp}					Radial runout K_{ea}					Outside surface inclination S_D			Axial runout S_{ea}			Width deviation Δ_{Cs}	Width variation V_{Cs}				
		2,3,4	0,1,2,3,4																					
		Class 0	Class 6	Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	All types	Class 0, 6	Class 5	Class 4	Class 2
over	incl.	max		max					max					max			max				max			
2.5 [5]	6	10	9	6	5	3	2	1.5	15	8	5	3	1.5	8	4	1.5	8	5	1.5			5	2.5	1.5
6	18	10	9	6	5	3	2	1.5	15	8	5	3	1.5	8	4	1.5	8	5	1.5	Depends on tolerance of Δ_{Bs} in relation to d of same bearing	Depends on tolerance of V_{Bs} in relation to d of same bearing	5	2.5	1.5
18	30	12	10	7	6	3	2.5	2	15	9	6	4	2.5	8	4	1.5	8	5	2.5			5	2.5	1.5
30	50	16	13	8	7	4	3	2	20	10	7	5	2.5	8	4	1.5	8	5	2.5			5	2.5	1.5
50	80	20	16	10	8	5	3.5	2	25	13	8	5	4	8	4	1.5	10	5	4			6	3	1.5
80	120	26	20	11	10	5	4	2.5	35	18	10	6	5	9	5	2.5	11	6	5			8	4	2.5

Note 4) To be applied in case snap rings are not installed on the bearings. Note 5) Nominal outer diameter of bearings of 2.5 mm is included in this dimensional category.

Table 5 Tolerance of Outer Ring Flange

Units: μm

Precision grade		Outer tolerance Δ_{D1s} or Δ_{D2s} high	Outer tolerance Δ_{D1s} or Δ_{D2s} low	Outer surface inclination relevant to the back side S_{D1} max	Backside axial runout S_{ea1} max	Width deviation Δ_{C1s} or Δ_{C2s} high	Width deviation Δ_{C1s} or Δ_{C2s} low	Width variation V_{C1s} or V_{C2s} max
ISO standards	Class 0	※ (See table on the right)		—	—	Same as the V_{Bs} of the bore of the same bearing.		Same as the V_{Bs} of the bore of the same bearing.
	Class 6			—	—			
	Class 5			8	11			5
	Class 4			4	7			2.5
	Class 2			1.5	$\frac{3}{4}$ 1)			1.5

※

Units: μm

Nominal flange outer diameter D_1 or D_2 (mm) over	incl.	Outer diameter deviation Δ_{D1s} or Δ_{D2s} high	low
	10	+220	−36
10	18	+270	−43
18	30	+330	−52
30	50	+390	−62

Note 1) Applicable to bearings with a nominal outer diameter D of 18 mm or less.

Table 6 NTN Standards for High Precision and Low Noise Bearings ($\phi D \leqq$ 18 mm)

(1) Tolerance of inner ring

Units: μm

Precision grade	Mean bore tolerance Δ_{dmp} high	Mean bore tolerance Δ_{dmp} low	Bore tolerance Δ_{ds} high	Bore tolerance Δ_{ds} low	Bore variation V_{dp} max	Mean bore variation V_{dmp} max	Radial runout K_{ia} max	Bore surface inclination S_d max	Axial runout S_{ia} max	Width deviation Δ_{Bs} high	Width deviation Δ_{Bs} low	Width variation V_{Bs} max
PS 5	0	−5	0	−5	1	1	2.5	3	3	0	−40	2.5
PS 4	0	−5	0	−5	1	1	1.5	2.5	2.5	0	−40	2.5

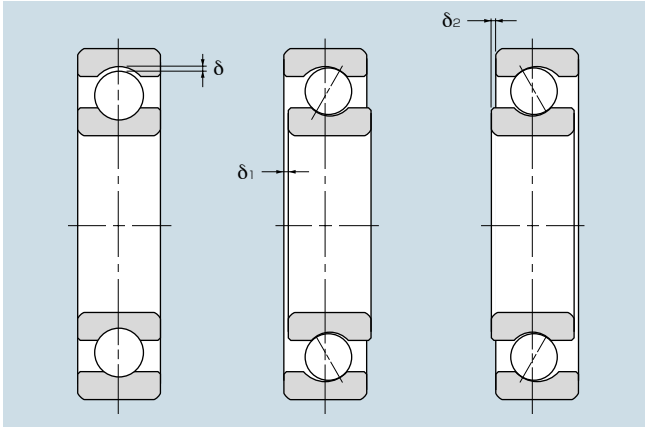
(2) Tolerance of outer ring

Units: μm

Precision grade	Mean outer diameter tolerance Δ_{Dmp} high	low	Outer diameter tolerance Δ_{Ds} Open bearings high	low	Shield bearings high	low	Sealed bearings high	low	Outer diameter variation V_{Dp} Open bearings max	Shield bearings max	Sealed bearings max	Mean outer diameter variation V_{Dmp} max	Radial runout K_{ea} max	Outer diameter surface inclination S_D max	Axial runout S_{ea} max	Width deviation Δ_{Cs} high	low	Width variation V_{Cs} max
PS 5	0	−5	0	−5	+1	−6	0	−5	1	3	1.5	1	5	8	8	0	−40	2.5
PS 4	0	−5	0	−5	+1	−6	0	−5	1	3	1.5	1	2.5	4	2.5	0	−40	2.5

1.4 Bearing internal clearance

Bearing internal clearance refers to the amount of movement of the non-fixed bearing ring when the bearing is still to be installed in the shaft or housing. As **Figure 1** shows, either the inner ring or outer ring is fixed and the amount of movement in the radial or axial direction by the non-fixed bearing ring is the bearing internal clearance. Depending on the direction of movement, the clearance is referred to as either **radial internal clearance** or **axial internal clearance**.



Radial internal clearance $= \delta$ Axial internal clearance $= \delta_1 + \delta_2$

Fig. 1 Bearing Internal Clearance

In order to accurately measure the bearing internal clearance, a measurement load is placed on the bearing ring. Therefore, the measured clearance value (measured clearance) will be larger than the true clearance by the amount of the elastic deformation caused by the measurement load. In order to calculate the true bearing internal clearance, the increase in the clearance caused by the elastic deformation must be corrected by using **Table 1**. This elastic deformation is small enough to be ignored for roller bearings.

Table 1 Radial Internal Clearance Compensation for Measurement Loads (Deep Groove Ball Bearings)

Units: μm

Nominal bore diameter mm over	incl.	Measurement load N {kgf}		Internal clearance correction C2	CN	C3	C4	C5
10 (included)	18	24.5	{2.5}	3~4	4	4	4	4
18	50	49	{5}	4~5	5	6	6	6
50	200	147	{15}	6~8	8	9	9	9

1.4.1 Internal clearance selection

The internal clearance of a bearing under operating conditions (operating clearance) is **usually smaller** than the initial clearance of the same bearing before being installed and operated. This is due to several factors, including bearing fit, difference in temperature between the inner and outer rings, etc. As the operating clearance of a bearing has an effect on bearing life, heat generation, vibration and noise, care must be taken in selecting the most suitable operating clearance.

<Criteria for selecting bearing internal clearance>

In theory, the life of a bearing is at longest when the operating clearance is slightly negative in steady operation. However, in reality it is difficult to constantly maintain this optimum condition. If the negative clearance is enlarged by fluctuating operating conditions, heat will be produced and life will decrease dramatically. Therefore, under normal conditions **an internal clearance slightly larger than zero should be selected as the operating clearance**.

For normal operating conditions (i.e., when normal load fitting is used, and the rotational speed, operating temperature and other factors are normal), an appropriate operating clearance can be achieved by selecting a normal clearance.

Table 2 shows examples of applying internal clearances other than CN (normal) clearance.

Table 2 Examples of Applications Where Bearing Clearances Other Than CN (Normal) Clearance Are Used

Operating conditions	Applications	Selected clearance
With heavy or shock load, clearance is large.	Railway car axles	C3
	Vibration screens	C3, C4
With indeterminate load, both inner and outer rings are tight-fitted.	Railway car traction motors	C4
	Tractors and final speed regulators	C4
Shaft or inner ring is heated.	Paper making machines and driers	C3, C4
	Rolling mill table rollers	C3
Reduction of noise and vibration when rotating.	Micromotors	C2, CM
Adjustment of clearance to minimize shaft runout.	Main spindles of lathes (Double-row cylindrical roller bearings)	C9NA, C0NA
Loose fitting for both inner and outer rings.	Compressor roll neck	C2

1.4.2 Calculating of operating clearance

The operating clearance of a bearing can be calculated from the initial bearing internal clearance and decrease in internal clearance due to interference and decrease in internal clearance due to the difference in temperature between the inner and outer rings.

$$\delta_{eff} = \delta_o - (\delta_f + \delta_t) \quad \cdots\cdots (1)$$

δ_{eff} : Operating clearance, mm
δ_o : Bearing internal clearance, mm
δ_f : Reduced amount of internal clearance due to interference, mm
δ_t : Reduced amount of internal clearance due to temperature differential of inner and outer rings, mm

(1) Reduced internal clearance due to interference

When bearings are installed with interference fixed on shafts and in housings, the inner ring will expand and the outer ring will contract, **thereby reducing the internal clearance of the bearings.**

The amount of expansion or contraction varies depending on the shape of the bearing, the shape of the shaft or housing, and the dimensions and materials of the parts, but the differential ranges from approximately **70 to 90 percent of the effective interference**.

$$\delta_f = (0.70 \sim 0.90)\ \Delta d_{eff} \quad \cdots\cdots (2)$$

δ_f : Reduced amount of internal clearance due to interference, mm
Δd_{eff} : Effective interference, mm

(2) Reduced internal clearance due to inner/outer ring temperature differences

During operation, the outer ring will normally range from 5 to 10˚C cooler than the inner ring or rotating parts. However, if the cooling effect of the housing is large, the shaft is connected to a heat source, or a heated substance is conducted through a hollow shaft, the temperature difference between the two rings can be even greater. **The amount of internal clearance is thus further reduced by the expansion differential of the two rings**.

$$\delta_t = \alpha \cdot \Delta T \cdot D_o \quad \cdots\cdots (3)$$

δ_t : Reduced amount of internal clearance due to temperature differential of inner and outer rings, mm
α : Bearing material expansion coefficient 12.5×10^{-6}/˚C
ΔT : Inner/outer ring temperature differential, ˚C
D_o : Outer ring raceway diameter, mm

The outer ring raceway diameter D_o can be approximated by using equations (4) and (5).

For ball bearings and spherical roller bearings,

$$D_o = 0.20\ (d + 4.0D) \quad \cdots\cdots (4)$$

For roller bearings (except spherical roller bearings),

$$D_o = 0.25\ (d + 3.0D) \quad \cdots\cdots (5)$$

d : Bearing bore diameter, mm
D : Bearing outer diameter, mm

Table 3 Radial Internal Clearance of Deep Groove Ball Bearings

Units: μm

Nominal bore diameter d mm		C2		CN		C3		C4		C5	
over	incl.	min	max	min	max	min	max	min	max	min	max
—	2.5	0	6	4	11	10	20	—	—	—	—
2.5	6	0	7	2	13	8	23	—	—	—	—
6	10	0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90

Table 4 Radial Internal Clearance of Miniature and Extra Small Ball Bearings (bore diameter ϕd<10 mm)

Units: μm

MIL standard	Tight				Standard						Loose		Extra Loose	
Symbol	C2S		CNS		CNM		CNL		C3S		C3M		C3M	
Internal clearance	min	max	min	max	min	max	min	max	min	max	min	max	min	max
	0	5	3	8	5	10	8	13	10	15	13	20	20	28

Note 1) These standards are specified in accordance with MIL 23063. However, **NTN** codes are shown.

2. High-temperature, Long-life Bearings

NTN high-temperature, long-life bearings for fixed locations combine low price with long life by using a special high-temperature, long-life grease that was developed by **NTN**.

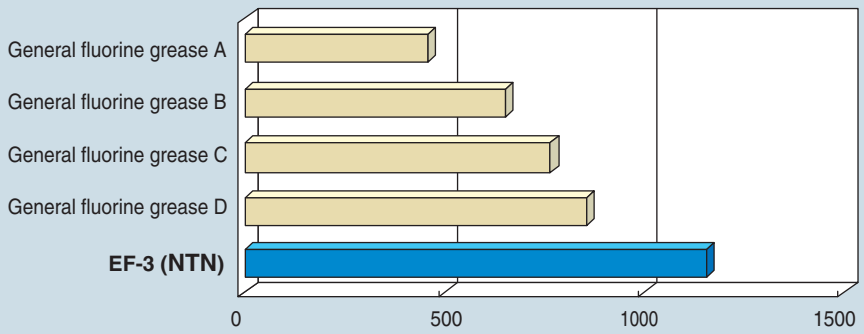
2.1 Recommended grease by operating temperature

Operating temperature range	**NTN** grease code	**NTN** grease name
~180℃	L353	J
~220℃	LX90	N-1
~260℃	LY08	EF-3

2.2 Typical qualities of the recommended grease

NTN grease code	L353	LX90	LY08
NTN grease name	J	N-1	EF-3
Base oil	Ester oil	Fluorine oil	Fluorine oil
Thickener	Urea	PTFE	PTFE
Worked penetration, NLGI	1~2	2	2
Drop point	280 or greater	None	None
Oil separation point, 100×24h	—	6.0	5.3

2.3 High temperature durability test data for grease



[Test conditions]
Bearing : TS3-6005ZZC4
Rotational speed : 100 min^{-1}
Radial Load : 980 N {100 kgf}
Ambient Temperature : 250˚C
Enclosed capacity : 35% of the space capacity ratio

2.4 Compatible bearing sizes

If heat resistance specifications are used*, there is no limit to the bearing size.

*

Operating temperature range	Heat-resistant processing code
~160˚C	TS2
~200˚C	TS3
~250˚C	TS4

3. Conductive Bearings

3.1 The need for conductivity

One of the properties required of bearings for office equipment is electric conductivity. One method for making bearings conductive is to enclose them in electro-conductive grease, and the conductive properties of bearings is greatly affected by the properties of the grease.

In recent years, because of the needs for improved image quality and reduced electromagnetic static, and the needs for simpler mechanisms, there is a strong demand for improved electro-conductivity in bearings.

3.2 NTN electro-conductive grease

In order to meet the above needs, **NTN** has developed electro-conductive grease for bearings to be used in photosensitive drum units and fusing units, and these bearings have been used by many customers.

It should be noted that all **NTN** electro-conductive grease is chemical attack preventing. (See the section on chemical attack preventing bearings for details.)

3.3 Recommended grease brands by operating

Operating temperature range	**NTN** grease code	**NTN** grease name
～70˚C	L745	EP-3
120˚C～	LY47	EF-7

3.4 Typical qualities of recommended grease

NTN grease code	L745	LY47
NTN grease name	EP-3	EF-7
Base oil	PAO	Fluorine oil
Thickener	Electro-conductive substance Lithium	Electro-conductive substance
Worked penetration, NLGI	2	3
Drop point	260 or greater	None
Oil separation point, 100×24h	1.6	0.5
Features	Chemical attack preventing	Chemical attack preventing

3.5 Compatible bearing sizes

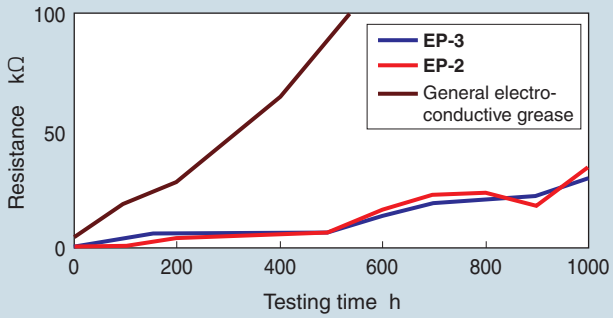
Electro-conductivity is assured by the use of electro-conductive grease, so that there is no limit to the size of bearings.

3.6 Electro-conductivity performance evaluation data

The following shows the measured resistance data for bearings with the grease on the left encapsulated.

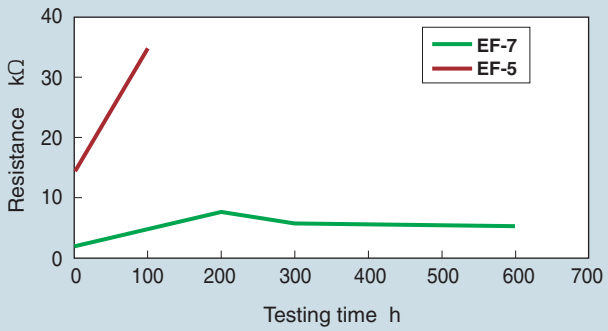
[Evaluation conditions]

Tested bearing : #6806ZZ
Radial load : 49 N {5kgf}
Rotational speed : 100 min^{-1}
Ambient temperature : Room temperature
Operating time : 1000h

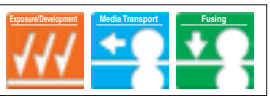


[Evaluation conditions]

Tested bearing : #SC05B98ZZ
Radial load : 220N {22kgf}
Rotational speed : 130min^{-1}
Ambient temperature : 200˚C
Operating time : 600h



4. Chemical Attack Preventing Bearings



4.1 Chemical attack

Because office equipment is using more resins, there are many resin parts surrounding the bearings. Bearings use many types of oils for lubrication and corrosion resistance, and, in recent years, these oils have led to breaking (**Photo 1**) and cracking (**Photo 2**) of resin parts.

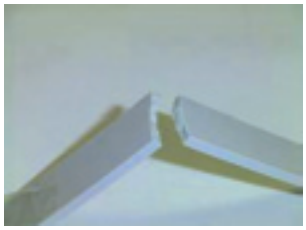


Photo 1 Breaking (PC-ABS)

Photo 2 Cracks (PC)

4.2 NTN chemical attack preventing bearings

NTN has developed special oils (greases and corrosion preventing oils) that have minimal affect on the resins used in office equipment, and these are widely used.

4.3 Typical qualities of grease used in NTN chemical attack preventing bearings

NTN grease code	L542	LX90	LY08	L745	LY47
NTN grease name	EP-1	N-1	EF-3	EP-3	EF-7
Operating temperature range	~180˚C	~220˚C	~260˚C	~70˚C	~250˚C
Base oil	PAO	Fluorine oil	Fluorine oil	PAO	Fluorine oil
Thickener	Urea	PTFE	PTFE	Electro-conductive substance Lithium	Electro-conductive substance
Worked penetration, NLGI	3	2	2	2	3
Drop point	260 or greater	None	None	230 or greater	None
Oil separation point, 100˚C× 24h	0.4	6.0	5.3	1.6	0.5
Features	Non-conductive grease			Electro-conductive grease	

4.4 Chemical attack performance evaluation data

		Resin material							
NTN grease code (**NTN** grease name))		ABS	PC	PC+ABS	POM	PA	PBT	PEEK	PPS
①	**L353（J）**	×	×	×	○	○	○	○	○
②	**LX90（N-1）**	○	○	○	○	○	○	○	○
③	**L542（EP-1）**	○	○	○	○	○	○	○	○
④	**L745（EP-3）**	○	○	○	○	○	○	○	○
⑤	**LY08（EF-3）**	○	○	○	○	○	○	○	○
⑥	**LY47（EF-7）**	○	○	○	○	○	○	○	○

※ ○: No attack, ×: Attacks
※Typical samples of the above resins were used (i.e., generally available resins).
※Bearings ② through ⑥ use chemical attack preventing grease.

4.5 Chemical attack preventing corrosion preventing oils

The corrosion preventing oil used in **NTN** chemical attack preventing bearings is a specially developed oil. (It has been confirmed that this oil will not attack the resins listed above.)

4.6 Compatible bearing sizes

Compatible with all bearings regardless of size.

5. Integrated Rotation Sensor Bearings

5.1 Features

This integrated sensor bearing is an integrated product combining a bearing with a rotation sensor (rotary encoder). Integrated sensor bearings have the following features:

- **Because assembly and adjustment processes can be shortened, they lead to lower costs.**
- **Installation space can be smaller (compact design).**

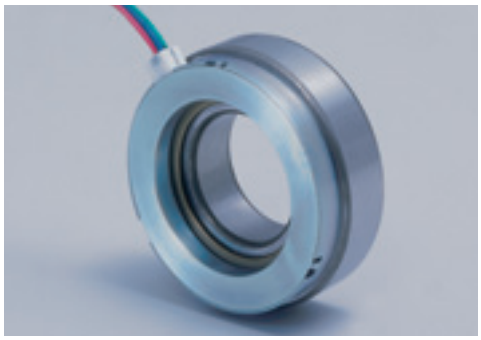


Photo 1 Appearance

5.2 Bearing models and pulses

Table 1 shows the relations between small diameter size bearing models (excluding bearing models with shaft diameter of 20 mm or greater) and pulses.

Table 1 Bearing Models and Pulses

Shaft diameter	Bearing model	Pulses	Output phases
15	6202	32	A, B
17	6203	32	A, B

※Please consult with us with regard to other bearing models.

5.3 Construction

Photo 1 shows the appearance of the 6206 type and **Figure 1** shows its cross section. As the figure shows, a hall effect IC detects the changes in magnetic poles when a magnetic encoder with alternating N and S poles is rotated, and these changes are output as pulse signals. By installing two hall effect ICs at 90 degrees to one another, two phase output can be achieved allowing the detection of the rotational direction.

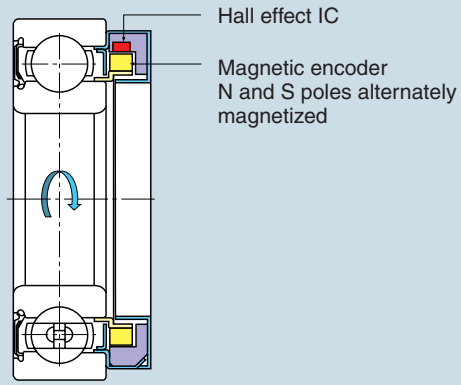


Fig. 1 Cross Section

5.4 Main specifications

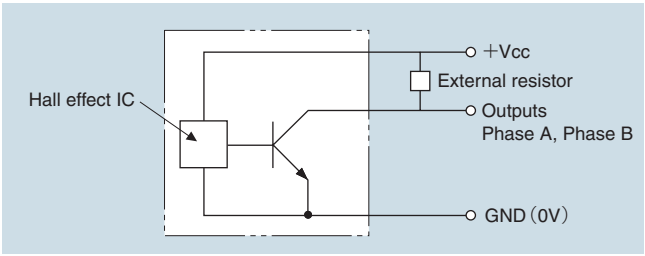


Fig. 2 Circuit Diagram

① Input voltage: 5 V to 24 V
② Output format: Open collector
③ Induced current: 20 mA or less
④ Output waveform: Rectangular waveform
⑤ Output pulses: See **Table 1**
⑥ Temperature range: -40˚C to 120˚C
⑦ Wire colors: See **Table 2**

Table 2 Wire Colors

Red	+Vcc
White	Phase A output
Blue	Phase B output
Black	Ground (0 V)

5.5 Output accuracy

Definition of output accuracy
The definition of output accuracy is given below. (**Fig. 3**)

① Proximity pitch error (%) $= |(T_n - T_{n+1})| / T_n \times 100 \ (n = 1,2,3\cdots)$
② Duty ratio (%) $= T_p / T_n \times 100$
③ Phase A and B timing (angle) $= T_{AB} / T_n \times 360$

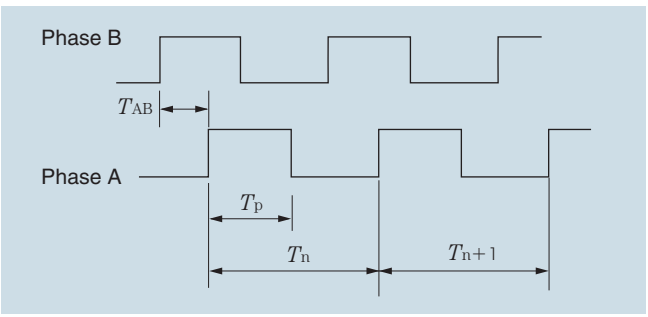


Fig. 3 Definition of Output Accuracy

5.6 Standards (tentative) for degree of Phase A and Phase B output accuracy

① Proximity pitch error (%) = 5% or less
② Duty ratio (%) = 50%±15%
③ Phase A and B timing (angle) = 90 degrees ±45 degrees

5.7 Uses

Rotational angle detection mechanism (paper feeder units, photoconductive drum units)

*** Do not use these bearings in areas where human life depends on them.**

6. Thin-type Ball Bearings (Series 67)

In order to meet the needs for more compact and lighter office equipment, we supply the Series 67 thin-type ball bearings that have smaller bearing cross section dimensions than the Series 68 deep-groove ball bearings. In addition, design can be optimized for sealed bearings and models with snap rings.

6.1 Features of Series 67

- Series 67 are designed to be thinner than those of Series 68. (See **Fig. 1**.)
- Both open and non-contact sealed models (LLF) are available. (See **Fig. 2**.)
  Furthermore, shield models (ZZ) are compatible with bores of ϕ12, ϕ15, ϕ20, ϕ25 and ϕ30.
- These bearings can be made compatible with snap rings. (See **Fig. 3**.)
- The dimensional accuracy and rotation accuracy meet JIS class 0 standards.
- Open models have seal grooves on their outer ring (except for the 6700).
- The inner rings do not have seal grooves.

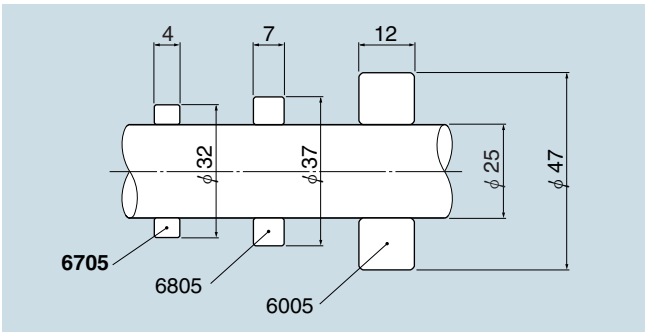


Fig. 1 Comparison of Cross Section Dimensions

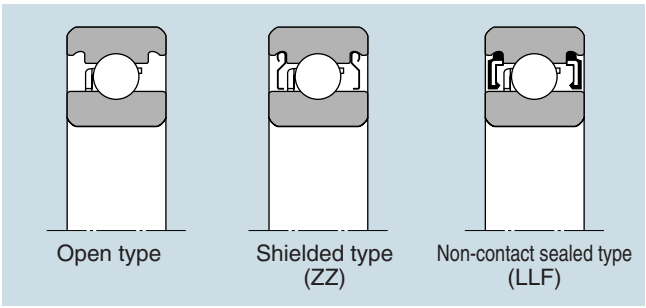
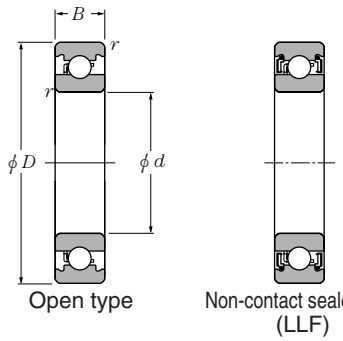
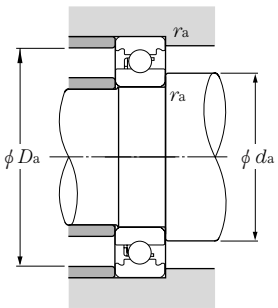


Fig. 2 Shapes of Series 67

6.2 Series 67 dimension table





Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{f_0 \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19				2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{or} = 0.6F_r + 0.5F_a$
However, when $P_{or} < F_r$, then make $P_{or} = F_r$.

Main dimensions mm				Basic dynamic rated load	Basic static rated load	Basic dynamic rated load	Basic static rated load	Coefficient	Model numbers			Allowed rotational speed min^{-1}	Installation dimensions mm				Mass kg
				N		kgf						Grease lubrication open types ZZ, LLF					
d	D	B	rs min ❶	C_r	C_{or}	C_r	C_{or}	f_0	Open type	Shielded type	Non-contact sealed type		d_a min	d_a max	D_a max	r_{as} max	(Reference)
10	15	3	0.1	855	435	87	44	15.7	**6700**	—	—	34 000	10.8	11.5	14.2	0.1	0.0014
	15	4	0.1	855	435	87	44	15.7	—	—	**W6700LLF**	34 000	10.8	11.5	14.2	0.1	0.0021
12	18	4	0.2	930	530	95	54	16.2	**6701**	**6701ZZ**	**6701LLF**	31 000	13.1	13.8	16.4	0.2	0.0026
15	21	4	0.2	940	585	96	59	16.5	**6702**	**6702ZZ**	**6702LLF**	28 000	16.1	16.8	19.4	0.2	0.003
17	23	4	0.2	1 000	660	102	67	16.3	**6703**	—	**6703LLF**	26 000	18.1	18.8	21.4	0.2	0.0039
20	27	4	0.2	1 040	730	106	74	16.1	**6704**	**6704ZZ**	**6704LLF**	23 000	21.6	22.3	25.4	0.2	0.0057
25	32	4	0.2	1 100	840	112	86	15.8	**6705**	**6705ZZ**	**6705LLF**	20 000	26.6	27.3	30.4	0.2	0.0068
30	37	4	0.2	1 140	950	117	97	15.7	**6706**	**6706ZZ**	**6706LLF**	16 000	31.6	32.3	35.4	0.2	0.0081

❶ Minimum allowed dimensions for chamfer dimension r

6.3 Dimension table of sealed, thin-type ball bearings with snap rings

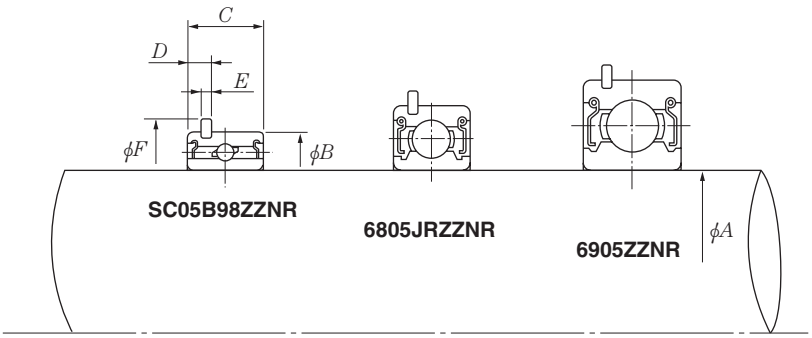


Fig. 3

Name	Internal design	(Bore × outer diameter × width) A × B × C	Snap ring groove location D	Snap ring dimensions E	F（最大）
SC04C21ZZNR	**6704**	20 × 27 × 7	1.3	0.85	29.7
SC05B98ZZNR	**6705**	25 × 32 × 7	1.3	0.85	34.46
SC06C28ZZNRX2	**6706**	30 × 37 × 7	1.3	0.85	39.5
SC07B06ZZNR	**6707**	35 × 44 × 6.5	1.65	0.85	46.8

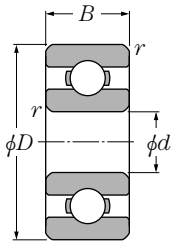
<Reference>

Name	(Bore × outer diameter × width) A × B × C	Snap ring groove location D	Snap ring dimensions E	F (max)
6804	20 × 32 × 7	1.3	0.85	34.8
6904	20 × 37 × 9	1.7	0.85	39.8
6805	25 × 37 × 7	1.3	0.85	39.8
6905	25 × 42 × 9	1.7	0.85	44.8

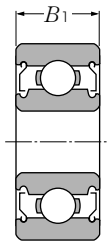
6.4 Bearings with insulation sleeves

We can also make bearings with insulation sleeves. In addition, we can also make electro-conductive specification models.

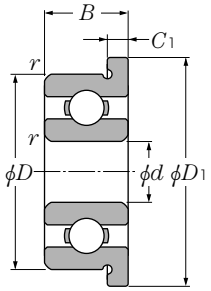
7. Miniature and Extra Small Ball Bearings



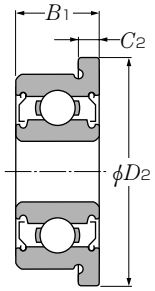
Open type



Shielded type (ZZ)



Open type with flange (FL)

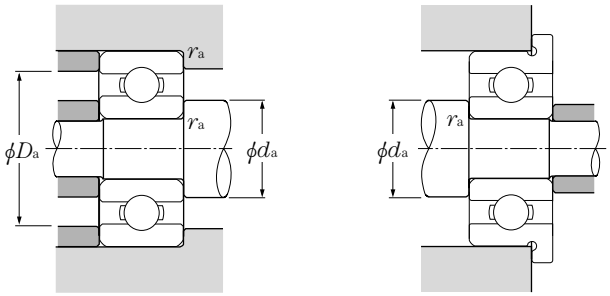


Shielded type with flange (FL-ZZ)

d 4～8mm

d	*D*	*B*	*B*1	*D*1	*D*2	*C*1	*C*2	*r*s min ❶	Basic dynamic rated load *C*r (N)	Basic static rated load *C*or (N)	Basic dynamic rated load *C*r (kgf)	Basic static rated load *C*or (kgf)	Coefficient *f*o	Allowed rotational speed min⁻¹ Grease lubrication	Allowed rotational speed min⁻¹ Oil lubrication
4	7	2	2.5	8.2	8.2	0.6	0.6	0.08	222	88.0	23.0	9.00	15.3	54 000	63 000
	8	2	3	9.2	9.2	0.6	0.6	0.08	395	140	40.0	14.0	13.9	52 000	61 000
	9	2.5	4	10.3	10.3	0.6	1	0.15	640	224	65.0	23.0	12.7	49 000	57 000
	10	3	4	11.2	11.6	0.6	0.8	0.15	650	235	66.0	24.0	13.3	46 000	55 000
	11	4	4	12.5	12.5	1	1	0.15	715	276	73.0	28.0	13.7	45 000	52 000
	12	4	4	13.5	13.5	1	1	0.2	970	360	99.0	36.0	12.8	43 000	51 000
	13	5	5	15	15	1	1	0.2	1 310	490	134	50.0	12.4	42 000	49 000
	16	5	5	—	—	—	—	0.3	1 760	680	179	69.0	12.4	37 000	44 000
5	8	2	2.5	9.2	9.2	0.6	0.6	0.08	217	91.0	22.0	9.50	15.8	49 000	57 000
	9	2.5	3	10.2	10.2	0.6	0.6	0.15	500	211	51.0	21.0	14.6	46 000	55 000
	10	3	4	11.2	11.6	0.6	0.8	0.15	715	276	73.0	28.0	13.7	45 000	52 000
	11	3	5	12.5	12.5	0.8	1	0.15	715	282	73.0	29.0	14.0	43 000	51 000
	13	4	4	15	15	1	1	0.2	1 080	430	110	44.0	13.4	40 000	47 000
	13	—	5	—	15	—	1	0.2	1 080	430	110	44.0	13.4	40 000	47 000
	14	5	5	16	16	1	1	0.2	1 330	505	135	52.0	12.8	39 000	46 000
	16	5	5	18	18	1	1	0.3	1 760	680	179	69.0	12.4	37 000	44 000
	19	6	6	—	—	—	—	0.3	2 340	885	238	90.0	12.1	34 000	40 000
6	10	2.5	3	11.2	11.2	0.6	0.6	0.1	465	196	47.0	20.0	15.2	43 000	51 000
	12	3	4	13.2	13.6	0.6	0.8	0.15	830	365	85.0	37.0	14.5	40 000	47 000
	13	3.5	5	15	15	1.0	1.1	0.15	1 080	440	110	45.0	13.7	39 000	46 000
	15	5	5	17	17	1.2	1.2	0.2	1 350	530	137	54.0	13.3	37 000	44 000
	16	6	6	—	—	—	—	0.2	1 770	695	181	71.0	12.7	36 000	42 000
	17	6	6	19	19	1.2	1.2	0.3	2 190	865	224	88.0	12.3	35 000	42 000
	19	6	6	22	22	1.5	1.5	0.3	2 340	885	238	90.0	12.1	34 000	40 000
7	13	3	4	14.2	14.6	0.6	0.8	0.15	825	375	84.0	38.0	14.9	38 000	45 000
	14	3.5	5	16	16	1	1.1	0.15	1 170	505	120	51.0	14.0	37 000	44 000
	17	5	5	19	19	1.2	1.2	0.3	1 610	715	164	73.0	14.0	35 000	41 000
	19	6	6	—	—	—	—	0.3	2 240	910	228	93.0	12.9	34 000	40 000
	22	7	7	—	—	—	—	0.3	3 350	1 400	340	142	12.5	32 000	37 000
8	12	2.5	3.5	13.2	13.6	0.6	0.8	0.1	515	252	52.0	26.0	15.9	38 000	45 000
	14	3.5	4	15.6	15.6	0.8	0.8	0.15	820	385	84.0	39.0	15.2	36 000	43 000
	16	4	5	18	18	1	1.1	0.2	1 610	715	164	73.0	14.0	35 000	41 000
	19	6	6	22	22	1.5	1.5	0.3	1 990	865	202	88.0	13.8	33 000	39 000
	22	7	7	25	25	1.5	1.5	0.3	3 350	1 400	340	142	12.5	32 000	37 000
	24	8	8	—	—	—	—	0.3	4 000	1 590	410	162	11.7	31 000	36 000

❶ Minimum allowed dimensions for chamfer dimension *r*. ❷ Also applicable to models with flanges.
❸ These dimensions are applicable to sealed and shield bearings.
Remarks: Refer to Cat. No. 2202/E “Ball and Roller Bearings” for the shaft diameters and dimensions of miniature and extra small ball bearings not listed above.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

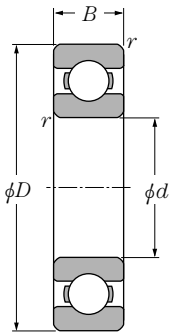
$\frac{f_o \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{or} = 0.6F_r + 0.5F_a$
However, when $P_{or} < F_r$, then make $P_{or} = F_r$.

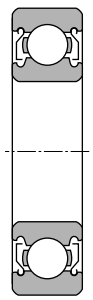
Model number							Installation dimensions mm				Mass (reference) g		Models ❺ compatible with snap ring grooves and snap rings
Open type	Shielded type	Non-contact sealed type	Low torque ❷ sealed type	Contact sealed type	Open type with flange	Shielded type with flange	d_a min	d_a max ❸	D_a max	r_{as} max	Open type	Open type with flange	
674A	WA674ASSA ❻	—	—	—	FL674A	FLWA674ASSA	4.6	5.0	6.4	0.08	0.28	0.35	
BC4-8	WBC4-8ZZ	—	—	—	FLBC4-8	FLWBC4-8ZZ	4.8	5.0	6.8	0.08	0.38	0.46	
684AX50	W684AX50ZZ	W684AX50LLF	—	W684AX50LL	FL684AX50	FLW684AX50ZZ	5.0	5.2	7.8	0.1	0.67	0.76	
BC4-10	WBC4-10ZZ	—	—	—	FLBC4-10	FLAWBC4-10ZZ	5.2	6.0	8.8	0.15	1	1.1	
694	694ZZ	—	—	—	FL694	FL694ZZ	5.2	6.4	9.8	0.15	1.8	2	
604	604ZZ	—	—	—	FL604	FL604ZZ	5.6	6.6	10.4	0.2	2.1	2.3	
624	624ZZ	624LLF	—	—	FL624	FL624ZZ	5.6	6.2	11.4	0.2	3.2	3.5	
634	634ZZ	—	—	—	—	—	6	7.6	14	0.3	5.1	—	
675	WA675ZZ	—	—	—	FL675	FLWA675ZZ	5.6	6.0	7.4	0.08	0.32	0.4	
BC5-9	WBC5-9ZZ	—	—	—	FLBC5-9	FLWBC5-9ZZ	5.2	6.1	7.8	0.15	0.55	0.63	
BC5-10	WBC5-10ZZ	—	—	—	FLBC5-10	FLAWBC5-10ZZ	6.2	6.4	8.8	0.15	0.88	0.97	
685	W685ZZ	—	—	—	FL685	FLW685ZZ	6.2	6.8	9.8	0.15	1.1	1.3	
695	695ZZ	695LLB	—	—	FL695	FL695ZZ	6.6	6.9	11.4	0.2	2.4	2.7	○
—	WBC5-13ZZ	—	—	—	—	FLWBC5-13ZZ	6.6	6.9	11.4	0.2	3.4 ❹	3.7 ❹	
605	605ZZ	605LLB	—	—	FL605	FL605ZZ	6.6	7.4	12.4	0.2	3.5	3.9	○
625	625ZZ	625LLB	—	625LLU	FL625	FL625ZZ	7	7.6	14	0.3	4.8	5.2	
635	635ZZ	635LLB	—	635LLU	—	—	7	9.5	17	0.3	8	—	
676A	WA676AZZ	WA676ALLF	—	WA676ALL	FL676A	FLWA676AZZ	6.6	6.7	9.2	0.1	0.65	0.74	
BC6-12	WBC6-12ZZ	—	—	WBC6-12LL	FLBC6-12	FLAWBC6-12ZZ	7.2	7.9	10.8	0.15	1.3	1.4	○
686	W686ZZ	W686LLB	—	W686LLX	FL686	FLW686ZZ	7.0	7.2	11.8	0.15	1.9	2.2	○
696	696ZZ	696LLB	—	696LLU	FL696	FL696ZZ	7.6	7.8	13.4	0.2	3.8	4.3	○
BC6-16A	BC6-16AZZ	—	—	—	—	—	7.6	8.0	14.4	0.2	5.2	—	
606	606ZZ	606LLB	606LLH	606LLU	FL606	FL606ZZ	8	8.6	15	0.3	6	6.5	
626	626ZZ	626LLB	—	626LLU	FL626	FL626ZZ	8	9.5	17	0.3	8.1	9.2	○
BC7-13	WBC7-13ZZ	—	—	—	FLBC7-13	FLAWBC7-13ZZ	8.2	8.9	11.8	0.15	1.4	1.5	
687A	W687AZZ	—	—	—	FL687A	FLW687AZZ	8.2	8.7	12.8	0.15	2.1	2.4	
697	697ZZ	—	—	697LLU	FL697	FL697ZZ	9	10.0	15	0.3	5.2	5.7	
607	607ZZ	607LLB	—	607LLU	—	—	9	10.4	17	0.3	8	—	
627	627ZZ	627LLB	627LLHX	627LLU	—	—	9	12.2	20	0.3	13	—	
678A	W678AZZ	—	—	—	FL678A	FLAW678AZZ	8.8	9.1	11.2	0.1	0.75	0.86	
BC8-14	WBC8-14ZZ	WBC8-14LLF	—	WBC8-14LL	FLBC8-14	FLWBC8-14ZZ	9.2	9.5	12.8	0.15	1.8	1.9	
688A	W688AZZ	W688ALLB	—	W688ALLU	FL688A	FLW688AZZ	9.6	10.0	14.4	0.2	3.1	3.5	○ ❼
698	698ZZ	698LLB	—	698LLU	FL698	FL698ZZ	10	10.6	17	0.3	7.3	8.4	○
608	608ZZ	608LLB	608LLHX	608LLU	FL608MU	FL608MZZ	10	12.2	20	0.3	12	13	○
628	628ZZ	628LLB	628LLH	628LLU	—	—	10	12.1	22	0.3	17	—	

❹ Shows the values for double shielded bearings. ❺ See page 18. ❻ Also compatible with steel plate shields. ❼ The internal specifications differ.

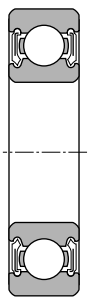
8. Deep Groove Ball Bearings



Open type

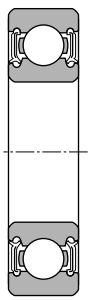


Shielded type (ZZ)



Non-contact sealed type (LLB)

Low-torque sealed type (LLH)



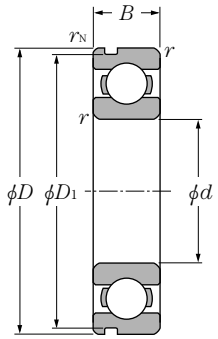
Contact sealed type (LLU)

d 10～45mm

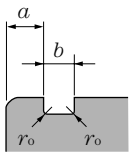
Main dimensions mm					Basic dynamic rated load kN	Basic static rated load kN	Basic dynamic rated load kgf	Basic static rated load kgf	Coefficient	Allowed rotational speed min^{-1}				Model number				
d	*D*	*B*	*r*s min ❶	*r*Ns min	*C*r	*C*or	*C*r	*C*or	*f*o	Grease lubrication, open type ZZ LLB	Oil lubrication, open type ZZ LLB	LLH	LLU	Open type	Shielded type	Non-contact sealed type	Low-torque sealed type	Contact sealed type
10	19	5	0.3	—	1.83	0.925	187	94	14.8	32 000	38 000	—	24 000	**6800**	**ZZ**	**LLB**	—	**LLU**
	22	6	0.3	0.3	2.7	1.27	275	129	14.0	30 000	36 000	25 000	21 000	**6900**	**ZZ**	**LLB**	**LLH**	**LLU**
	26	8	0.3	—	4.55	1.96	465	200	12.4	29 000	34 000	25 000	21 000	**6000**	**ZZ**	**LLB**	**LLH**	**LLU**
12	21	5	0.3	—	1.92	1.04	195	106	15.3	29 000	35 000	—	20 000	**6801**	**ZZ**	**LLB**	—	**LLU**
	24	6	0.3	0.3	2.89	1.46	295	149	14.5	27 000	32 000	22 000	19 000	**6901**	**ZZ**	**LLB**	**LLH**	**LLU**
	28	8	0.3	—	5.10	2.39	520	244	13.2	26 000	30 000	21 000	18 000	**6001**	**ZZ**	**LLB**	**LLH**	**LLU**
15	24	5	0.3	—	2.08	1.26	212	128	15.8	26 000	31 000	—	17 000	**6802**	**ZZ**	**LLB**	—	**LLU**
	28	7	0.3	0.3	3.65	2.00	375	204	14.8	24 000	28 000	18 000	16 000	**6902**	**ZZ**	**LLB**	**LLH**	**LLU**
	32	9	0.3	0.3	5.60	2.83	570	289	13.9	22 000	26 000	18 000	15 000	**6002**	**ZZ**	**LLB**	**LLH**	**LLU**
	35	11	0.6	0.5	7.75	3.60	790	365	12.7	19 000	23 000	18 000	15 000	**6202**	**ZZ**	**LLB**	**LLH**	**LLU**
17	26	5	0.3	—	2.23	1.46	227	149	16.1	24 000	28 000	18 000	15 000	**6803**	**ZZ**	**LLB**	**LLH**	**LLU**
	30	7	0.3	0.3	4.65	2.58	475	263	14.7	22 000	26 000	—	14 000	**6903**	**ZZ**	**LLB**	—	**LLU**
	35	10	0.3	0.3	6.80	3.35	695	345	13.6	20 000	24 000	16 000	14 000	**6003**	**ZZ**	**LLB**	**LLH**	**LLU**
	40	12	0.6	0.5	9.60	4.60	980	465	12.8	18 000	21 000	15 000	12 000	**6203**	**ZZ**	**LLB**	**LLH**	**LLU**
20	32	7	0.3	0.3	4.00	2.47	410	252	15.5	21 000	25 000	15 000	13 000	**6804**	**ZZ**	**LLB**	**LLH**	**LLU**
	37	9	0.3	0.3	6.40	3.70	650	375	14.7	19 000	23 000	14 000	12 000	**6904**	**ZZ**	**LLB**	**LLH**	**LLU**
	42	12	0.6	0.5	9.40	5.05	955	515	13.9	18 000	21 000	13 000	11 000	**6004**	**ZZ**	**LLB**	**LLH**	**LLU**
25	37	7	0.3	0.3	4.30	2.95	435	300	16.1	18 000	21 000	12 000	10 000	**6805**	**ZZ**	**LLB**	**LLH**	**LLU**
	42	9	0.3	0.3	7.05	4.55	715	460	15.4	16 000	19 000	11 000	9 800	**6905**	**ZZ**	**LLB**	**LLH**	**LLU**
	47	12	0.6	0.5	10.1	5.85	1 030	595	14.5	15 000	18 000	11 000	9 400	**6005**	**ZZ**	**LLB**	**LLH**	**LLU**
30	42	7	0.3	0.3	4.70	3.65	480	370	16.5	15 000	18 000	10 000	8.800	**6806**	**ZZ**	**LLB**	**LLH**	**LLU**
	47	9	0.3	0.3	7.25	5.00	740	510	15.8	14 000	17 000	10 000	8 400	**6906**	**ZZ**	**LLB**	**LLH**	**LLU**
35	47	7	0.3	0.3	4.90	4.05	500	410	16.4	13 000	16 000	—	7 600	**6807**	**ZZ**	**LLB**	—	**LLU**
	55	10	0.6	0.5	9.55	6.85	975	695	15.8	12 000	15 000	8 500	7 100	**6907**	**ZZ**	**LLB**	**LLH**	**LLU**
40	52	7	0.3	0.3	5.10	4.40	520	445	16.3	12 000	14 000	8 000	6 700	**6808**	**ZZ**	**LLB**	**LLH**	**LLU**
	62	12	0.6	0.5	12.2	8.90	1 240	910	15.8	11 000	13 000	7 500	6 300	**6908**	**ZZ**	**LLB**	**LLH**	**LLU**
45	58	7	0.3	0.3	5.35	4.95	550	500	16.1	11 000	12 000	—	5 900	**6809**	**ZZ**	**LLB**	—	**LLU**
	68	12	0.6	0.5	13.1	10.4	1 330	1 060	16.1	9 800	12 000	6 700	5 600	**6909**	**ZZ**	**LLB**	**LLH**	**LLU**

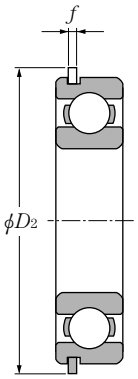
❶ Minimum allowed dimensions for chamfer dimension *r*.

Remarks: Refer to Cat. No. 2202/E “Ball and Roller Bearings” for the shaft diameters and dimensions of deep groove ball bearings not listed above.

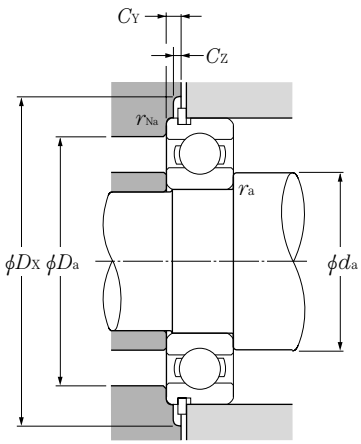


With snap ring groove





With snap ring



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

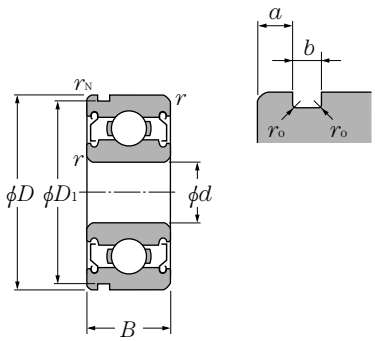
$\frac{f_o \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{or} = 0.6F_r + 0.5F_a$
However, when $P_{or} < F_r$, then make $P_{or} = F_r$.

Model number		Snap ring groove dimensions mm				Snap ring dimensions mm		Installation dimensions mm								Mass ❹ kg	Models ❺ compatible with snap ring grooves and snap rings
With snap ring groove ❷	With snap ring ❷	D_1 max	a max	b max	r_0 max	D_2 max	f max	min	d_a max ❸	D_a max	D_X (Reference)	C_Y max	C_Z min	r_{as} max	r_{Nas} max	(Reference)	
—	—	—	—	—	—	—	—	12	12.5	17	—	—	—	0.3	—	0.005	
N	**NR**	20.8	1.05	0.8	0.2	24.8	0.7	12	13	20	25.5	1.5	0.7	0.3	0.3	0.009	
—	—	—	—	—	—	—	—	12	13.5	24	—	—	—	0.3	—	0.019	○
—	—	—	—	—	—	—	—	14	14.5	19	—	—	—	0.3	—	0.006	○
N	**NR**	22.8	1.05	0.8	0.2	26.8	0.7	14	15	22	27.5	1.5	0.7	0.3	0.3	0.011	
NX2	**NX2RX3**	26.44	2.20	0.9	0.3	32.7	0.85	14	16	26	33.4	2.8	0.9	0.3	0.3	0.021	
—	—	—	—	—	—	—	—	17	17.5	22	—	—	—	0.3	—	0.007	
N	**NR**	26.7	1.3	0.95	0.25	30.8	0.85	17	17.5	26	31.5	1.9	0.9	0.3	0.3	0.016	
N	**NR**	30.15	2.06	1.35	0.4	36.7	1.12	17	19	30	37.5	2.9	1.2	0.3	0.3	0.03	
N	**NR**	33.17	2.06	1.35	0.4	39.7	1.12	19	20	31	40.5	2.9	1.2	0.6	0.5	0.045	
—	—	—	—	—	—	—	—	19	19.5	24	—	—	—	0.3	—	0.008	○
N	**NR**	28.7	1.3	0.95	0.25	32.8	0.85	19	20	28	33.5	1.9	0.9	0.3	0.3	0.018	
N	**NR**	33.17	2.06	1.35	0.4	39.7	1.12	19	21	33	40.5	2.9	1.2	0.3	0.3	0.039	
N	**NR**	38.1	2.06	1.35	0.4	44.6	1.12	21	23	36	45.5	2.9	1.2	0.6	0.5	0.066	
N	**NR**	30.7	1.3	0.95	0.25	34.8	0.85	22	22.5	30	35.5	1.9	0.9	0.3	0.3	0.019	
N	**NR**	35.7	1.7	0.95	0.25	39.8	0.85	22	24	35	40.5	2.3	0.9	0.3	0.3	0.036	
N	**NR**	39.75	2.06	1.35	0.4	46.3	1.12	24	26	38	47	2.9	1.2	0.6	0.5	0.069	
N	**NR**	35.7	1.3	0.95	0.25	39.8	0.85	27	28	35	40.5	1.9	0.9	0.3	0.3	0.022	
N	**NR**	40.7	1.7	0.95	0.25	44.8	0.85	27	29	40	45.5	2.3	0.9	0.3	0.3	0.042	
N	**NR**	44.6	2.06	1.35	0.4	52.7	1.12	29	30.5	43	53.5	2.9	1.2	0.6	0.5	0.08	
N	**NR**	40.7	1.3	0.95	0.25	44.8	0.85	32	33	40	45.5	1.9	0.9	0.3	0.3	0.026	
N	**NR**	45.7	1.7	0.95	0.25	49.8	0.85	32	34	45	50.5	2.3	0.9	0.3	0.3	0.048	
N	**NR**	45.7	1.3	0.95	0.25	49.8	0.85	37	38	45	50.5	1.9	0.9	0.3	0.3	0.029	
N	**NR**	53.7	1.7	0.95	0.25	57.8	0.85	39	40	51	58.5	2.3	0.9	0.6	0.5	0.074	
N	**NR**	50.7	1.3	0.95	0.25	54.8	0.85	42	43	50	55.5	1.9	0.9	0.3	0.3	0033	
N	**NR**	60.7	1.7	0.95	0.25	64.8	0.85	44	45	58	65.5	2.3	0.9	0.6	0.5	0.11	
N	**NR**	56.7	1.3	0.95	0.25	60.8	0.85	47	48	56	61.5	1.9	0.9	0.3	0.3	0.04	
N	**NR**	66.7	1.7	0.95	0.25	70.8	0.85	49	51	64	72	2.3	0.9	0.6	0.5	0.128	

❷ We also make sealed and shield bearing models. ❸ These dimensions are applicable to sealed and shield bearings. ❹ Excluding bearings with snap rings.
❺ See page 18.

9. Bearings with Snap Ring Grooves and Snap Rings



Snap ring groove, shielded type (ZZ)

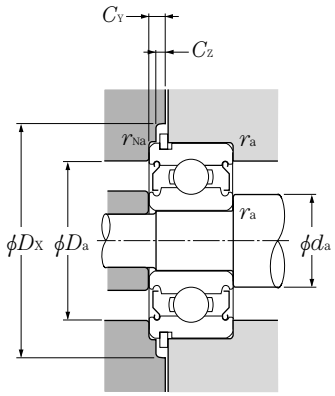
Snap ring, shielded type (ZZ)

d 5～17mm

Main dimensions mm					Basic dynamic rated load N	Basic static rated load N	Basic dynamic rated load kgf	Basic static rated load kgf	Coefficient	Allowed rotational speed min^{-1}		Model number				
d	D	B	$r_{s\,min}$ ❶	$r_{Ns\,min}$ min	C_r	C_{or}	C_r	C_{or}	f_o	Grease lubrication	Oil lubrication	Snap ring groove, shielded type	Snap ring, shielded type	Snap ring, non-contact shielded type	Snap ring, low-torque sealed type	Snap ring, contact sealed type
5	13	4	0.2	0.1	1 080	430	110	44	13.4	40 000	47 000	**SC559ZZN**	**ZZNR**	**LLBNR**	—	—
	14	5	0.2	0.2	1 330	505	135	52	12.8	39 000	46 000	**SC571ZZN**	**ZZNR**	**LLBNR**	—	—
6	12	4	0.15	0.1	640	365	65	37	14.5	40 000	47 000	＊**F-SC6A06ZZ1N**	**ZZ1NR**	—	—	**LLNR**
	13	5	0.15	0.1	1 080	440	110	45	13.7	39 000	46 000	**SC6A04ZZN**	**ZZNR**	—	—	**LLXNR**
	15	5	0.2	0.2	1 350	530	137	54	13.3	37 000	44 000	**SC6A17ZZN**	**ZZNR**	**LLBNR**	—	**LLUNR**
	19	6	0.3	0.3	2 340	885	238	90	12.1	34 000	40 000	**SC669ZZN**	**ZZNR**	**LLBNR**	**LLHNR**	**LLUNR**
8	16	5	0.2	0.1	1 260	585	128	60	14.6	35 000	41 000	**SC866ZZN**	**ZZNR**	**LLBNR**	—	**LLUNR**
	19	6	0.3	0.3	1 990	865	202	88	13.8	33 000	39 000	**SC8A91ZZN**	**ZZNR**	**LLBNR**	—	**LLUNR**
	22	7	0.3	0.4	3 350	1 400	340	142	12.5	32 000	37 000	**SC850ZZN**	**ZZNR**	**LLBNR**	**LLHNR**	**LLUNR**
10	26	8	0.3	0.3	4 550	1 960	465	200	12.4	29 000	34 000	**SC0039ZZN**	**ZZNR**	**LLBNR**	**LLHXNR**	**LLUNR**
12	21	7	0.3	0.3	1 920	1 040	195	106	15.3	29 000	35 000	**SC0189ZZN**	**ZZNR**	**LLBNR**	—	**LLUNR**
17	26	5	0.3	0.3	2 230	1 460	227	149	16.1	24 000	28 000	**SC03A04ZZN**	**ZZNR**	**LLBNR**	**LLHNR**	**LLUNR**

❶ Minimum allowed dimensions for chamfer dimension r.

Remarks: Bearings with asterisks (*) next to their model number indicate stainless steel bearings.



Dynamic equivalent radial load
$P_r = XF_r + YF_a$

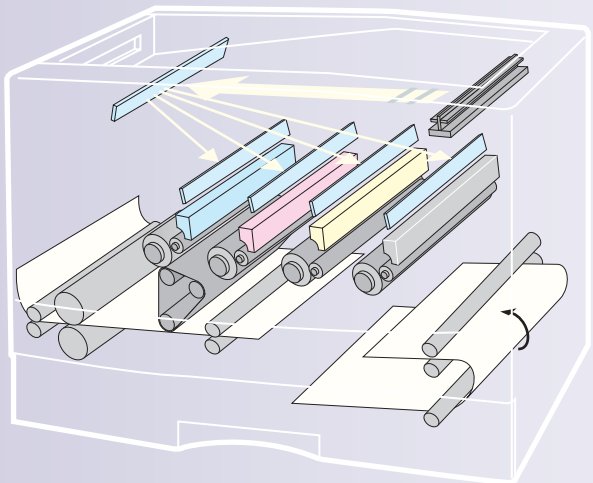
$\frac{f_0 \cdot F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leqq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30				1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.89	0.44				1.00

Static equivalent radial load
$P_{or} = 0.6F_r + 0.5F_a$
However, when $P_{or} < F_r$, then make $P_{or} = F_r$.

Snap ring groove dimensions mm				Snap ring dimensions mm		Installation dimensions mm								Mass kg
D_1 max	a max	b min	r_0 max	D_2 max	f max	d_a min	d_a max	D_a max	D_X (Reference)	C_Y max	C_Z min	r_{as} max	r_{Nas} max	(Reference)
12.15	0.88	0.55	0.2	15.2	0.55	6.6	6.9	11.4	15.9	1.2	0.6	0.2	0.1	0.002
13.03	1.28	0.65	0.06	16.13	0.54	6.6	7.4	12.4	16.9	1.6	0.6	0.2	0.2	0.004
11.15	0.78	0.60	0.02	14.2	0.55	7.2	7.9	10.8	14.9	1.1	0.6	0.15	0.1	0.001
12.15	1.08	0.55	0.2	15.2	0.55	7.0	7.2	11.8	15.9	1.4	0.6	0.15	0.1	0.002
14.03	1.03	0.65	0.06	17.2	0.60	7.6	7.8	13.4	17.9	1.4	0.7	0.2	0.2	0.004
17.9	0.93	0.80	0.2	22.0	0.70	8.0	9.5	17.0	22.8	1.4	0.7	0.3	0.3	0.008
14.95	0.53	0.65	0.05	18.2	0.54	9.6	10.0	14.4	18.9	0.9	0.6	0.2	0.1	0.003
17.9	0.93	0.80	0.2	22.0	0.70	10.0	10.6	17	22.7	1.4	0.7	0.3	0.3	0.008
20.8	2.35	0.80	0.2	24.8	0.70	10.0	12.7	20	25.5	2.8	0.7	0.3	0.4	0.013
24.5	2.20	0.90	0.3	28.8	0.85	12	13.5	24	29.5	2.8	0.9	0.3	0.3	0.02
20.25	1.18	0.80	0.2	24.0	0.70	14	14.5	19	24.7	1.7	0.7	0.3	0.3	0.009
25.15	1.05	0.81	0.3	29.2	0.71	19	19.5	24	29.9	1.5	0.8	0.3	0.3	0.009

Ⅱ Resin Products

1. Separating Pins ····· 21
2. Separating Plates ····· 21
3. Slide Bearings ····· 22
4. Insulation Sleeves ····· 22
5. Fusing Gears ····· 23
6. Paper Output Parts (roller, rib) ····· 23
7. Blades ····· 24
8. Bearings for Cartridges ····· 24
9. Bearing Units with Seals ····· 25
10. BEAREE Selection Guidelines ····· 26
11. Base Resins and Characteristics of Major Grades ····· 27



1. Separating Pins

Separating pins are used to separate paper from fusing rollers and pressure rollers.

The base material is very heat resistant a coating is applied that is toner resistant. This material can resist temperature distortion at operating temperatures from 200 to 230˚C.Because of the wear resistance of the separating parts, the rollers are not damaged, either.

The tip is precision formed to a 0.05mm radius or smaller, ensuring reliable paper separation performance. In addition, **NTN** offers three (3) kinds of coating films for you to choose from so that you may be able to select one that is best suited to your application.

Processing : Injection molding, Coating

Separating pin material	Coating material	Operating temperature limit (guidelines)	Contact angle (vs. horizontal)
BEAREE AS5021 (material: PPS)	FE7030 (Color phase: Green) FE7031 (Color phase: Black)	230˚C	95˚
BEAREE PI5022 (material: PI)	FE7092	300˚C (Crystallization treatment)	110˚

*The larger the contact angle, the greater the resistance to becoming soiled by the toner.

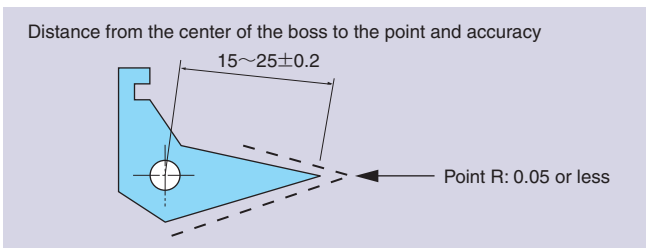


Fig. 1 Example of Typical Dimensions mm

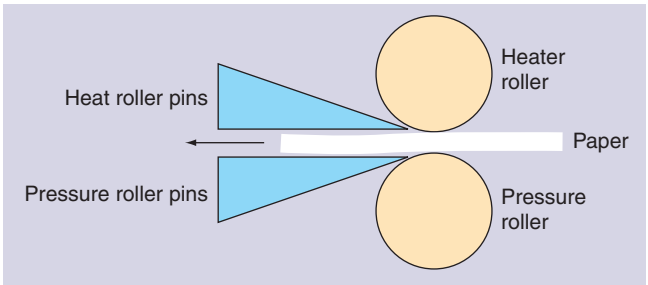
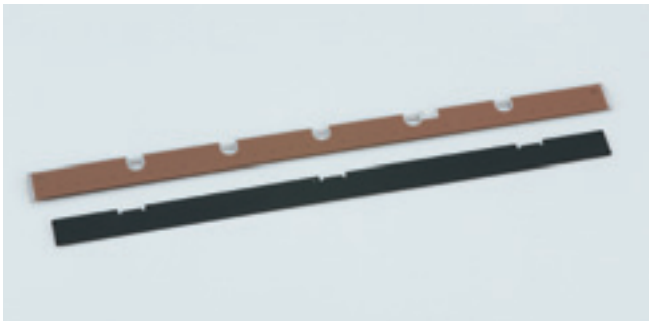


Fig. 2 Uses of Separating Pins

2. Separating Plates

Parts for paper guide that guides papers coming out of the transfer drum. In recent years, trends are away from use of jaws for paper separation and more and more separating plates are being employed in place of jaws for enhanced performance. We have two types of separating plates: film type and coating type.

Processing : See table below.



Type	Makeup	Processing
Film type	SUS plate, **BEAREE FL9004**	press forming, filming
Coating type	SUS plate, **BEAREE FE7031**	press forming, coating

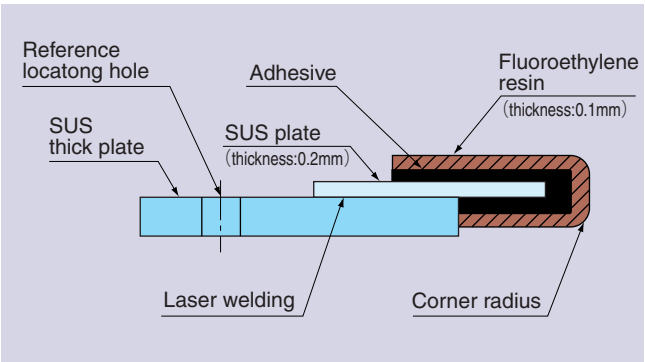


Fig. 1 Typical Film-type Separating Plates

- A 0.1mm thick filming on the edges eliminates local wears.
- It is of the design that a 0.2mm thick SUS plate extends close to the roller position, where the SUS plate is laser-welded to the thick SUS plate.

(Patent pending)

3. Slide Bearings

Slide bearings are used for fusing roller and pressure roller spindles, and they have excellent heat resistance, low friction coefficients and superior wear resistance.

Processing : Injection molding

Table 1 Materials and Features

Material name	Properties		Features
	Operating temperature limit (guidelines)	Conductivity	
BEAREE AS5054(PPS)	230˚C	—	Low friction
BEAREE AS5962(PPS)	230˚C	○	Low friction and electro-conductive
BEAREE PI 5013(Polyimide)	240˚C	—	Low friction and high temperature atmosphere
BEAREE PI 5900(Polyimide)	240˚C	○	High temperature atmosphere and electro-conductive

Example of Typical Dimensions (mm)

Bearing bore: ϕ6–ϕ40

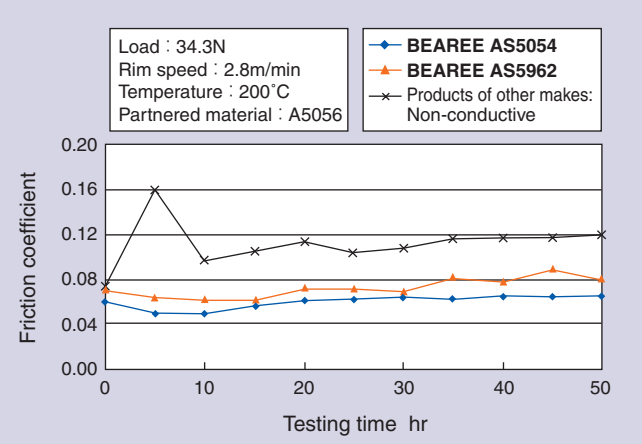


Fig. 1 Friction Coefficient in a High Temperature Radial Test

4. Insulation Sleeves

Insulation sleeves are placed between heat rollers and roller bearings to prevent the transmitting of heat to the roller bearings. They are also used to prevent the rollers from discharging heat.

Insulation sleeves assure heat resistance and strength.

*** Insulation sleeves can be sold in sets with roller bearings.**

Processing : Injection molding

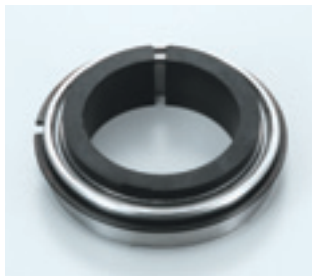
Table 1 Materials and Features

Material name	Properties				Features
	Operating temperature limit (guidelines)	Sliding	Strength	Conductivity	
BEAREE AS5040(PPS)	230˚C	—	◎	—	Strength
BEAREE AS5055(PPS)	230˚C	○	○	—	Noise measures
BEAREE AS5963(PPS)	230˚C	○	○	○	Noise measures and conductivity
BEAREE PI 5033(Polyimide)	240˚C	—	◎	—	High temperature atmosphere

Example of Typical Dimensions (mm)

Bore: ϕ15–ϕ50
Thickness: 1.5–3

Abutment shape



Bearing model number:2TS3-SX05J11ZZ

Bearing with insulation sleeve

5. Fusing Gears

Fusing gears are injection molded gears used in higher temperature locations, such as fusing units.

These fusing gears are very strong, heat resistant and have long service lives.

NTN has various kinds of fusing gears for use as drive gears or planetary gears.

Processing : Injection molding

Table 1 Materials and Features

Material name	Properties			Main uses
	Operating temperature limit (guidelines)	Sliding	Strength	
BEAREE AI 5003(Polyamideimide)	250˚C	○	◎	Drive and idle gears
BEAREE PI 5033(Polyimide)	240˚C	—	◎	Drive gears
BEAREE AS5045(PPS)	230˚C	○	○	Drive and idle gears
BEAREE AS5040(PPS)	230˚C	—	◎	Drive gears

Table 2 Example of Typical Dimensions

Shape	Spur gears and helical gears
Module	0.8～1.5
Pitch circle diameter	15～60 mm

6. Paper Output Parts (roller, rib)

For the paper output parts that come into contact with pre-solidified toner on papers coming out past the transfer unit, adhesion-resistant special fluoroethylene resin materials are used to prevent toner from blotting papers.

Processing : Injection molding

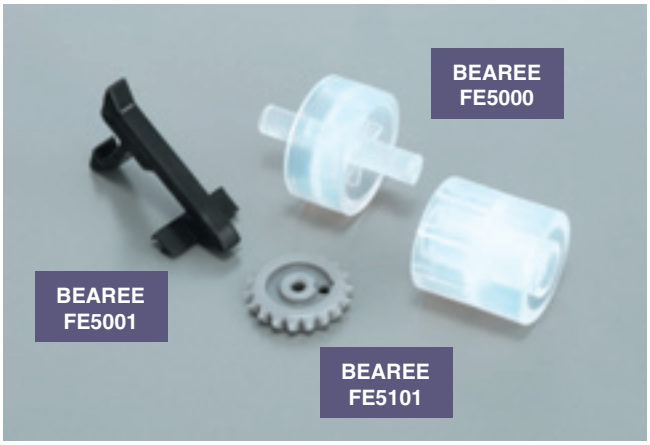
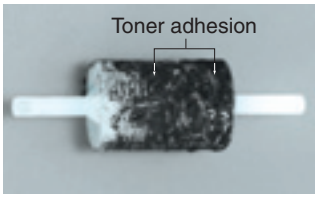


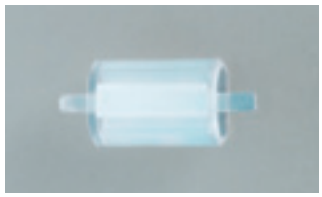
Table 1 Materials and Features

Material name	Operating temperature limit (guidelines)	Contact angle (vs. horizontal)
BEAREE FE5000 (Hue: Transparent) **BEAREE FE5001** (Hue: Black) (Characteristics of fluoroethylene)	200˚C	110˚
BEAREE FE5100 (Hue: White) **BEAREE FE5101** (Hue: Gray) (Characteristics of fluoroethylene)	150˚C	95˚
General POM (material for comparison)	100˚C	65˚

* The larger the contact angle, the greater the resistance to becoming soiled by the toner.



General POM



BEAREE FE5000

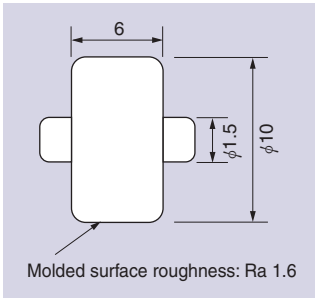


Fig. 1 Example of Typical Dimensions

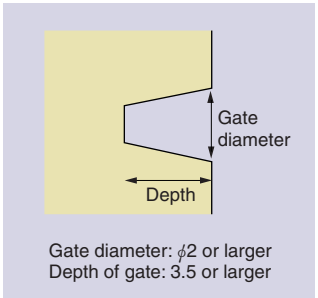


Fig. 2 Gate Configuration for Paper Output Roller

7. Blades (Being Developed)

NTN manufactures the low-friction and highly wear-resistant **BEAREE ER3605** and **BEAREE ER3002** cleaning blade to remove unneeded toner from photoconductive drums.

The **BEAREE ER3605** and **BEAREE ER3002** are made from fluorine-containing rubber with a special additive to give it superior low friction and wear resistance properties.

The low friction characteristic prevents sticking and slipping, and because the design angle has been improved for greater range, these blades have superior cleaning ability.

Rubber material: **BEAREE ER3605**, **BEAREE ER3002**
Processing : Press forming, high-accuracy shearing

Table 1 Friction Test Results

Test time: 60 minutes
Speed: 12 m
Opposing material: Polycarbonate

	Friction coefficient μ
Urethane	0.9
BEAREE ER3605 (Fluoroethylene-based material)	0.6
BEAREE ER3002 (Fluoroethylene-based material)	0.5

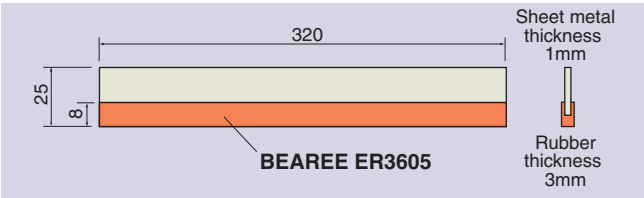


Fig. 1 Example of Typical Dimensions

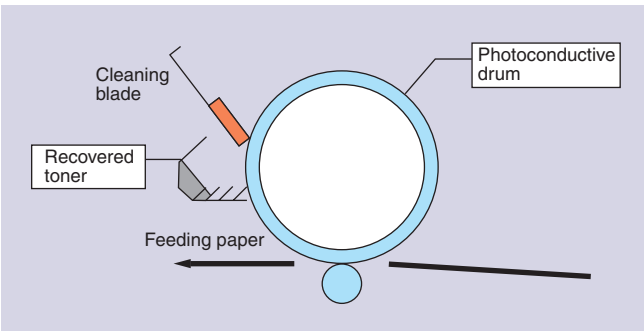


Fig. 2 Example of Use with a Photoconductive Drum

8. Bearings for Cartridges

The bearings enjoy superiority in terms of low friction coefficient and wear-resistance when used in conjunction with soft material parts (SUS, aluminum alloy) employed for toner cartridge mixer shaft and mag roller shaft, etc.

Actual Dimensional Accuracy

For items with an internal diameter of ϕ8, the tolerance range is 40 mm.

Materials: **BEAREE NY5101**, **BEAREE NY5102**, **BEAREE DM50300**

Processing : Injection molding

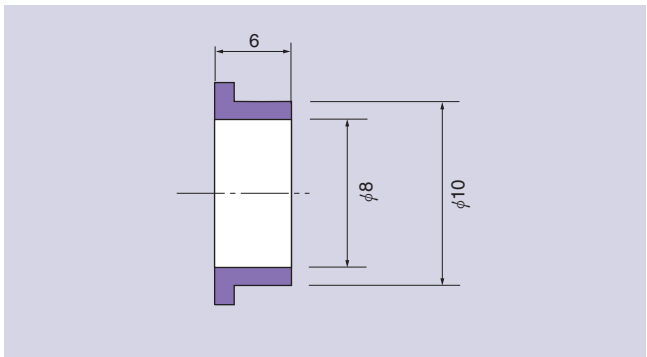


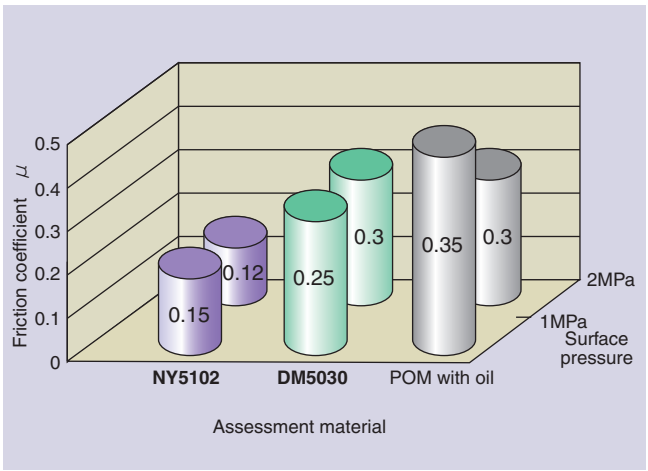
Fig. 1 Example of Typical Dimensions

9. Bearing Units with Seals

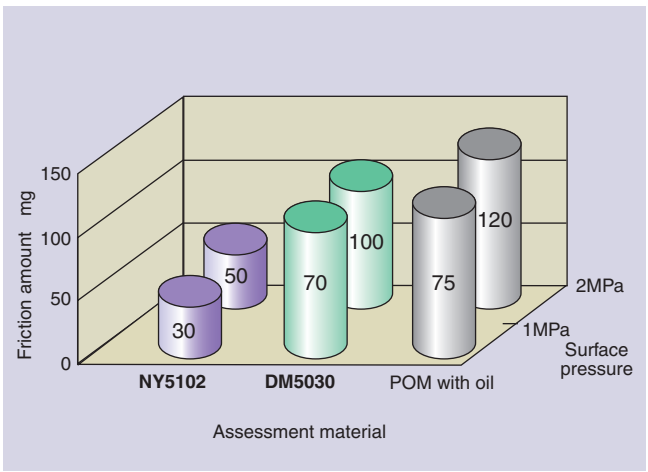
Bearing units, made up of a **BEAREE DM5030** bearing and **BEAREE ER3202** seal made of slippery rubber, are used for toner cartridge mixer shaft and mag roller shaft, etc.

Bearing material: **BEAREE DM5030(POM)**
Seal material: **BEAREE ER3202(NBR)**

Test time: 50 hr Speed: 7.5 m/min Opposing material: A5056



Test time: 50 hr Speed: 7.5 m/min Opposing material: A5056



Processing : Seal is press-fitted into injection-molded bearing.
* The seal does not have an outer ring.

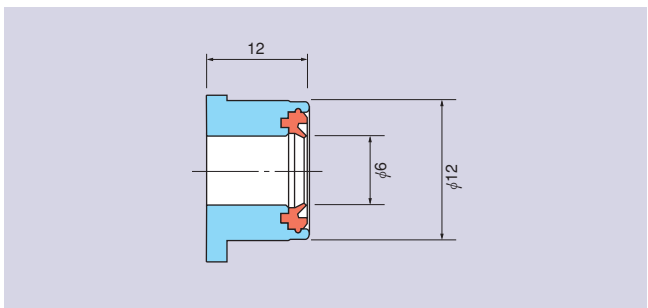


Fig. 1 Example of Typical Dimensions

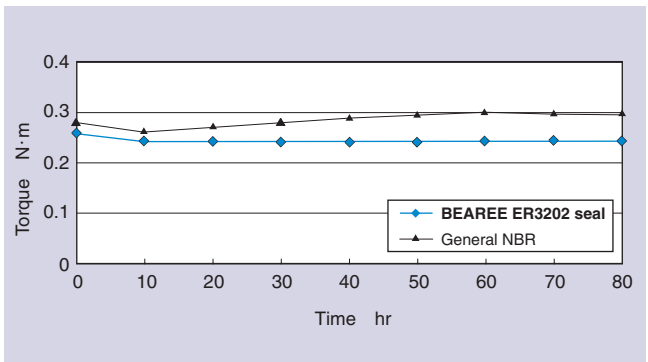


Fig. 2 Temporal Changes in Rotational Torque by Seal Specification (Bearing model is BEAREE DM5030)

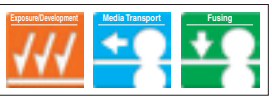
10. BEAREE Selection Guidelines

Material for machining　Material for injection molding　Material for coating

		Classification by chemical structure	High performance sliding material Sliding bearings, friction discs, piston rings	Sliding material for soft mating material Sliding bearings, seal rings	Sliding material for use immersed in water and chemicals Sliding bearings, hot water pump bearings	Special application materials Electro-conductive, foodstuff production machinery	Paper output parts	Gear materials	Separating pin materials	Coating materials Separating pins, roots pump rotors
Plastics / Engineering plastics / Super engineering plastics (Specialized engineering plastics)	Polyetheretherketone (PEEK)	Polyethers	PK5900	PK5300		PK5030				
	Polyethernitrile (PEN)									
	Polyetherimide (PEI)									
	Polyethersulfone (PES)									
	Fluoroplastics (PTFE) (PFA) (FEP) (ETFE) (PVdF) (FE)	Fluoroplastics	FL3000 FL3020 FL3030 FL3700	FL3030 FL3040 FL3050	FL3700	FL3060 FL3642	FE5000 FE5101			FE7030 FE7031 FE7092
	Polyimide (PI)	Polyimides	PI 5001 PI 5013	PI 5010 PI 5013		PI 5001 PI 5900		PI 5030 PI 5033 AI 5003	PI 5022 AI 5003	
	Polyamideimide (PAI)									
High engineering plastics	Polyphenylensulfide (PPS)	Polysulfides	AS5000	AS5000 AS5005 AS5054	AS5704	AS5910 AS5950 AS5962 AS5963		AS5040 AS5044 AS5045	AS5021 AS5025	
	Polysulfone (PSF、PSU)									
General purpose engineering plastics	Polyacetal (POM)	Polyethers	DM5030	DM5030						
	Modified polyphenylene ether (Modified PPE) (= Modified polyphenylene oxide: Modified PPO)									
	Polyethylene naphthalate (PEN)	Polyethers								
	Polyethylene terephthalate (PET)									
	Polybuthylene terephthalate (PBT)									
	Polycarbonate (PC)									
	Polyamide (PA)	Polyamides	NY5000 NY5101 NY5102			NY5910 NY5911		NY5010 NY5910		
	Epoxy resin (EP)	–								
	Polyethylene (PE)	Polyolefins	UH3000 UH5041			UH3000 UH3954 UH5000 UH5043				
General purpose plastics	Polypropylene (PP)	Polyolefins								
	Polyvinylchloride (PVC)	Polyvinyls								
	Polystyrene (PS)									
	Acrylonitrile-butadiene-styrene (ABS)									
	Polymethyl methacrylate (PMMA)									
	Polyurethane (PUR)	–								
	Phenolic resin (PF)	–								
	Melamine resin (MF)	–								
	Urea resin (UF)	–								
	Silicone resin (SI)	–								
Elastomer / Fluorine oil (PFAE) (PFPE)	Fluororubbers		ER3000 ER3201 ER3202	ER3600		ER3002 ER3605				
	NBRs									

BEAREE FL 3000
- 3000: Material number
- FL: Material grade

11. Base Resins and Characteristics of Major Grades



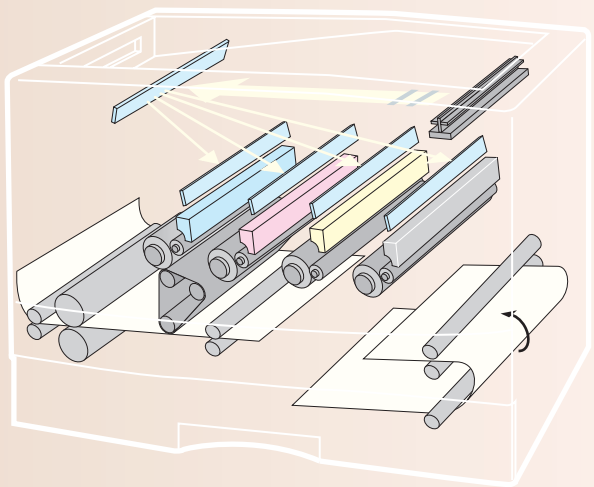
[ ] : Molding method

Grade	Base resin	Characteristics
BEAREE FL	Fluoroplastic (Tetrafluoroethylene)	The base resin of BEAREE FL is a fluoroplastic with excellent characteristics, such as low friction, low adhesion, and resistance to wear, heat, chemicals and weather. Special additives are used in BEAREE FL to ensure the best performance in sliding applications. [Compression molding, extrusion and coating]
BEAREE FE	Fluoroplastic (other than Tetrafluoroethylene) Fluorine oil	The performance of BEAREE FE is slightly lower than that of BEAREE FL, but it is easier to use. It is excellent for low friction and wear resistance, and is suitable for anti-stick coating materials. [Injection molding, extrusion and coating]
BEAREE PI	Polyimide	BEAREE PI has excellent heat resistance and mechanical strength. This material uses special additives to improve the properties of polyimide, which is known as the most heat-resistant plastic. Thermosetting and thermoplastic types are available, and can be selected according to the application. The high water absorption of this type should be taken into consideration in product design. [Injection molding, extrusion, compression molding and coating]
BEAREE AI	Polyamideimide	The heat resistance of BEAREE AI is slightly lower than BEAREE PI, however, it has excellent mechanical properties, such as shock and fatigue resistance. The high water absorption of this type should be taken into consideration in product design. [Injection molding and extrusion]
BEAREE UH	Polyethylene	This material has lower performance than the "super" engineering plastics, but it takes advantage of the excellent properties of polyethylene, such as low friction, high resistance to wear, chemicals and shock, non-sticking quality, and good electrical properties. The shrinkage factor during molding and thermal expansion coefficient are high. It is difficult to bond this material. [Injection molding, extrusion and compression molding]
BEAREE AS	Polyphenylensulfide	BEAREE AS is widely applicable because its base resin of polyphenylenesulfide has excellent heat and wear resistance, mechanical strength and moldability. Also, this material is suited for cost effective mass production. [Injection molding]
BEAREE LC	Aromatic polyester	This material has excellent heat resistance and mechanical strength, especially rigidity. When using with materials based on liquid crystal polymer, designers should consider the anisotropy of the material in product design. [Injection molding]
BEAREE PK	Polyetheretherketone	BEAREE PK is based on polyetheretherketone, which has excellent properties close to polyimide in heat, chemical, shock and fatigue resistance, and self-lubrication. Therefore, the characteristics of this material are similar to BEAREE PI and AI, but with less water absorption. It should be noted during product design that the shrinkage factor during molding is high. [Injection molding and extrusion]
BEAREE NY	Polyamide	This material is based on polyamide, one of the most common general purpose engineering plastics, and it is superior in shock and wear resistance. The heat resistance of this material is lower than "super" engineering plastics, but it is much more economical. It should be noted during product design that the water absorption is high. [njection molding]
BEAREE DM	Polyoxymethylene (Polyacetal)	This material is based on polyoxymethylene that is superior in fatigue, creep and wear resistance, and dimensional stability. Because of the high levels of oxygen in the molecular structure, however, making this material fire retardant is difficult. As is the case with BEAREE NY, this material is much more economical than "super" engineering plastics based materials. [Injection molding]
BEAREE ER	Elastomer (Sliding Rubber)	BEAREE ER is based on an elastomer. This "sliding rubber" is a fluoroplastic with elasticity and is superior in elasticity, non-stick quality, low friction, and resistance to heat, wear and creep.

■Products using BEAREE PI, BEAREE AI, BEAREE LC and BEAREE PK are considered strategic products as defined by the Foreign Exchange and Trade Control Act when used for certain purposes and products. When exporting a product that comes under this act, an export license from the Japanese government is required. Contact **NTN** for details.

Ⅲ Sintered Products

1. Oil-impregnated Sintered Bearings "NTN BEARPHITE" ·····29
2. Hybrid BEARPHITE Bearings ·····33
3. Hydrodynamic BEARPHITE Bearings ·····34
4. Products under Development ·····35
5. NTN BEARPHITE Standard Products ·····36



1. Oil-impregnated Sintered Bearings "NTN BEARPHITE"

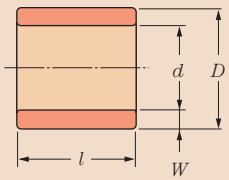
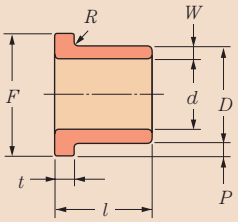
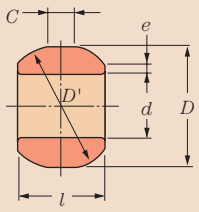
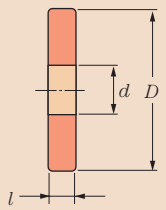
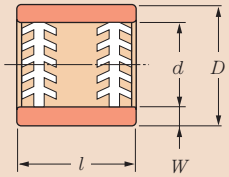
1.1 Features of "NTN BEARPHITE" oil-impregnated sintered bearings

- **NTN BEARPHITE** is a unique material that has minute, high quality, natural graphite particles added to it. It has excellent bearing properties for a wide range of uses.
- Because **NTN BEARPHITE** is made from sintered metal, it has a porous metal composition, so that it has the necessary lubricant holding and circulating ability which is required of oil-impregnated bearings.
- Because of the stable lubrication properties of **NTN BEARPHITE**, the bearings have a long service life, and they demonstrate excellent bearing performance from low to high temperatures.

Copper-based spherical bearing

Graphite skeleton of the bearing on the left after melting

1.2 Available dimensional ranges

Type	Code	Shape	Available ranges			Remarks
			d	D	l	
Sleeve type	**S**		0.8～60	1.6～70	1～40	W=0.5 min. l=W×10
Flange type	**F**		0.8～50	2～60	1～35	W=0.5 min. t=0.5 min. $P \leqq t$ R=0.2 min.
Spherical type	**A**		1.5～22	5～34	3～20	C=2 min. e=0.8 min.
Thrust washer type	**W**		5～62	18～75	2～3	L=1.2 min.
Hydrodynamic BEARPHITE	**HDB**		1.5	3	3.5～5	
			2	4	6	
			3	5.5	8.75	

* In addition to the above, **NTN** makes bearings with special shapes and dimensions. Please contact **NTN** for details.

1.3 Material characteristics of NTN BEARPHITE

Series	Material code	Chemical components %						Density g/cm³ (±0.2)	Oil retention vol. % (±0.2)	Radial crushing strength MPa(min.) (over)
		Cu	Sn	C	Fe	Ni	Other			
Copper series	H	Residual amount	8～11	1～2	–	–	–	6.6	18	150
	HD	Residual amount	8～11	1～2	–	2～4	–	6.8	18	150
	HQ	Residual amount	8～11	–	–	–	–	6.6	18	150
	HR	Residual amount	8～11	3～4	–	–	–	6.6	12	120
	HZ12	Residual amount	8～11	0.4～1	8～12	2～4	–	6.8	18	150
	HZ16	Residual amount	8～11	0.5～2.5	–	–	P:1 max	7.2	15	150
	HZ18	Residual amount	8～11	–	–	–	MoS_2:4～7	6.6	12	150
Copper-Iron series	EE	33～38	3～6	1～2	Residual amount	–	3 max	6.2	18	150
	EB	18～22	0.5～2.5	0.5～2.5	Residual amount	–	1 max	6.2	18	150
	EC	38～42	1～3	0.5～2.5	Residual amount	–	1 max	6.4	18	150
	EZ06	Residual amount	1～3	0.5～2.5	38～42	–	1 max	6.9 6.5	12 18	150
	EZ10	35～45	1～3	0.5～1.5	Residual amount	–	1 max	6.4	18	150
Iron series	P	8～11	–	–	Residual amount	–	3 max	6.1	18	200
	F	–	–	–	Residual amount	–	3 max	5.9	20	180
	L	1～3	–	2～4	Residual amount	–	1 max	6.0	15	180

1.4 Materials used in office equipment and bearing properties

Series	Material code	Bearing properties						Remarks
		Audio	Vibration	Sliding	High temperature	High speed	Load	
Copper series	H	◎	○	○	○	○	○	Standard copper series material
	HQ	○	○	◎	△	△	△	Suitable for sliding applications
	HR	△	○	△	◎	△	○	Excellent wear resistance at high temperatures
Copper-Iron series	EB	○	○	△	△	△	○	Alternative for copper-iron series EC material
	EC	○	○	△	△	△	○	Alternative for copper series H material
	EZ06	○	○	△	△	○	◎	Excellent wear resistance
	EZ10	○	○	○	○	○	◎	Excellent wear resistance
Iron series	P	△	△	○	△	◎	○	Suitable as a high strength material
	F	△	△	△	△	○	○	Standard iron series material

Note) ◎ Excellent ○ Good △ Poor

1.5 Technical data

1.5.1 Relations between material temperature increases (heat generation) and friction coefficient

- H material (copper series) has the lowest temperature increase and friction coefficient.
- The order of materials according to temperature increases and friction coefficients are as follows:
  H material (copper series) < HQ material (copper series) < EC material (copper-iron series) < F material (iron series)

1) Sample

Bearing size：S6×12×8
Lubricant：IS0 VG68
Bearing material：H、HQ、EC、F
Shaft materia：SUJ2　Shaft hardness：HRC60
Shaft surface roughness：Ra0.2μm

2) Test conditions

Surface pressure：0.2～2.0MPa
Rim speed：38m/min
Operating clearance：12μm
Room temperature：25±2°C

3) Test equipment

Type A testing machine used (**Figure 1** shows an outline.)

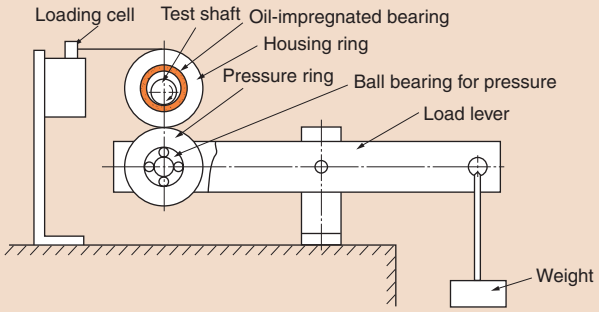


Fig. 1 Outline of the Type A Testing Machine

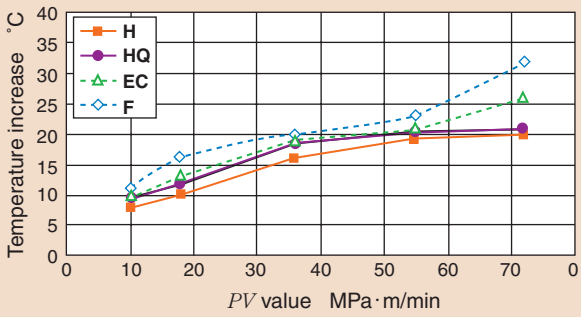


Fig. 2 Temperature Increase Caused by Bearing Material

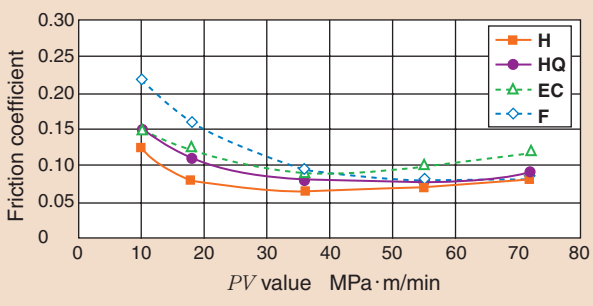


Fig. 3 Friction Coefficient Based on Bearing Material

1.5.2 Relation between operating clearance and lubricant viscosity with temperature increases and friction coefficients

- When the operating clearance is 10 μm or less, there is a tendency for heat generation and higher friction coefficients.
- The higher the viscosity of the lubricant, the higher the temperature and friction coefficient.

1) Sample

Bearing size：S6×12×8
Lubricant：ISO VG32、VG68、VG100
Bearing material：H material (copper series)
Shaft materia：SUJ2　Shaft hardness：HRC60
Shaft surface roughness：Ra0.2μm

2) Test conditions

Surface pressure：0.2～2.0MPa
Rim speed：38m/min
Operating clearance：12μm
Room temperature：25±2°C

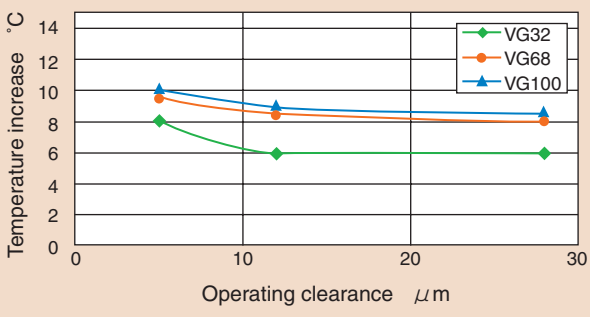


Fig. 4 Temperature Increase Caused by Operating Clearance and Lubricant Viscosity

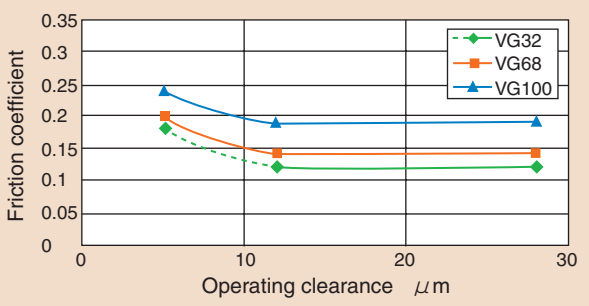


Fig. 5 Friction Coefficient Based on Operating Clearance and Lubricant Viscosity

1.5.3 Friction properties when sliding

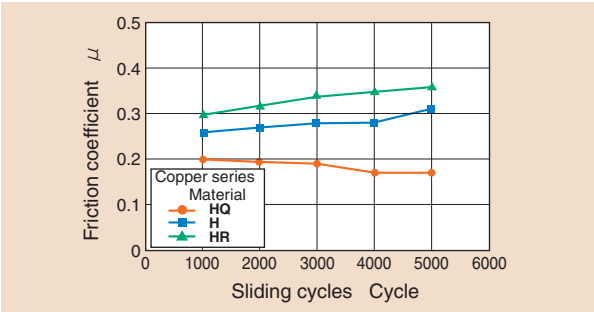
1) Sample

Bearing size	: S6×10×5
Bearing material	: H, HQ, HR
Lubricant	: ISO VG 68
Shaft materia	: SUS 420J2
Shaft surface roughness	: 0.2μmRa
Shaft hardness	: HV580

2) Test conditions

Surface pressure	: 0.07MPa
Sliding speed	: 5.8m/min
Stroke	: 160mm
Operating clearance	: 10～14μm
Room temperature	: 25±2˚C

3) Test results



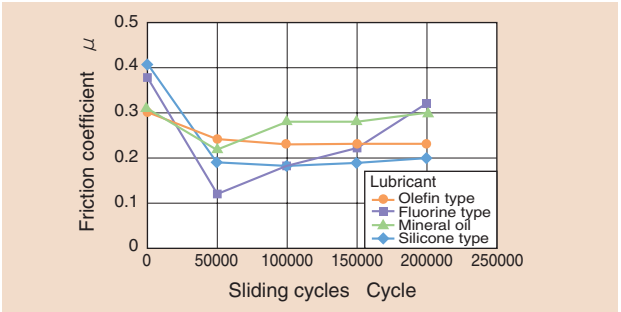
1) Sample

Bearing size	: S6×10×5
Bearing material	: H
Shaft materia	: SUS 420J2
Shaft surface roughness	: 0.2μmRa
Shaft hardness	: HV580

2) Test conditions

Surface pressure	: 0.08MPa
Sliding speed	: 5.4m/min
Stroke	: 160mm
Operating clearance	: 10～14μm
Room temperature	: 25±2˚C

3) Test results



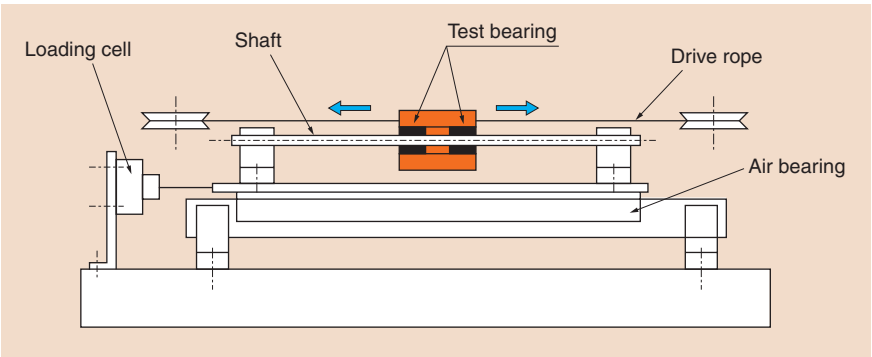


Fig. 6 Test Machine

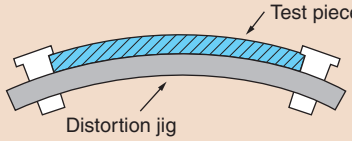
1.6 Oil-resistance test results of the resin (80˚C×72h)

No.	Resin name	Mineral oil	Synthetic hydrocarbon	Ester based	Alkylphenyl ether	Liquid grease	
		Tellus 68	Floil 947P	Alltime J652	Moresco BS-100	AL-1	EU-1
1	Polyphenylene ether	○	△	△	△	△	○
2	Polyphenylensulfide	○	○	○	○	○	○
3	Polycarbonate	○	○	×1)	○	×2)	○
4	Polyetherimied	◎	◎	◎	◎	◎	◎
5	Polybuthylene terephthalate	○	○	○	○	○	○
6	Polyamide	○	○	○	○	○	◎
7	Polyoxymethylene (POM) (= Polyacetal)	○	○	○	○	○	○
8	Acrylonitrile-butadiene-styrene resin	△	△	△	△	△	△
9	Polyethylene terephthalate	○	○	○	○	○	○
10	Polyarylate	○	◎	×1)	◎	○	◎

Note) ◎ : Deformation ratio up to 40%　○ : Deformation ratio 41 to 70%　△ : Deformation ratio 71% or greater　× : Breaks

1) After 24 hours, break occurs
2) After 72 hours, cracks in several areas

【Test machine】



2. Hybrid BEARPHITE Bearings

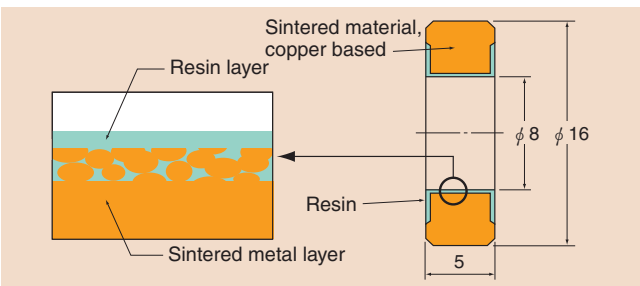
2.1 Hybrid BEARPHITE bearings

Currently, roller bearings are being used for light load conditions, such as in office equipment, but in order to reduce costs many companies are considering replacing these roller bearings with sliding bearings. However, because office equipment uses many shafts made of aluminum and SUM electroplated with nickel, these shafts can be damaged by oil-impregnated bearings. Resin bearings cannot be used in locations where accuracy is required, and their use is also limited because of their high linear expansion coefficient.

Therefore, we combined the dimensional precision of metal with the sliding ability of resin to realize "**Hybrid BEARPHITE**" as an alternative to roller bearings. This hybrid bearing achieves **low friction**, **high precision** and **quiet operation**.

2.2 Features

- More accurate than resin bearings.
- Can be used even when the shaft is aluminum.
- Low friction (μ = 0.05)
- Quieter than roller bearings.
- Can withstand axial loads.



2.3 Comparison with other bearings

Item	Hybrid BEARPHITE	Resin slide bearing	Oil-impregnated sintered bearing
Bore	±5μm	±15μm	±5μm
Outer diameter	±8μm	±15μm	±8μm
Bore roundness	10μm or less	50μm or less	10μm or less
Concentricity	15μm or less	30μm or less	15μm or less
Cylindricality	10μm or less	40μm or less	10μm or less
Dimension changes	○	×	○
Sliding against aluminum	○	○	×
Sliding against SUM+Ni electroplating	○	○	△

2.4 Hybrid BEARPHITE dimensions

Bore	Outer diameter	Length	Roller bearing code
ϕ 6	ϕ 12	4	**WBC6-12ZZ**
ϕ 8	ϕ 16	5	**W688AZZ**
	ϕ 22	7	**608ZZ**

2.5 Technical data

<Test conditions> Bearing size (Bore×Outer diameter×Width) : ϕ8×ϕ16×5
Radial load : 29.4N
Rotational speed : 240min^{-1}
Temperature : Room temperature
Partnered material : SUM+Ni electroplating (15 μm clearance)

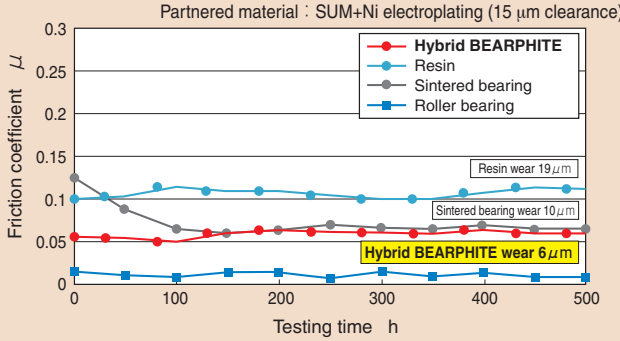


Fig. 1 Hybrid BEARPHITE Wear Properties

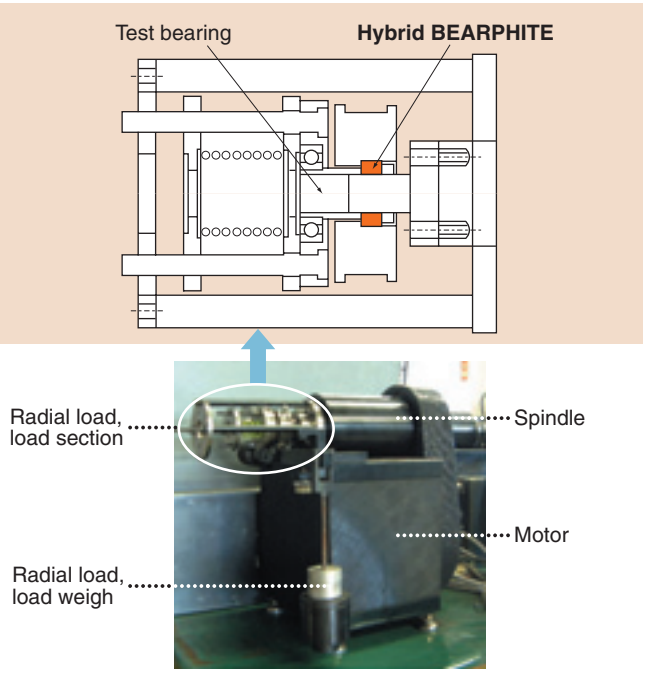


Fig. 2 Wear Testing Device

3. Hydrodynamic BEARPHITE Bearings

3.1 Lubrication principle of hydrodynamic BEARPHITE bearings

Hydrodynamic BEARPHITE bearings are oil-impregnated sintered bearings with herringbone hydrodynamic grooves on the bore surface.

The hydrodynamic effect of these bearings creates a good oil film, so that the shaft is totally supported in a non-contact state during operation. This contributes to high rotational accuracy, low noise and long service life. Because of these features, these bearings are widely used in polygon scanner motors, cooling fans, etc. When the spindle rotates, the action caused by the opposing inclined grooves forms a good oil film inside the entire bearing clearance, so that the spindle is supported very rigidly.

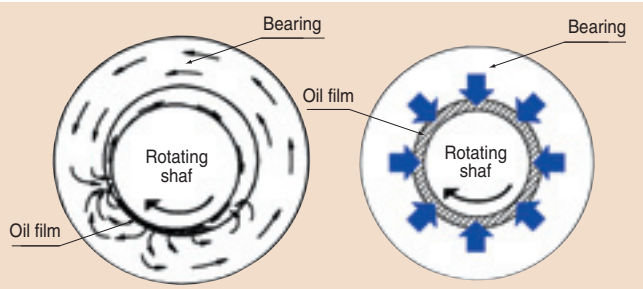


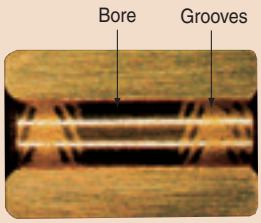
Fig. 1 Oil-impregnated Bearing Oil Film and Movement of Oil

Fig. 2 Hydrodynamic Bearing Oil Film and Movement of Oil

3.2 Comparison with other bearings

	Hydrodynamic BEARPHITE	Fluid hydrodynamic bearing	Roller bearing	Oil-impregnated sintered bearing
Rotational accuracy	◎	◎	○	×
High speed range	◎	◎	○	×
Low speed range	○	×	◎	○
Seizure resistance	◎	×	○	○
Noise	◎	◎	×	○
Torque	△	△	◎	○
Cost	○	△	△	◎

◎ : Excellent ○ : Good △ : Usable × : Not usable



3.3 Hydrodynamic BEARPHITE usage example

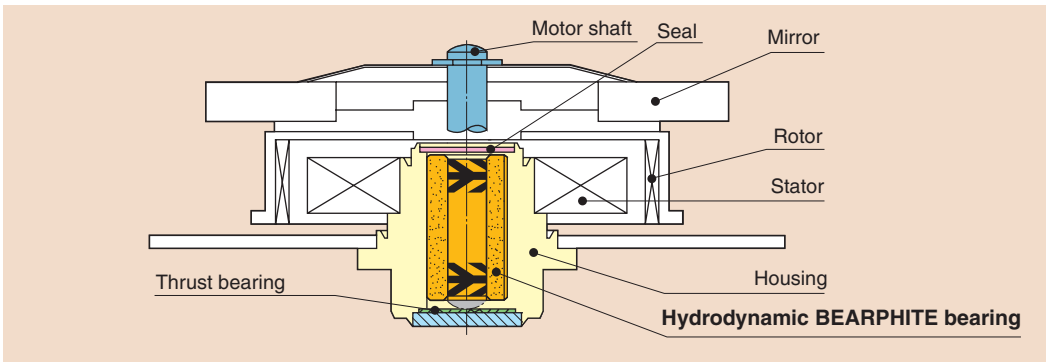
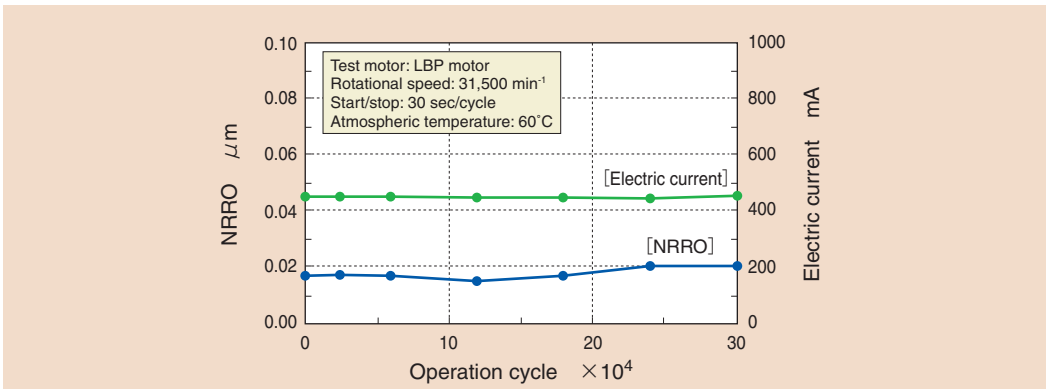


Fig. 3 Structural Diagram of Hydrodynamic BEARPHITE Bearing Used in LBP

3.4 Technical data



4. Products under Development

4.1 NTN BEARPHITE SG

4.1.1 NTN BEARPHITE SG

NTN BEARPHITE SG is a series of oil-impregnated sintered bearings that use a special liquid grease. This grease stabilizes the rotational torque of the bearing over a wide range of operating temperatures, and the small amount of leakage vastly improves the durability of the bearing.

There are two types of grease: AL-1 for normal temperatures and EU-1 for high temperatures.

4.1.2 AL-1 properties

Typical characteristics of AL-1

Item	Properties
Allowed temperature range	80˚C or less
Base oil	Synthetic oil (PE based)
Thickener	Lithium
Uses	Office equipment, cooling fans

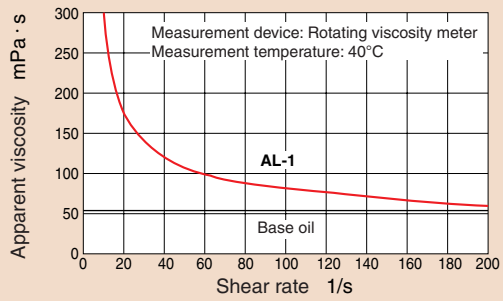


Fig. 1 Shear Rate Dependency of Apparent Viscosity (AL-1)

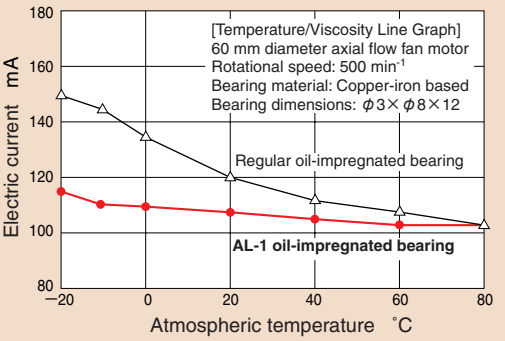


Fig. 2 Temperature Dependency of Axial Flow Fan Drive Current

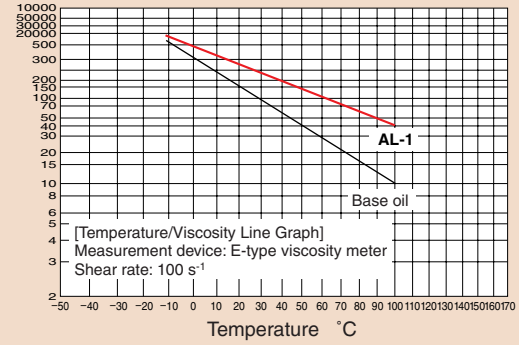


Fig. 3 Temperature Dependency of Viscosity (AL-1)

Typical characteristics of EU-1

Item	Properties
Allowed temperature range	140˚C or less
Base oil	Synthetic oil
Thickener	Urea
Uses	Office equipment, automobile electronic components

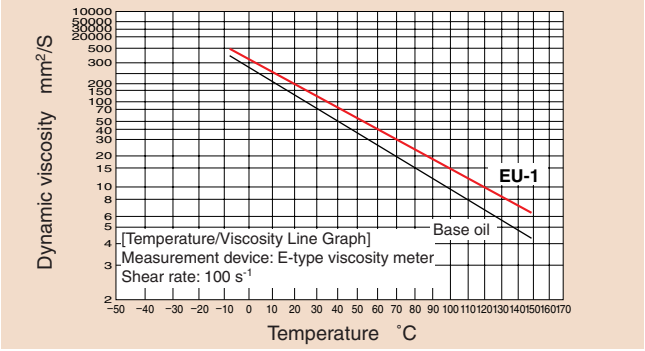


Fig. 4 Temperature Dependency of Viscosity (EU-1)

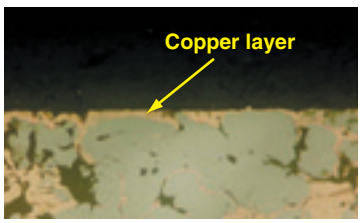
4.2 Oil-impregnated bearings with improved wear resistance

4.2.1 Features

These bearings have superior wear resistance when compared with conventional oil-impregnated bearings, so that aggressivity on the shafts is reduced.

4.2.2 Material (EZ10)

A copper layer is formed on the surface of the bearings.



Bearing Cross Section Photograph

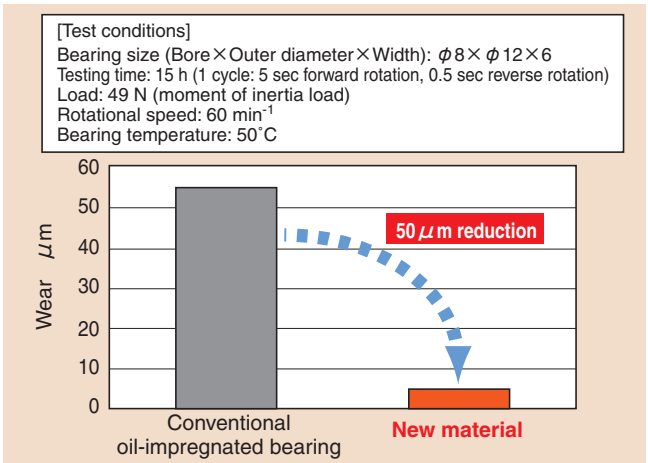
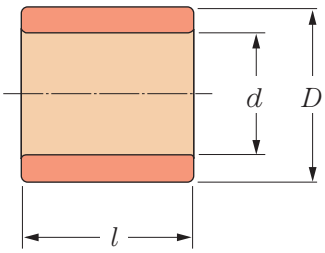


Fig. 1 Test Results

5. NTN BEARPHITE Standard Products

The bearing dimensions and tolerances of the sleeve and flange models are summarized in the table below.
NTN owns the dies, so that there is no die cost.

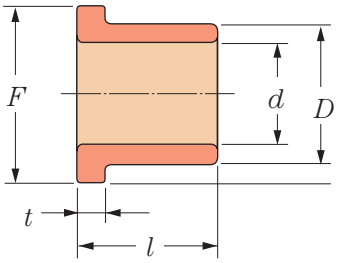
Sleeve type



Dimension example :
S $d \times D \times l$

Flange type

Dimension units: mm



Dimension example :
F $d \times D \times l : F \times t$

Sleeve Bearings

d 4mm

Dimensions mm						Product code
Bore ϕd		Outer diameter ϕD		Length ℓ		
4	$^{+0.030}_{+0.010}$	6	$^{+0.055}_{+0.035}$	3	$^{0}_{-0.100}$	**B-S4-1047**
4	$^{+0.012}_{0}$	6	$^{+0.038}_{+0.023}$	3.8	$^{+0.050}_{0}$	**B-S4-194**
4	$^{+0.012}_{0}$	6	$^{+0.038}_{+0.023}$	4.5	±0.100	**B-S4-1004**
4	$^{+0.030}_{0}$	6	$^{0}_{-0.030}$	4.5	±0.100	**B-S4-1040**
4	$^{+0.012}_{0}$	6	$^{+0.038}_{+0.023}$	5	±0.100	**B-S4-1220**
4	$^{+0.012}_{0}$	6	$^{+0.038}_{+0.023}$	6	$^{0}_{-0.100}$	**B-S4-73**
4	$^{+0.020}_{+0.012}$	6	$^{+0.015}_{+0.005}$	6	$^{0}_{-0.100}$	**B-S4-1142**
4	$^{+0.028}_{+0.010}$	6	$^{+0.034}_{+0.019}$	7	$^{0}_{-0.100}$	**B-S4-110**
4	$^{+0.030}_{0}$	7	$^{+0.038}_{+0.023}$	2	$^{0}_{-0.100}$	**B-S4-1042**
4	$^{+0.004}_{-0.002}$	7	$^{+0.020}_{+0.010}$	4	±0.100	**B-S4-87**
4	$^{+0.012}_{0}$	7	$^{+0.038}_{+0.023}$	6	±0.100	**B-S4-11**
4	$^{+0.012}_{0}$	7	$^{+0.038}_{+0.023}$	8	±0.150	**B-S4-1218**
4	$^{+0.012}_{0}$	7	$^{+0.038}_{+0.023}$	8	$^{0}_{-0.150}$	**B-S4-105**
4	$^{+0.012}_{0}$	7	$^{+0.038}_{+0.023}$	10	$^{0}_{-0.150}$	**B-S4-1242**
4	$^{+0.012}_{0}$	8	$^{+0.038}_{+0.023}$	3	±0.100	**B-S4-21**
4	$^{+0.015}_{+0.007}$	8	$^{+0.008}_{0}$	3	±0.100	**B-S4-1023**
4	$^{+0.022}_{+0.010}$	8	$^{+0.038}_{+0.023}$	4	±0.100	**B-S4-84**
4	$^{+0.030}_{+0.010}$	8	$^{+0.030}_{+0.020}$	4	$^{0}_{-0.100}$	**B-S4-1153**
4	$^{+0.020}_{+0.010}$	8	$^{+0.038}_{+0.023}$	5	$^{0}_{-0.100}$	**B-S4-74**
4	$^{+0.012}_{0}$	8	$^{+0.038}_{+0.023}$	6	±0.100	**B-S4-30**

Note: Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

d 4～5mm

Dimensions mm						Product code
Bore ϕd		Outer diameter ϕD		Length ℓ		
4	$^{+0.012}_{0}$	8	$^{+0.038}_{+0.023}$	8	±0.100	**B-S4-31**
4	$^{+0.012}_{0}$	9	$^{+0.038}_{+0.023}$	5	$^{0}_{-0.200}$	**B-S4-36**
4	$^{+0.012}_{0}$	9	$^{+0.038}_{+0.023}$	6	±0.100	**B-S4-37**
4	$^{+0.026}_{+0.014}$	10	$^{+0.038}_{+0.023}$	7	±0.100	**B-S4-68**
4	$^{+0.012}_{0}$	10	$^{+0.038}_{+0.023}$	8	±0.150	**B-S4-40**
4	$^{+0.012}_{0}$	10	$^{+0.038}_{+0.023}$	20	±0.150	**B-S4-55**
5	$^{+0.020}_{0}$	7	$^{+0.040}_{+0.020}$	2.4	$^{0}_{-0.100}$	**B-S5-1039**
5	$^{+0.020}_{+0.013}$	7	$^{+0.040}_{+0.025}$	3	±0.100	**B-S5-146**
5	$^{+0.035}_{+0.020}$	7	$^{+0.040}_{+0.025}$	4	$^{0}_{-0.300}$	**B-S5-1084**
5	$^{+0.040}_{+0.025}$	7	$^{+0.040}_{+0.020}$	4	±0.050	**B-S5-1099**
5	$^{+0.035}_{+0.020}$	7	$^{+0.040}_{+0.025}$	5	$^{0}_{-0.300}$	**B-S5-1213**
5	$^{+0.025}_{+0.005}$	7	$^{+0.050}_{+0.020}$	6	±0.100	**B-S5-1152**
5	$^{+0.030}_{+0.010}$	8	$^{+0.040}_{+0.020}$	3.5	$^{0}_{-0.100}$	**B-S5-1024**
5	$^{+0.023}_{+0.013}$	8	$^{+0.023}_{+0.013}$	4	±0.100	**B-S5-41**
5	$^{+0.020}_{+0.012}$	8	$^{+0.015}_{+0.005}$	4	$^{0}_{-0.100}$	**B-S5-1141**
5	$^{+0.070}_{+0.050}$	8	$^{+0.030}_{+0.010}$	5	±0.100	**B-S5-1241**
5	$^{+0.035}_{+0.025}$	8	$^{+0.038}_{+0.023}$	5	±0.050	**B-S5-89**
5	$^{+0.040}_{+0.020}$	8	$^{+0.020}_{0}$	6	±0.100	**B-S5-5**
5	$^{+0.012}_{0}$	8	$^{+0.028}_{+0.012}$	8	±0.150	**B-S5-10**
5	$^{+0.012}_{0}$	8	$^{+0.038}_{+0.023}$	10	±0.150	**B-S5-39**

Sleeve Bearings

d 5～6mm

Dimensions mm						Product code
Bore		Outer diameter		Length		
ϕd		ϕD		ℓ		
5	$^{+0.012}_{0}$	8	$^{+0.038}_{+0.023}$	12	±0.150	**B-S5-14**
5	$^{+0.015}_{0}$	9	$^{+0.030}_{+0.015}$	4	±0.100	**B-S5-1123**
5	$^{+0.030}_{+0.010}$	9	$^{+0.040}_{+0.020}$	4	$^{0}_{-0.100}$	**B-S5-134**
5	$^{+0.020}_{+0.005}$	9	$^{+0.030}_{+0.015}$	5	±0.100	**B-S5-87**
5	$^{+0.025}_{+0.013}$	9	$^{+0.039}_{+0.018}$	6	±0.100	**B-S5-19**
5	$^{+0.012}_{0}$	9	$^{+0.038}_{+0.023}$	10	±0.150	**B-S5-1032**
5	$^{+0.015}_{0}$	10	$^{+0.030}_{+0.015}$	3	±0.100	**B-S5-1125**
5	$^{+0.012}_{0}$	10	$^{+0.038}_{+0.023}$	4	±0.100	**B-S5-22**
5	$^{+0.019}_{+0.013}$	10	$^{+0.038}_{+0.023}$	4.5	$^{0}_{-0.100}$	**B-S5-1034**
5	$^{+0.020}_{+0.012}$	10	$^{+0.015}_{+0.005}$	4.5	$^{0}_{-0.100}$	**B-S5-1142**
5	$^{+0.028}_{+0.018}$	10	$^{+0.020}_{+0.010}$	6	±0.100	**B-S5-25**
5	$^{+0.018}_{+0.006}$	10	$^{+0.038}_{+0.023}$	7	±0.100	**B-S5-40**
5	$^{+0.012}_{+0.006}$	11	$^{+0.040}_{+0.032}$	4	±0.100	**B-S5-97**
5	$^{+0.012}_{+0.006}$	11	$^{+0.040}_{+0.032}$	5	±0.100	**B-S5-109**
5	$^{+0.012}_{0}$	12	$^{+0.046}_{+0.028}$	11	±0.100	**B-S5-31**
5	$^{+0.050}_{+0.020}$	13	$^{+0.030}_{+0.010}$	5	$^{0}_{-0.100}$	**B-S5-66**
6	$^{+0.030}_{+0.010}$	8	$^{+0.040}_{+0.020}$	3	$^{0}_{-0.100}$	**B-S6-1292**
6	$^{+0.040}_{+0.025}$	8	$^{+0.040}_{+0.020}$	3	$^{0}_{-0.100}$	**B-S6-1051**
6	$^{+0.020}_{+0.012}$	8	$^{+0.015}_{+0.005}$	3	$^{0}_{-0.100}$	**B-S6-311**
6	$^{+0.027}_{+0.017}$	8	$^{+0.035}_{+0.020}$	4	±0.100	**B-S6-168**
6	$^{+0.040}_{+0.025}$	8	$^{+0.040}_{+0.020}$	4	±0.050	**B-S6-1035**
6	$^{+0.030}_{+0.010}$	8	$^{+0.040}_{+0.020}$	4	$^{0}_{-0.100}$	**B-S6-1048**
6	$^{+0.020}_{0}$	8	$^{+0.050}_{+0.020}$	4	±0.100	**B-S6-1060**
6	$^{+0.020}_{0}$	8	$^{+0.050}_{+0.020}$	5	$^{0}_{-0.100}$	**B-S6-2**
6	$^{+0.020}_{+0.005}$	8	$^{+0.040}_{+0.020}$	5	±0.050	**B-S6-1050**
6	$^{+0.020}_{0}$	8	$^{+0.038}_{+0.023}$	5	±0.100	**B-S6-1093**
6	$^{+0.040}_{+0.025}$	8	$^{+0.040}_{+0.020}$	5	±0.050	**B-S6-1139**
6	$^{+0.027}_{+0.017}$	8	$^{+0.035}_{+0.020}$	6	±0.100	**B-S6-4**
6	$^{+0.038}_{+0.020}$	8	$^{-0.013}_{-0.035}$	6	±0.100	**B-S6-1129**
6	$^{+0.020}_{0}$	8	$^{+0.050}_{+0.020}$	8	$^{-0.050}_{-0.250}$	**B-S6-7**
6	$^{+0.020}_{+0.010}$	8	$^{+0.050}_{+0.020}$	8	$^{-0.050}_{-0.250}$	**B-S6-199**
6	$^{+0.030}_{+0.015}$	8	$^{+0.038}_{+0.023}$	8	$^{0}_{-0.100}$	**B-S6-1189**
6	$^{+0.020}_{0}$	8	$^{+0.050}_{+0.020}$	8	$^{-0.050}_{-0.250}$	**B-S6-1246**

Note: Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

d 6mm

Dimensions mm						Product code
Bore		Outer diameter		Length		
ϕd		ϕD		ℓ		
6	$^{+0.012}_{0}$	8	$^{+0.038}_{+0.023}$	9	$^{0}_{-0.100}$	**B-S6-8**
6	$^{+0.020}_{+0.010}$	8	$^{+0.050}_{+0.040}$	9.6	$^{0}_{-0.200}$	**B-S6-301**
6	$^{+0.030}_{+0.015}$	8	$^{+0.038}_{+0.023}$	10	±0.100	**B-S6-140**
6	$^{+0.040}_{+0.020}$	8	$^{+0.046}_{+0.028}$	10	$^{-0.050}_{-0.200}$	**B-S6-177**
6	$^{+0.015}_{0}$	8	$^{+0.038}_{+0.023}$	10	$^{0}_{-0.300}$	**B-S6-262**
6	$^{+0.012}_{0}$	8	$^{+0.110}_{+0.075}$	12	±0.150	**B-S6-1080**
6	$^{+0.023}_{+0.008}$	8	$^{+0.038}_{+0.023}$	13	$^{0}_{-0.150}$	**B-S6-146**
6	$^{+0.018}_{0}$	9	$^{+0.038}_{+0.023}$	3	±0.100	**B-S6-194**
6	$^{+0.035}_{+0.025}$	9	$^{+0.038}_{+0.023}$	3	$^{0}_{-0.200}$	**B-S6-342**
6	$^{+0.023}_{+0.008}$	9	$^{+0.038}_{+0.023}$	4	±0.100	**B-S6-1191**
6	$^{+0.035}_{+0.025}$	9	$^{+0.038}_{+0.023}$	5	±0.050	**B-S6-180**
6	$^{+0.015}_{0}$	9	$^{+0.038}_{+0.023}$	6	±0.100	**B-S6-17**
6	$^{+0.015}_{0}$	9	$^{+0.038}_{+0.023}$	6	±0.100	**B-S6-1343**
6	$^{+0.015}_{0}$	9	$^{+0.038}_{+0.023}$	8	±0.100	**B-S6-18**
6	$^{+0.035}_{+0.025}$	9	$^{+0.038}_{+0.023}$	8	±0.100	**B-S6-211**
6	$^{+0.015}_{0}$	9	$^{+0.038}_{+0.023}$	10	±0.100	**B-S6-19**
6	$^{+0.035}_{+0.025}$	9	$^{+0.038}_{+0.023}$	10	±0.100	**B-S6-165**
6	$^{+0.015}_{0}$	9	$^{+0.030}_{+0.015}$	16	±0.100	**B-S6-230**
6	$^{+0.030}_{+0.015}$	10	$^{+0.038}_{+0.023}$	2	$^{0}_{-0.100}$	**B-S6-328**
6	$^{+0.035}_{+0.023}$	10	$^{+0.038}_{+0.023}$	3	±0.100	**B-S6-219**
6	$^{+0.030}_{+0.015}$	10	$^{+0.041}_{+0.025}$	3	$^{0}_{-0.100}$	**B-S6-321**
6	$^{+0.030}_{+0.015}$	10	$^{+0.041}_{+0.025}$	3.5	$^{0}_{-0.100}$	**B-S6-149**
6	$^{+0.020}_{+0.012}$	10	$^{+0.015}_{+0.005}$	3.5	$^{0}_{-0.100}$	**B-S6-1193**
6	$^{+0.015}_{0}$	10	$^{+0.038}_{+0.023}$	4	±0.100	**B-S6-110**
6	$^{+0.020}_{+0.012}$	10	$^{+0.015}_{+0.005}$	4	$^{0}_{-0.100}$	**B-S6-1194**
6	$^{+0.030}_{+0.015}$	10	$^{+0.038}_{+0.023}$	4	$^{0}_{-0.100}$	**B-S6-265**
6	$^{+0.045}_{+0.035}$	10	$^{+0.038}_{+0.023}$	4	$^{0}_{-0.100}$	**B-S6-1256**
6	$^{+0.035}_{+0.023}$	10	$^{+0.038}_{+0.023}$	5	$^{+0.200}_{0}$	**B-S6-272**
6	$^{+0.020}_{+0.012}$	10	$^{+0.015}_{+0.005}$	5	$^{0}_{-0.100}$	**B-S6-1196**
6	$^{+0.070}_{+0.050}$	10	$^{+0.038}_{+0.023}$	5	±0.100	**B-S6-316**
6	$^{+0.030}_{+0.015}$	10	$^{+0.041}_{+0.025}$	5	±0.100	**B-S6-197**
6	$^{+0.015}_{0}$	10	$^{+0.038}_{+0.023}$	6	±0.100	**B-S6-218**
6	$^{+0.030}_{+0.015}$	10	$^{+0.041}_{+0.025}$	6	$^{0}_{-0.100}$	**B-S6-288**

Sleeve Bearings

d 6～7mm

Dimensions mm						Product code
Bore ϕd		Outer diameter ϕD		Length ℓ		
6	+0.020 +0.012	10	+0.015 +0.005	6	0 −0.100	B-S6-1197
6	+0.012 0	10	+0.038 +0.023	7	±0.100	B-S6-117
6	+0.012 0	10	+0.038 +0.023	8	±0.100	B-S6-85
6	+0.045 +0.033	10	+0.038 +0.023	8	0 −0.100	B-S6-1312
6	+0.012 0	10	+0.038 +0.023	9	±0.100	B-S6-39
6	+0.012 0	10	+0.038 +0.023	10	0 −0.100	B-S6-43
6	+0.015 0	10	+0.038 +0.023	11	±0.100	B-S6-45
6	+0.015 0	10	+0.038 +0.023	12	±0.150	B-S6-46
6	+0.012 0	10	+0.046 +0.028	13	±0.100	B-S6-48
6	+0.020 +0.012	10	+0.033 +0.023	14	−0.300 −0.500	B-S6-160
6	+0.012 0	10	+0.038 +0.023	15	±0.150	B-S6-52
6	+0.050 +0.020	10	0 −0.030	17	±0.150	B-S6-88
6	+0.017 +0.005	10	+0.038 +0.023	17	±0.100	B-S6-310
6	+0.040 +0.020	11	+0.041 +0.023	4	±0.100	B-S6-175
6	+0.033 +0.018	11	+0.038 +0.023	5	+0.200 0	B-S6-1325
6	+0.012 0	12	+0.046 +0.028	3	±0.100	B-S6-1359
6	+0.010 0	12	+0.046 +0.028	3	−0.100 −0.300	B-S6-1061
6	+0.012 0	12	+0.046 +0.028	4	±0.100	B-S6-1395
6	+0.012 0	12	+0.038 +0.023	6	±0.100	B-S6-353
6	+0.012 0	12	+0.046 +0.028	7	±0.100	B-S6-196
6	+0.040 +0.020	12	+0.200 0	8	±0.100	B-S6-62
6	+0.012 0	12	+0.046 +0.028	8	±0.100	B-S6-63
6	+0.030 +0.010	12	+0.040 +0.020	8	0 −0.100	B-S6-279
6	+0.040 +0.020	12	+0.200 0	9	±0.150	B-S6-65
6	+0.012 0	12	+0.046 +0.028	12	±0.100	B-S6-179
6	+0.035 +0.020	12	+0.048 +0.028	17	0 −0.100	B-S6-299
6	+0.012 0	12	+0.046 +0.028	19	±0.150	B-S6-1321
6	+0.012 0	12	+0.046 +0.028	20	±0.150	B-S6-245
6	+0.012 +0.006	13	+0.046 +0.028	3.5	±0.100	B-S6-227
6	+0.015 0	13	+0.030 +0.010	5	±0.100	B-S6-215
6	+0.015 0	13	−0.020 −0.040	5	±0.100	B-S6-1340
6	+0.018 +0.006	15	+0.046 +0.028	5	±0.100	B-S6-184
7	+0.012 0	9	+0.038 +0.023	6	±0.100	B-S7-63

d 7～8mm

Dimensions mm						Product code
Bore ϕd		Outer diameter ϕD		Length ℓ		
7	+0.025 +0.010	10	+0.038 +0.023	4	±0.100	B-S7-1255
7	+0.015 0	10	+0.035 +0.023	10	±0.150	B-S7-4
7	+0.025 +0.010	10	+0.038 +0.023	10	±0.050	B-S7-1110
7	+0.012 0	10	±0.030	12	0 −0.100	B-S7-23
7	+0.020 0	11	0 −0.027	3	0 −0.100	B-S7-55
7	+0.040 +0.020	11	+0.051 +0.033	7	±0.100	B-S7-6
7	+0.015 0	11	+0.046 +0.028	10	±0.150	B-S7-24
7	+0.015 0	12	+0.046 +0.028	5	±0.100	B-S7-1025
7	+0.053 +0.038	12	+0.046 +0.028	7	±0.100	B-S7-46
7	+0.015 0	13	0 −0.020	4	±0.050	B-S7-14
7	+0.015 0	13	+0.046 +0.028	15	±0.150	B-S7-22
7	+0.048 +0.033	14	+0.046 +0.028	10	±0.100	B-S7-48
8	+0.030 +0.015	10	+0.038 +0.023	3	±0.100	B-S8-413
8	+0.020 +0.012	10	+0.015 +0.005	3	0 −0.100	B-S8-423
8	+0.020 +0.012	10	+0.015 +0.005	3.5	0 −0.100	B-S8-411
8	+0.030 +0.015	10	+0.038 +0.023	5	±0.100	B-S8-1406
8	+0.030 +0.010	10	0 −0.020	5	0 −0.500	B-S8-394
8	+0.045 +0.030	10	+0.038 +0.023	6	±0.100	B-S8-235
8	+0.030 +0.015	10	+0.038 +0.023	8	±0.100	B-S8-1504
8	+0.015 0	10	+0.038 +0.023	8	±0.100	B-S8-187
8	+0.015 0	10	+0.038 +0.023	10	±0.100	B-S8-5
8	+0.035 +0.020	10	+0.040 +0.020	15	±0.150	B-S8-1497
8	+0.018 0	11	+0.038 +0.023	4	±0.100	B-S8-342
8	+0.029 +0.014	11	+0.043 +0.028	10	±0.100	B-S8-160
8	+0.015 0	11	+0.046 +0.028	12	±0.150	B-S8-17
8	+0.022 0	11	+0.055 +0.028	18	±0.150	B-S8-20
8	+0.015 0	11	+0.046 +0.028	20	±0.150	B-S8-21
8	+0.040 +0.015	11	+0.046 +0.016	25	0 −0.300	B-S8-243
8	+0.020 0	12	+0.030 +0.010	2	0 −0.100	B-S8-1388
8	+0.015 0	12	+0.038 +0.023	3	±0.100	B-S8-354
8	+0.050 +0.010	12	+0.050 0	3	±0.100	B-S8-1232
8	+0.040 +0.025	12	+0.046 +0.028	4	0 −0.100	B-S8-192
8	+0.015 0	12	+0.046 +0.028	4	0 −0.100	B-S8-414

Note: Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

Sleeve Bearings

d 8mm

Dimensions mm						Product code
Bore ϕd		Outer diameter ϕD		Length ℓ		
8	$^{+0.030}_{+0.010}$	12	$^{+0.040}_{+0.020}$	4	$^{0}_{-0.100}$	**B-S8-358**
8	$^{+0.015}_{0}$	12	$^{+0.038}_{+0.023}$	5	±0.100	**B-S8-356**
8	$^{+0.020}_{+0.005}$	12	$^{+0.038}_{+0.023}$	5	±0.050	**B-S8-1141**
8	$^{+0.030}_{+0.015}$	12	$^{+0.041}_{+0.023}$	5	$^{0}_{-0.100}$	**B-S8-1252**
8	$^{+0.018}_{0}$	12	$^{+0.046}_{+0.028}$	6	±0.100	**B-S8-32**
8	$^{+0.015}_{0}$	12	$^{+0.046}_{+0.028}$	6	±0.100	**B-S8-36**
8	$^{+0.035}_{+0.015}$	12	$^{+0.041}_{+0.023}$	6	±0.100	**B-S8-288**
8	$^{+0.034}_{+0.025}$	12	$^{+0.046}_{+0.028}$	6	±0.100	**B-S8-370**
8	$^{+0.055}_{+0.040}$	12	$^{+0.046}_{+0.028}$	6	±0.100	**B-S8-1100**
8	$^{+0.015}_{0}$	12	$^{+0.046}_{+0.028}$	8	±0.100	**B-S8-42**
8	$^{+0.040}_{+0.025}$	12	$^{+0.046}_{+0.028}$	8	$^{0}_{-0.100}$	**B-S8-169**
8	$^{+0.030}_{+0.015}$	12	$^{+0.041}_{+0.023}$	8	$^{0}_{-0.100}$	**B-S8-1253**
8	$^{+0.020}_{+0.005}$	12	$^{+0.046}_{+0.028}$	8	±0.100	**B-S8-436**
8	$^{+0.015}_{0}$	12	$^{+0.046}_{+0.028}$	10	±0.100	**B-S8-1402**
8	$^{+0.018}_{0}$	12	$^{+0.046}_{+0.028}$	10	$^{0}_{-0.300}$	**B-S8-381**
8	$^{+0.035}_{+0.013}$	12	$^{0}_{-0.018}$	11	$^{0}_{-0.200}$	**B-S8-188**
8	$^{+0.025}_{+0.010}$	12	$^{+0.046}_{+0.028}$	11	$^{0}_{-0.200}$	**B-S8-289**
8	$^{+0.015}_{0}$	12	$^{+0.046}_{+0.028}$	12	±0.100	**B-S8-1311**
8	$^{+0.055}_{+0.040}$	12	$^{+0.046}_{+0.028}$	12	$^{0}_{-0.100}$	**B-S8-1021**
8	$^{+0.035}_{+0.013}$	12	$^{+0.041}_{+0.023}$	12	±0.100	**B-S8-63**
8	$^{+0.035}_{+0.013}$	12	$^{+0.041}_{+0.023}$	14	±0.100	**B-S8-209**
8	$^{+0.035}_{+0.013}$	12	$^{+0.041}_{+0.023}$	15	$^{0}_{-0.200}$	**B-S8-73**
8	$^{+0.015}_{+0.008}$	12	$^{+0.034}_{+0.023}$	16	$^{0}_{-0.100}$	**B-S8-75**
8	$^{+0.035}_{+0.013}$	12	$^{+0.041}_{+0.023}$	18	$^{0}_{-0.200}$	**B-S8-79**
8	$^{+0.015}_{0}$	12	$^{+0.046}_{+0.028}$	18	±0.150	**B-S8-81**
8	$^{+0.015}_{0}$	12	$^{+0.046}_{+0.028}$	20	±0.100	**B-S8-84**
8	$^{+0.022}_{0}$	12	$^{+0.046}_{+0.028}$	35	±0.500	**B-S8-296**
8	$^{+0.015}_{0}$	13	$^{+0.046}_{+0.028}$	5	±0.100	**B-S8-90**
8	$^{+0.035}_{+0.013}$	13	$^{+0.041}_{+0.023}$	9	±0.150	**B-S8-91**
8	$^{+0.035}_{+0.013}$	13	$^{+0.041}_{+0.023}$	15	$^{0}_{-0.200}$	**B-S8-93**
8	$^{+0.015}_{0}$	14	$^{+0.046}_{+0.028}$	3.5	±0.100	**B-S8-231**
8	$^{+0.035}_{+0.010}$	14	$^{+0.046}_{+0.028}$	4.1	±0.100	**B-S8-307**
8	$^{+0.025}_{+0.010}$	14	$^{+0.045}_{+0.026}$	16	±0.100	**B-S8-115**

Note: Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

d 8～10mm

Dimensions mm						Product code
Bore ϕd		Outer diameter ϕD		Length ℓ		
8	$^{+0.017}_{0}$	15	$^{+0.045}_{+0.025}$	22	±0.150	**B-S8-328**
8	$^{+0.017}_{0}$	15	$^{+0.045}_{+0.025}$	24	±0.200	**B-S8-130**
8	$^{+0.015}_{0}$	16	$^{+0.036}_{+0.018}$	5	$^{0}_{-0.200}$	**B-S8-132**
8	$^{+0.028}_{+0.005}$	16	$^{+0.046}_{+0.028}$	10	±0.100	**B-S8-234**
8	$^{+0.015}_{0}$	16	$^{+0.046}_{+0.028}$	13	±0.150	**B-S8-376**
8	$^{+0.023}_{+0.008}$	16	$^{+0.046}_{+0.028}$	15	±0.150	**B-S8-137**
8	$^{+0.015}_{0}$	16	$^{+0.046}_{+0.028}$	20	±0.150	**B-S8-258**
9	$^{+0.020}_{+0.005}$	12	$^{+0.046}_{+0.028}$	9	$^{0}_{-0.100}$	**B-S9-34**
9	$^{+0.025}_{+0.010}$	12	$^{+0.046}_{+0.028}$	13	±0.050	**B-S9-1014**
9	$^{+0.015}_{0}$	13	$^{+0.046}_{+0.028}$	8	±0.150	**B-S9-37**
9	$^{+0.015}_{0}$	14	$^{+0.046}_{+0.028}$	12	±0.100	**B-S9-12**
10	$^{+0.015}_{0}$	12	$^{+0.046}_{+0.028}$	7.8	±0.150	**B-S10-122**
10	$^{+0.015}_{0}$	13	$^{+0.046}_{+0.028}$	8	±0.100	**B-S10-3**
10	$^{+0.070}_{+0.050}$	14	$^{+0.038}_{+0.023}$	4	±0.100	**B-S10-132**
10	$^{+0.070}_{+0.050}$	14	$^{+0.038}_{+0.023}$	5	±0.100	**B-S10-21**
10	$^{+0.055}_{0}$	14	$^{+0.046}_{+0.028}$	5	±0.100	**B-S10-1044**
10	$^{+0.018}_{0}$	14	$^{+0.046}_{+0.028}$	7	±0.100	**B-S10-25**
10	$^{+0.015}_{0}$	14	$^{+0.046}_{+0.028}$	12	±0.150	**B-S10-136**
10	$^{+0.015}_{0}$	14	$^{+0.046}_{+0.028}$	15	±0.100	**S10-144**
10	$^{+0.015}_{0}$	14	$^{+0.046}_{+0.028}$	16	±0.150	**B-S10-42**
10	$^{+0.030}_{+0.010}$	14	$^{+0.036}_{+0.018}$	18	±0.100	**B-S10-44**
10	$^{+0.015}_{0}$	15	$^{+0.046}_{+0.028}$	4	±0.100	**B-S10-1025**
10	$^{+0.035}_{+0.013}$	15	$^{+0.041}_{+0.023}$	19	$^{0}_{-0.100}$	**B-S10-53**
10	$^{+0.015}_{0}$	16	$^{+0.046}_{+0.028}$	9	±0.150	**B-S10-1050**
10	$^{+0.015}_{0}$	16	$^{+0.046}_{+0.028}$	14	±0.150	**B-S10-170**
10	$^{+0.015}_{0}$	16	$^{+0.046}_{+0.028}$	15	±0.150	**B-S10-60**
10	$^{+0.035}_{+0.020}$	16	$^{+0.046}_{+0.028}$	20	±0.150	**B-S10-125**
10	$^{+0.045}_{+0.027}$	18	$^{+0.050}_{+0.032}$	5	±0.100	**B-S10-1102**

Flange Bearings

d 4mm

Dimensions mm												Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness				
ϕd		ϕD		ℓ		ϕF		t				
4	+0.030 +0.010	6	0 −0.050	2.5	±0.100	8	±0.100	1	±0.100			B-F4-1
4	+0.030 0	6	−0.020 −0.050	3	±0.200	11 / 9.5	±0.200 / 0 −0.100	1.5	±0.200			B-F4-2※
4	+0.030 +0.010	6	0 −0.050	5	±0.100	8	±0.100	1	±0.100			B-F4-73
4	+0.030 0	6	−0.020 −0.050	5	±0.200	10	±0.200	1.5	±0.200			B-F4-43
4	+0.030 +0.010	6	0 −0.050	7	±0.100	8	±0.100	1	±0.100			B-F4-1079
4	+0.038 +0.020	6 / 5.6	0 −0.018 / 0 −0.100	5.9	±0.100	9	±0.100	1	±0.100			B-F4-1045K※
4	+0.030 0	7	0 −0.018	2.5	±0.100	8.2	±0.100	0.6	±0.100			B-F4-5
4	+0.030 0	7	0 −0.058	3	±0.300	8.2	±0.100	0.6	±0.100			B-F4-50※
4	+0.050 +0.020	7	0 −0.050	3	±0.100	9	±0.150	0.9	±0.100			B-F4-6
4	+0.030 0	7	−0.025 −0.083	3	±0.300	10	±0.300	1.5				B-F4-7
4	+0.020 0	7	0 −0.020	4.7		9	±0.100	1.5	±0.100			B-F4-101
4	+0.050 +0.020	7	−0.010 −0.030	5	±0.100	9	±0.100	1	±0.100			B-F4-93
4	+0.048 0	7	−0.040 −0.098	6	±0.100	10	±0.200	1.5	±0.100			B-F4-9
4	+0.048 0	7	−0.025 −0.061	9.5	±0.200	10	±0.300	7				B-F4-41
4	+0.012 0	7	+0.038 +0.023	10	±0.100	9	±0.200	1.5	±0.100			B-F4-49
4	+0.020 0	7 / 6	0 −0.020 / −0.100 −0.200	4.7		9	±0.100	1.5	±0.100			B-F4-102※
4	+0.048 0	7 / 6.5	−0.040 −0.098 / 0 −0.200	4.5	±0.100	10	±0.100	1.5	±0.100			B-F4-97※
4	+0.048 0	7 / 6.5	−0.040 −0.098 / 0 −0.200	6	±0.100	10	±0.100	1.5	±0.100			B-F4-10※
4	+0.030 0	8	−0.025 −0.083	3	±0.300	12	±0.300	1.5				B-F4-40
4	+0.012 0	8	+0.046 +0.028	3.5	±0.100	10	±0.200	1	±0.100			B-F4-36
4	+0.018 0	8	+0.038 +0.023	4	±0.100	11	±0.100	1.5	−0.100 −0.200			B-F4-15
4	+0.012 +0.002	8	+0.046 +0.028	5	±0.100	10	±0.100	1	0 −0.100			B-F4-152
4	+0.012 0	8	+0.038 +0.023	5		12	±0.100	2	0 −0.100			B-F4-18
4	+0.048 0	8	−0.013 −0.049	5.4	±0.300	18	±0.200	2.2				B-F4-35
4	+0.045 +0.033	8	+0.038 +0.023	6	±0.150	12	±0.140	2	±0.200			B-F4-21
4	+0.012 0	8	+0.038 +0.023	10	±0.100	12	±0.100	2	±0.050			B-F4-33
4	+0.030 0	8 / 6.8	−0.025 −0.083 / 0 −0.090	8	±0.200	12	±0.140	2	±0.200			B-F4-57※

d 4～5mm

Dimensions mm												Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness				
ϕd		ϕD		ℓ		ϕF		t				
4	+0.060 +0.045	8 / 7	+0.032 +0.023 / ±0.200	6	±0.100	10	±0.100	1.5	±0.200			B-F4-42※
4	+0.080 +0.050	8 / 7	−0.020 −0.070 / 0 −0.100	6	±0.300	12	±0.300	2	±0.300			B-F4-1016K※
4	+0.040 +0.020	9	+0.050 +0.030	6	±0.100	12	±0.100	2	±0.100			B-F4-145
4	+0.040 +0.020	9	+0.050 +0.030	8	±0.100	12	±0.100	2	±0.100			B-F4-27
4	+0.021 +0.015	10	+0.045 +0.030	4	±0.100	12	±0.100	1.5	±0.100			B-F4-59※
4	+0.048 0	10	−0.013 −0.049	9.6	±0.300	18	±0.200	1.9				B-F4-147
4	+0.038 +0.020	11 / 10.5	0 −0.027 / 0 −0.100	3.5	±0.100	13	±0.100	1	±0.100			B-F4-67※
4 / 4.15	+0.020 +0.010 / ±0.030	9	0 −0.010	4.3	+0.100 0	11.13	0 −0.050	2.9	±0.050			B-F4-53※
4 / 4.15	+0.020 +0.010 / ±0.030	9	0 −0.010	4.3	+0.100 0	17 / 11.15	0 −0.050	2.2	±0.100			B-F4-60※
4 / 4.15	+0.020 +0.010 / ±0.030	9	0 −0.010	4.9	+0.100 0	11.13	0 −0.050	2.9	±0.050			B-F4-54※
5	+0.050 0	7	0 −0.050	2.5	±0.100	8	±0.100	1	±0.200			B-F5-1093
5	+0.030 0	7	0 −0.022	3	±0.100	8	±0.100	1				B-F5-1094
5	+0.075 0	7.92 / 7.5	−0.090 / 0 −0.100	0 3		10	±0.500	1	±0.150			B-F5-135K※
5	+0.075 0	7.92 / 7.5	−0.090 / 0 −0.100	0 5		10	±0.500	1	±0.150			B-F5-67※
5	+0.038 +0.020	8	+0.041 +0.023	3	±0.100	10	±0.100	1	0 −0.050			B-F5-100
5	+0.038 +0.020	8	+0.041 +0.023	3	±0.100	10	±0.100	1	0 −0.050			B-F5-1056
5	+0.038 +0.020	8	+0.041 +0.023	3	±0.100	10	±0.100	1	0 −0.050			B-F5-53
5	+0.050 +0.020	8	+0.028 +0.019	3.5	±0.100	11	±0.100	1.5	±0.100			B-F5-2
5	+0.022 +0.010	8	+0.034 +0.019	4	±0.200	9	±0.200	1	0 −0.100			B-F5-77
5	+0.012 0	8	+0.020 0	5	±0.100	10	±0.150	0.9	±0.100			B-F5-4
5	+0.025 +0.010	8	+0.038 +0.023	5	±0.100	11	±0.200	1	±0.100			B-F5-5
5	+0.025 +0.013	8	+0.038 +0.023	6	±0.100	11	±0.150	1.5	±0.100			B-F5-7
5	+0.025 +0.010	8	+0.038 +0.023	7	±0.100	11	±0.100	1	±0.100			B-F5-72
5	+0.025 +0.010	8	+0.038 +0.023	11	±0.150	11	±0.200	1	±0.100			B-F5-1081
5	+0.018 0	9	0 −0.018	4	±0.100	11	±0.100	1.5	±0.100			B-F5-10

Note: Items indicated with an asterisk (*) have a special shape. Please contact **NTN** for details.
Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

Flange Bearings

d 5～6mm

Dimensions mm												Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness				
ϕd		ϕD		ℓ		ϕF		t				
5	$^{+0.012}_{0}$	9	$^{0}_{-0.018}$	4	±0.100	11	±0.100	1.5	±0.100			B-F5-108
5	$^{+0.007}_{+0.002}$	9	$^{0}_{-0.015}$	4	±0.100	11	±0.200	2.5	±0.100			B-F5-116※
5	$^{+0.012}_{0}$	9	$^{+0.038}_{+0.023}$	4.3	±0.100	11	±0.100	0.8	±0.200			B-F5-11
5	$^{+0.012}_{0}$	9	$^{+0.038}_{+0.023}$	5	±0.100	11	±0.100	0.8	±0.100			B-F5-85
5	$^{+0.018}_{+0.003}$	9 / 8	$^{+0.045}_{+0.030}$ / $^{-0.050}_{-0.200}$	5	±0.100	11	±0.100	1.5	±0.100			B-F5-120※
5	$^{+0.018}_{+0.003}$	9 / 8	$^{+0.045}_{+0.030}$ / $^{-0.050}_{-0.200}$	9.5	±0.150	11	±0.200	1.5	±0.100			B-F5-13※
5	$^{+0.020}_{+0.005}$	10	$^{+0.038}_{+0.023}$	4	±0.100	12	±0.100	1	±0.100			B-F5-30
5	$^{+0.014}_{+0.005}$	10	$^{+0.019}_{+0.010}$	5.5		13	±0.100	1	±0.100			B-F5-81
5	$^{+0.014}_{+0.005}$	10	$^{+0.019}_{+0.010}$	8	±0.150	13	±0.100	1	±0.100			B-F5-15
5	$^{+0.048}_{0}$	10	$^{-0.013}_{-0.049}$	8	±0.300	18	±0.200	2	±0.150			B-F5-35
5	$^{+0.030}_{+0.015}$	11	$^{+0.050}_{+0.020}$	4	±0.100	13	±0.100	0.8	±0.200			B-F5-18
5	$^{+0.028}_{+0.005}$	11	$^{+0.046}_{+0.028}$	13	±0.100	15	±0.100	2	±0.200			B-F5-107
5	$^{+0.016}_{+0.004}$	11 / 10.4	$^{+0.046}_{+0.028}$ / $^{-0.020}_{-0.070}$	5	±0.100	13 / 11.4	±0.100	2	$^{0}_{-0.100}$			B-F5-1008K※
5	$^{+0.016}_{+0.004}$	11 / 10.4	$^{+0.046}_{+0.028}$ / $^{-0.020}_{-0.070}$	5	±0.100	13 / 11.4	±0.100	2	$^{0}_{-0.100}$			B-F5-66※
5 / 5.4	$^{+0.013}_{+0.008}$ / ±0.100	7.8	$^{+0.010}_{0}$	2.3		8.8	$^{0}_{-0.100}$	0.9	±0.050			B-F5-48※
6	$^{+0.048}_{0}$	8	$^{0}_{-0.058}$	2.6	±0.200	10	±0.300	1	±0.100			B-F6-1272
6	$^{+0.120}_{0}$	8	$^{-0.013}_{-0.103}$	3	±0.300	10	±0.300	1	±0.300			B-F6-1247
6	$^{+0.030}_{+0.010}$	8	$^{0}_{-0.050}$	3	±0.100	10	±0.100	1	±0.100			B-F6-3
6	$^{+0.120}_{0}$	8	$^{-0.010}_{-0.030}$	4	±0.500	10	±0.500	1	±0.500			B-F6-1068
6	$^{+0.038}_{+0.020}$	8	$^{-0.013}_{-0.035}$	4	±0.100	10	±0.200	1	±0.100			B-F6-1099
6	$^{+0.030}_{+0.010}$	8	$^{0}_{-0.050}$	4	±0.100	10	±0.100	1	±0.100			B-F6-1292
6	$^{+0.012}_{0}$	8	$^{0}_{-0.015}$	5	±0.100	12	±0.100	1	±0.200			B-F6-121
6	$^{+0.015}_{0}$	8	$^{+0.038}_{+0.023}$	5.8	±0.150	12	±0.100	2	±0.100			B-F6-92
6	$^{+0.030}_{+0.010}$	8	$^{0}_{-0.050}$	6	±0.100	10	±0.100	1	±0.100			B-F6-1111
6	$^{+0.020}_{0}$	8	$^{-0.008}_{-0.030}$	9	±0.200	10	±0.200	1	±0.100			B-F6-1122
6	$^{+0.030}_{+0.010}$	8	$^{0}_{-0.043}$	10	±0.150	10	±0.100	1	±0.100			B-F6-306
6	$^{+0.035}_{+0.025}$	9	$^{+0.038}_{+0.023}$	4	$^{0}_{-0.100}$	11	±0.100	1	$^{0}_{-0.100}$			B-F6-180
6	$^{+0.018}_{0}$	9	$^{+0.034}_{+0.019}$	4	±0.100	11	±0.100	1	±0.100			B-F6-6

d 6mm

Dimensions mm												Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness				
ϕd		ϕD		ℓ		ϕF		t				
6	$^{+0.012}_{0}$	9	$^{+0.030}_{+0.015}$	5	±0.100	12	±0.100	1.5	±0.100			B-F6-126
6	$^{+0.012}_{0}$	9	$^{+0.038}_{+0.023}$	5	±0.100	12	±0.300	2	±0.200			B-F6-282
6	$^{+0.012}_{0}$	9	$^{+0.030}_{+0.015}$	6	±0.100	12	±0.100	1.5	±0.100			B-F6-168
6	$^{+0.018}_{0}$	9	$^{+0.034}_{+0.019}$	7	±0.100	11	±0.100	1	±0.100			B-F6-8
6	$^{+0.012}_{0}$	9	$^{+0.028}_{+0.019}$	7	±0.150	12	±0.100	2	±0.200			B-F6-289
6	$^{+0.012}_{0}$	9	$^{+0.005}_{-0.010}$	8	±0.200	12	±0.200	1.5	±0.200			B-F6-229
6	$^{+0.018}_{0}$	9	$^{+0.034}_{+0.019}$	9	$^{+0.200}_{0}$	11	±0.200	1	$^{0}_{-0.100}$			B-F6-10
6	$^{+0.032}_{+0.020}$	9	$^{+0.038}_{+0.023}$	10	±0.100	11	±0.100	1	$^{0}_{-0.200}$			B-F6-1324
6	$^{+0.030}_{0}$	9 / 7.8	$^{-0.025}_{-0.083}$ / $^{0}_{-0.090}$	5	±0.200	11	±0.200	2	±0.200			B-F6-283※
6	$^{+0.030}_{0}$	9 / 8	$^{-0.013}_{-0.036}$ / $^{0}_{-0.058}$	5.5	±0.300	13	±0.300	1.5	±0.300			B-F6-84※
6	$^{+0.050}_{+0.020}$	9 / 8	$^{-0.013}_{-0.071}$ / $^{0}_{-0.100}$	8	±0.100	10	±0.200	1.5	±0.080			B-F6-251※
6	$^{+0.012}_{0}$	9 / 8.5	$^{+0.021}_{+0.006}$ / $^{0}_{-0.100}$	3	±0.100	12	±0.100	1.5	$^{0}_{-0.200}$			B-F6-1123K※
6	$^{+0.012}_{0}$	9 / 8.5	$^{+0.021}_{+0.006}$ / $^{0}_{-0.100}$	5.5	±0.200	12	±0.100	1.5	$^{0}_{-0.200}$			B-F6-7※
6	$^{+0.030}_{0}$	9.6 / 8	$^{0}_{-0.040}$ / $^{0}_{-0.100}$	10	$^{0}_{-0.200}$	12	±0.100	1.5	$^{0}_{-0.200}$			B-F6-185※
6	$^{+0.012}_{0}$	10	$^{+0.038}_{+0.023}$	2.5	±0.100	12	±0.100	1	±0.100			B-F6-181
6	$^{+0.012}_{0}$	10	$^{+0.038}_{+0.023}$	3.5	±0.100	12	±0.100	1	±0.100			B-F6-14
6	$^{+0.045}_{+0.033}$	10	$^{+0.038}_{+0.023}$	3.8	±0.200	14	±0.140	1	±0.200			B-F6-116
6	$^{+0.012}_{0}$	10	$^{+0.038}_{+0.023}$	4	±0.100	12	±0.100	1.5	$^{0}_{-0.100}$			B-F6-15
6	$^{+0.048}_{0}$	10	$^{-0.025}_{-0.061}$	4	±0.200	14	±0.200	1	±0.200			B-F6-182
6	$^{+0.030}_{0}$	10	$^{-0.025}_{-0.061}$	4	±0.100	14	±0.140	2	±0.200			B-F6-18
6	$^{+0.030}_{0}$	10	$^{0}_{-0.036}$	4.5	$^{0}_{-0.100}$	12	±0.200	1	±0.100			B-F6-178
6	$^{+0.020}_{0}$	10	$^{0}_{-0.020}$	4.5	$^{0}_{-0.200}$	12	±0.200	2	$^{0}_{-0.100}$			B-F6-20
6	$^{+0.030}_{+0.015}$	10	$^{+0.038}_{+0.023}$	5	±0.100	12	±0.100	1	±0.100			B-F6-163
6	$^{+0.012}_{0}$	10	$^{+0.038}_{+0.023}$	5	±0.100	12	±0.100	2	±0.100			B-F6-24
6	$^{+0.078}_{+0.030}$	10	$^{0}_{-0.058}$	5	±0.100	14	$^{0}_{-0.200}$	1.5	$^{0}_{-0.300}$			B-F6-128
6	$^{+0.045}_{+0.033}$	10	$^{+0.038}_{+0.023}$	5	±0.200	14	±0.140	2	±0.200			B-F6-106
6	$^{+0.025}_{0}$	10	$^{0}_{-0.015}$	6	±0.100	12	±0.120	2	±0.100			B-F6-1112

Note: Items indicated with an asterisk (*) have a special shape. Please contact **NTN** for details.
Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

Flange Bearings

d 6mm

Dimensions mm												Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness				
ϕd		ϕD		ℓ		ϕF		t				
6	+0.048 0	10	−0.025 −0.061	6	±0.200	14	±0.200	1	±0.200			B-F6-183
6	+0.045 +0.033	10	+0.038 +0.023	6	±0.220	14	±0.140	2	±0.200			B-F6-30
6	+0.012 0	10	+0.038 +0.023	6.5	±0.100	12	±0.100	1.5	0 −0.100			B-F6-130
6	+0.025 0	10	0 −0.015	7	±0.100	12	±0.120	2	±0.100			B-F6-35
6	+0.012 0	10	+0.046 +0.028	7	±0.150	14	±0.100	2	±0.100			B-F6-36
6	+0.050 +0.020	10	0 −0.050	7.5	0 −0.300	14	±0.100	2	0 −0.100			B-F6-269※
6	+0.012 0	10	+0.038 +0.023	8	±0.100	12	±0.100	1.5	±0.100			B-F6-1273
6	+0.015 0	10	+0.038 +0.023	8	±0.100	14	±0.200	1	±0.050			B-F6-40
6	+0.035 +0.015	10	+0.046 +0.028	8	±0.150	14	±0.100	2	±0.200			B-F6-41
6	+0.012 0	10	+0.046 +0.028	9	±0.150	14	±0.100	2	±0.100			B-F6-46
6	+0.035 +0.015	10	+0.046 +0.028	9	±0.100	14	±0.100	2	0 −0.050			B-F6-47
6	+0.015 0	10	+0.046 +0.028	10	±0.150	14	±0.100	2	±0.100			B-F6-1035
6	+0.050 0	10 / 8	−0.020 −0.050 / −0.020 −0.100	4.5	±0.100	12	±0.200	3				B-F6-228※
6	+0.070 +0.020	10 / 8	−0.025 −0.061 / −0.020 −0.170	4.5	0 −0.300	14	±0.100	1.5	0 −0.100			B-F6-270※
6	+0.060 +0.010	10 / 8	−0.010 −0.050 / 0 −0.100	6	±0.200	12	±0.300	2	0 −0.200			B-F6-1201K※
6	+0.070 +0.020	10 / 8	−0.025 −0.061 / −0.020 −0.170	6	0 −0.300	14	±0.100	1.5	0 −0.100			B-F6-29※
6	+0.050 +0.020	10 / 8	−0.025 −0.047 / −0.040 −0.180	7	±0.150	12	±0.150	1	±0.100			B-F6-34※
6	+0.030 +0.010	10 / 8	−0.010 −0.030 / 0 −0.150	7	±0.100	12	±0.200	1	±0.100			B-F6-83※
6	+0.030 +0.010	10 / 8	−0.010 −0.030 / 0 −0.150	8	±0.100	12	±0.200	1	±0.100			B-F6-364K※
6	+0.050 +0.020	10 / 8	−0.025 −0.047 / −0.040 −0.180	9	±0.150	12	±0.150	1	±0.100			B-F6-1064K※
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	3.5	±0.500	12	±0.500	1.5	+0.100 −0.200			B-F6-78※
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	4	±0.200	14	±0.140	2	±0.200			B-F6-112※

Note: Items indicated with an asterisk (*) have a special shape. Please contact **NTN** for details.
Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

d 6mm

Dimensions mm												Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness				
ϕd		ϕD		ℓ		ϕF		t				
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	6	±0.200	14	±0.140	2	±0.200			B-F6-1187K※
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	8	±0.200	14	±0.135	2	±0.200			B-F6-45※
6	+0.030 0	10 / 8.8	−0.025 −0.083 / 0 −0.090	12	±0.200	14	±0.300	2	±0.200			B-F6-104※
6	+0.030 0	10 / 8.8	±0.200 / 0 −0.090	12	±0.200	14	±0.200	2	±0.200			B-F6-88※
6	+0.012 0	10 / 9	+0.038 +0.023 / 0 −0.100	4	±0.100	12	±0.150	1.5	±0.100			B-F6-16※
6	+0.012 0	10 / 9	+0.038 +0.023 / 0 −0.100	6	±0.100	12	±0.150	1.5	±0.100			B-F6-98※
6	+0.022 +0.010	11	+0.005 −0.010	4	±0.100	13.5 / 12.25	±0.100 / ±0.150	1.4	±0.050			B-F6-123※
6	+0.022 +0.010	11	+0.041 +0.023	5	±0.100	14	±0.100	2	±0.100			B-F6-57
6	+0.022 +0.010	11	0 −0.025	7	±0.150	14	±0.100	2	±0.100			B-F6-58
6	+0.025 +0.003	11	+0.040 +0.025	10	±0.150	14	±0.100	3	±0.100			B-F6-60
6	+0.024 +0.008	11 / 10	0 −0.020 / 0 −0.050	3	±0.100	13	±0.100	1	±0.100			B-F6-169※
6	+0.020 +0.010	12	+0.019 +0.001	4	±0.100	12.7	0 −0.300	1	0 −0.150			B-F6-171
6	+0.050 +0.010	12	0 −0.050	4	±0.200	15.8	0 −0.300	1.5	±0.100			B-F6-176※
6	+0.030 0	12	−0.016 −0.043	5	±0.250	16	±0.250	2	±0.250			B-F6-64
6	+0.030 +0.015	12	+0.040 +0.025	5.3	±0.050	14	+0.040 +0.010	1				B-F6-1075
6	+0.030 0	12	−0.032 −0.102	10	0 −0.400	16	±0.140	2	±0.200			B-F6-288
6	+0.012 0	12 / 8	+0.021 +0.006 / 0 −0.150	5.5		16	±0.100	1	±0.050			B-F6-235※
6	+0.012 0	12	−0.050 −0.077	5	0 −0.100	16 / 14.5	±0.250 / ±0.150	2	±0.100			B-F6-63※

Flange Bearings

d 7～8mm

Dimensions mm

Bore ϕd	Outer diameter ϕD	Length ℓ	Flange outer diameter ϕF	Flange thickness t	Product code
7 $^{+0.015}_{0}$	10 $^{+0.038}_{+0.023}$	6 ±0.100	13 ±0.100	1.3 ±0.100	**B-F7-1**
7 $^{+0.036}_{0}$	10 $^{-0.025}_{-0.061}$	8 ±0.100	12 ±0.100	2 ±0.100	**B-F7-3**
7 $^{+0.040}_{+0.020}$	12 $^{0}_{-0.020}$	12 ±0.100	15 ±0.100	3 ±0.100	**B-F7-5**
7 $^{+0.015}_{0}$	13 $^{+0.041}_{+0.023}$	10.5 ±0.150	16 ±0.100	2 ±0.100	**B-F7-27**
7 $^{+0.015}_{0}$	14 $^{0}_{-0.020}$	5 ±0.100	16 ±0.100	1 ±0.100	**B-F7-6**
8 $^{+0.036}_{0}$	10 $^{-0.025}_{-0.047}$	3 ±0.200	11.2 ±0.200	0.6	**B-F8-285**
8 $^{+0.021}_{+0.005}$	10 $^{+0.038}_{+0.023}$	5 ±0.100	13 ±0.100	2 ±0.200	**B-F8-1**
8 $^{+0.058}_{0}$	10 $^{0}_{-0.036}$	5.5 ±0.300	12 ±0.300	2 ±0.100	**B-F8-200**
8 $^{+0.037}_{+0.022}$	10 $^{+0.100}_{+0.082}$	8 ±0.200	12 ±0.200	1.5 ±0.200	**B-F8-295**
8 $^{+0.020}_{0}$	10 $^{0}_{-0.020}$	9.6 $^{0}_{-0.100}$	12 ±0.100 / 11	5.5 $^{0}_{-0.100}$	**B-F8-158※**
8 $^{+0.060}_{+0.040}$	10 $^{+0.038}_{+0.023}$	10 ±0.300	14 ±0.300	1 ±0.100	**B-F8-310**
8 $^{+0.035}_{+0.013}$	11 $^{-0.016}_{-0.043}$	4.5 ±0.100	13 ±0.100	1.5 ±0.100	**B-F8-1078**
8 $^{+0.020}_{0}$	11 $^{+0.050}_{+0.030}$	7 ±0.100	14 ±0.100	2 ±0.100	**B-F8-3**
8 $^{+0.060}_{+0.040}$	11 $^{+0.038}_{+0.023}$	7 ±0.100	15.5 $^{-0.100}_{-0.150}$	2 ±0.100	**B-F8-4**
8 $^{+0.030}_{0}$	11 $^{-0.010}_{-0.050}$ / 10 $^{-0.050}_{-0.100}$	8 ±0.200	14 ±0.200	2 ±0.200	**B-F8-324※**
8 $^{+0.047}_{+0.025}$	11 $^{0}_{-0.027}$ / 10.5 $^{0}_{-0.100}$	4 ±0.100	13 ±0.100	1.5 ±0.100	**B-F8-236※**
8 $^{+0.015}_{0}$	12 $^{+0.040}_{+0.012}$	3.5	20 ±0.300	2 $^{0}_{-0.100}$	**B-F8-362**
8 $^{+0.020}_{+0.012}$	12 $^{+0.015}_{+0.005}$	4 ±0.100	16 ±0.100	1.5 $^{0}_{-0.100}$	**B-F8-1019**
8 $^{+0.022}_{0}$	12 $^{+0.060}_{+0.033}$	4 ±0.100	16 ±0.100	1.5 ±0.100	**B-F8-8**
8 $^{+0.015}_{0}$	12 $^{+0.046}_{+0.028}$	4.5 ±0.100	16 ±0.100	2 ±0.200	**B-F8-100**
8 $^{+0.049}_{+0.013}$	12 $^{+0.046}_{+0.028}$	5 ±0.200	14 ±0.200	2 ±0.200	**B-F8-199**
8 $^{+0.050}_{+0.020}$	12 $^{0}_{-0.050}$	5 ±0.100	16 ±0.150	2 ±0.100	**B-F8-13※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.075}$	5 ±0.300	16 ±0.300	2 ±0.300	**B-F8-16**
8 $^{+0.070}_{+0.050}$	12 $^{+0.040}_{+0.020}$	6 ±0.100	14 ±0.100	2 ±0.200	**B-F8-188**
8 $^{+0.020}_{0}$	12 $^{+0.050}_{+0.030}$	6 $^{0}_{-0.100}$	16 ±0.100	2 $^{0}_{-0.100}$	**B-F8-23**
8 $^{+0.020}_{0}$	12 $^{+0.050}_{+0.030}$	7 ±0.100	14 ±0.100	2 ±0.100	**B-F8-25**
8 $^{+0.020}_{0}$	12 $^{-0.005}_{-0025}$	7 ±0.150	14 ±0.150 / 13 ±0.050	2 ±0.100	**B-F8-26※**
8 $^{+0.020}_{0}$	12 $^{-0.005}_{-0.025}$	7 ±0.150	14 $^{+0.050}_{-0.150}$ / 13 ±0.050	2 ±0.100	**B-F8-27※**

d 8mm

Dimensions mm

Bore ϕd	Outer diameter ϕD	Length ℓ	Flange outer diameter ϕF	Flange thickness t	Product code
8 $^{+0.015}_{0}$	12 $^{+0.046}_{+0.028}$	7 ±0.200	16 ±0.100	1.5 ±0.100	**B-F8-29**
8 $^{+0.175}_{+0.155}$	12 $^{+0.046}_{+0.028}$	8 ±0.100	15 ±0.100	2 ±0.200	**B-F8-30**
8 $^{+0.015}_{+0.003}$	12 $^{+0.040}_{+0.012}$	8 $^{0}_{-0.100}$	16 ±0.150	2 $^{0}_{-0.100}$	**B-F8-1015**
8 $^{+0.015}_{0}$	12 $^{+0.040}_{+0.012}$	8 $^{0}_{-0.100}$	16 ±0.150	2 $^{0}_{-0.100}$	**B-F8-33**
8 $^{+0.020}_{+0.005}$	12 $^{+0.040}_{+0.012}$	8 $^{0}_{-0.100}$	16 ±0.150	2 $^{0}_{-0.100}$	**B-F8-388**
8 $^{+0.049}_{+0.013}$	12 $^{+0.075}_{+0.032}$	10 ±0.300	14 ±0.300	1 ±0.100	**B-F8-146**
8 $^{+0.015}_{0}$	12 $^{+0.046}_{+0.028}$	10 $^{0}_{-0.300}$	15 ±0.100	2 ±0.100	**B-F8-41**
8 $^{+0.050}_{+0.020}$	12 $^{0}_{-0.050}$	10 ±0.150	16 ±0.150	2 ±0.100	**B-F8-45※**
8 $^{+0.040}_{+0.020}$	12 $^{0}_{-0.050}$	10 ±0.100	16 ±0.200 / 14 ±0.200	1.7 ±0.100	**B-F8-121※**
8 $^{+0.050}_{+0.020}$	12 $^{0}_{-0.050}$	12 $^{0}_{-0.300}$	14 ±0.100	1.5 $^{0}_{-0.100}$	**B-F8-50**
8 $^{+0.015}_{0}$	12 $^{+0.046}_{+0.028}$	12 ±0.150	14 ±0.100	2.5 ±0.100	**B-F8-52**
8 $^{+0.055}_{+0.040}$	12 $^{+0.046}_{+0.028}$	12 ±0.220	16 ±0.140	2 ±0.200	**B-F8-103**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$	15 ±0.500	16 ±0.300	2 ±0.200	**B-F8-58**
8 $^{+0.022}_{0}$	12 $^{+0.055}_{+0.028}$	16 ±0.150	14 ±0.100	2 ±0.100	**B-F8-59**
8 $^{+0.061}_{+0.025}$	12 $^{-0.032}_{-0.075}$ / 10 $^{-0.040}_{-0.200}$	6.5 ±0.100	14 ±0.100	1 ±0.100	**B-F8-160※**
8 $^{+0.030}_{+0.010}$	12 $^{-0.010}_{-0.030}$ / 10 $^{-0.050}_{-0.100}$	8 ±0.100	16 ±0.100	2 ±0.100	**B-F8-219※**
8 $^{+0.035}_{+0.013}$	12 $^{0}_{-0.060}$ / 10 $^{0}_{-0.100}$	9.5	16 $^{0}_{-0.060}$	4.5 ±0.100	**B-F8-212※**
8 $^{+0.036}_{0}$	12 $^{-0.050}_{-0.080}$ / 10.8 $^{0}_{-0.110}$	4 ±0.100	16 ±0.140	2 ±0.200	**B-F8-1110K※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ / 10.8 $^{0}_{-0.110}$	4 ±0.200	16 ±0.140	2 ±0.200	**B-F8-9※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ / 10.8 $^{0}_{-0.070}$	4.5 ±0.200	16 ±0.150	1 ±0.150	**B-F8-10※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ / 10.8 $^{0}_{-0.110}$	4.8 ±0.200	16 ±0.500	2 ±0.200	**B-F8-12※**
8 $^{+0.022}_{0}$	12 $^{-0.032}_{-0.102}$ / 10.8 $^{0}_{-0.110}$	5 ±0.200	16 ±0.140	2 ±0.200	**B-F8-1086K※**
8 $^{+0.036}_{0}$	12 $^{-0.032}_{-0.102}$ / 10.8 $^{0}_{-0.110}$	5 ±0.200	16 ±0.140	2 ±0.100	**B-F8-346K※**

Note: Items indicated with an asterisk (*) have a special shape. Please contact **NTN** for details.
Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

Flange Bearings

d 8mm

Dimensions mm											Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness			
ϕd		ϕD		ℓ		ϕF		t			
8	+0.036 0	12	−0.032 −0.102	5	±0.200	16	±0.140	2			B-F8-369K※
		10.8	0 −0.110								
8	+0.036 0	12	−0.032 −0.102	5	±0.200	16	±0.140	2	±0.200		B-F8-195※
		10.8	0 −0.110			12	±0.200				
8	+0.022 0	12	−0.032 −0.102	6	±0.200	16	±0.140	2	±0.200		B-F8-112※
		10.8	0 −0.110								
8	+0.036 0	12	−0.032 −0.102	8	±0.200	16	±0.140	2	±0.100		B-F8-101※
		10.8	0 −0.110								
8	+0.036 0	12	−0.032 −0.102	12	±0.200	16	±0.200	2	±0.100		B-F8-116※
		10.8	0 −0.110								
8	+0.036 0	12	−0.032 −0.102	14	±0.200	16	±0.140	2	±0.200		B-F8-56※
		10.8	0 −0.110								
8	+0.050 +0.020	12	−0.020 −0.050	7	±0.150	14	±0.100	2	±0.100		B-F8-245※
		11	−0.020 −0.050			13	−0.020 −0.050				
8	+0.036 0	12	0 −0.100	10	±0.100	15	±0.100	2	±0.100		B-F8-152※
		11	0 −0.100								
8	+0.025 +0.005	12	−0.020 −0.050	21.4	0 −0.200	14	±0.100	2.4	0 −0.200		B-F8-161※
		11	0 −0.100			13	±0.200				
8	+0.040 +0.025	12.5	0 −0.100	6	±0.100	19	±0.100	2	±0.100		B-F8-60
8	+0.015 0	12.5	+0.100 0	12	±0.150	25	±0.150	3	+0.100 0		B-F8-62
8	+0.022 +0.010	13	+0.046 +0.028	5	±0.100	18	±0.100	2.8	0 −0.100		B-F8-296
8	+0.017 0	13	+0.041 +0.023	6	±0.100	16	±0.150	2	±0.100		B-F8-221
8	+0.015 0	13	0 −0.027	10	±0.150	27	±0.150	3	±0.100		B-F8-66
8	+0.035 +0.013	13	+0.041 +0.023	11	±0.150	17	±0.100	2	±0.100		B-F8-67
8	+0.050 +0.030	13	+0.050 +0.030	12	±0.100	15	±0.100	3	±0.100		B-F8-68
8	+0.017 0	13	+0.041 +0.023	12	±0.100	16	±0.150	2	±0.100		B-F8-69
8	+0.050 +0.010	13	−0.010 −0.050	7	±0.150	16	±0.100	1.5	±0.100		B-F8-123※
		10	+0.100 −0.050								
8	+0.050 +0.010	13	−0.010 −0.050	9.5	±0.150	16	±0.100	1.5	±0.100		B-F8-65※
		10	+0.100 −0.050								
8	+0.030 0	13	−0.020 −0.050	8	±0.150	14	±0.100	2	±0.150		B-F8-270※
		11	±0.050 −0.150								

Note: Items indicated with an asterisk (*) have a special shape. Please contact **NTN** for details.
Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

d 8～10mm

Dimensions mm											Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness			
ϕd		ϕD		ℓ		ϕF		t			
8	+0.017 0	13	+0.041 +0.023	5	±0.100	16	±0.150	2	±0.100		B-F8-64※
		12	0 −0.100								
8	+0.040 0	13	−0.020 −0.040	12	±0.200	16	±0.200	2	±0.100		B-F8-171※
		12	0 −0.100			14					
8	+0.020 0	14	−0.032 −0.075	4	±0.300	15.6	±0.100	0.8	0 −0.200		B-F8-305
8	+0.036 0	14	−0.032 −0.075	4	±0.150	18	±0.200	1	±0.300		B-F8-74
8	+0.015 0	14	+0.046 +0.028	5.2	±0.100	17	±0.100	2	±0.100		B-F8-226
8	+0.020 0	14	−0.005 −0.025	5.4	0 −0.100	16	±0.150	2	±0.100		B-F8-1092K※
						15	±0.050				
8	+0.020 0	14	−0.005 −0.025	6	0 −0.100	16	±0.150	2	±0.100		B-F8-78※
						15	±0.050				
8	+0.020 0	14	0 −0.020	10	±0.100	18	±0.100	2	±0.200		B-F8-153
8	+0.020 0	14	0 −0.030	3.7	0 −0.100	16	−0.100 −0.300	2	±0.080		B-F8-1038K※
		12.5	0 −0.100								
8	+0.020 0	14	0 −0.030	4	±0.100	16	−0.100 −0.300	2	±0.080		B-F8-177※
		12.5	0 −0.100								
8	+0.040 +0.025	14	+0.046 +0.028	7	±0.100	16	±0.100	2	0 −0.100		B-F8-141※
		13.4	−0.020 −0.070			14.4					
8	+0.015 0	15	0 −0.018	8	±0.100	20	±0.100	3	0 −0.100		B-F8-88※
		12	−0.050 −0.200								
8	+0.058 0	16	−0.010 −0.050	6	±0.100	18	0 −0.200	2	0 −0.100		B-F8-234
8	+0.020 0	16	0 −0.030	7	±0.100	20	±0.200	2	±0.100		B-F8-1016HB
8	+0.028 +0.005	16	+0.046 +0.028	17	±0.100	22	±0.100	2	±0.100		B-F8-169
9	+0.040 +0.020	12	+0.041 +0.023	8	±0.100	16	±0.200	2	0 −0.100		B-F9-1002
9	+0.040 +0.020	12	+0.026 +0.006	10.5	±0.100	14	±0.200	1.5	±0.100		B-F9-2
9	+0.025 0	17	0 −0.025	7	±0.100	20	±0.100	2	±0.200		B-F9-4
10	+0.015 0	13	+0.046 +0.028	5.7	±0.100	14	±0.100	1	±0.100		B-F10-117
10	+0.025 +0.010	13	+0.040 +0.020	11	0 −0.100	14	−0.100 −0.200	2.8	0 −0.100		B-F10-93
10	+0.030 +0.010	13	−0.032 −0.075	14	±0.150	16	±0.100	1.5	±0.100		B-F10-106
10	+0.030 +0.010	13	−0.032 −0.075	16	±0.100	16	±0.100	1.5	±0.100		B-F10-107※
						14.5	±0.200				
10	+0.036 0	14	0 −0.110	4	±0.300	16	±0.400	2	±0.150		B-F10-3
10	+0.015 0	14	+0.046 +0.028	5	±0.100	18	±0.100	2	±0.100		B-F10-7

Flange Bearings

d 10mm

Dimensions mm										Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness		
ϕd		ϕD		ℓ		ϕF		t		
10	+0.020 +0.005	14	+0.046 +0.028	5	±0.100	19	±0.150	2	±0.100	**B-F10-1048**
10	+0.020 +0.005	14	+0.046 +0.028	5	±0.100	19	±0.150	2	±0.100	**B-F10-87**
10	+0.015 0	14	+0.046 +0.028	6	±0.100	18	±0.100	2	±0.100	**B-F10-72**
10	+0.045 +0.030	14	+0.050 +0.032	6	±0.100	18	±0.200	2	±0.100	**B-F10-96**
10	+0.050 +0.020	14	0 −0.050	7	±0.150	18	±0.100	2	±0.100	**B-F10-10**
10	+0.040 +0.025	14	+0.046 +0.028	7.5	±0.150	18	±0.100	2	±0.100	**B-F10-11**
10	+0.015 0	14	+0.046 +0.028	8	±0.100	18	±0.100	2	±0.200	**B-F10-113**
10	+0.055 +0.040	14	+0.046 +0.028	8	±0.100	18	±0.100	2	±0.100	**B-F10-12**
10	+0.015 0	14	+0.046 +0.028	10	±0.100	18	±0.100	2	±0.100	**B-F10-15**
10	+0.050 +0.020	14	0 −0.050	10	0 −0.300	18	±0.150	2	0 −0.100	**B-F10-17※**
10	+0.030 +0.010	14	0 −0.050	10	0 −0.300	18 16.5	±0.200 ±0.200	2	+0.100 0	**B-F10-69※**
10	+0.055 +0.040	14	+0.046 +0.028	12	±0.220	18	±0.140	2	±0.200	**B-F10-23**
10	+0.015 0	14	+0.046 +0.028	16	±0.100	18	±0.100	2	±0.100	**B-F10-26**
10	+0.015 0	14	+0.046 +0.028	18	±0.200	18	±0.100	2	±0.100	**B-F10-70**
10	+0.036 +0.016	14 12	0 −0.043 0 −0.200	7	±0.200	17 12	±0.200 0 −0.200	1.5	±0.200	**B-F10-9※**
10	+0.036 0	14 12.8	−0.032 −0.102 0 −0.110	4	±0.200	18	±0.140	2	±0.200	**B-F10-63※**
10	+0.036 0	14 12.8	−0.032 −0.102 0 −0.110	6	±0.200	18	±0.140	2	±0.200	**B-F10-131K※**
10	+0.036 0	14 12.8	−0.032 −0.102 0 −0.110	8	±0.200	18	±0.140	2	±0.200	**B-F10-60※**
10	+0.015 0	15	+0.046 +0.028	6.5	±0.100	18	±0.100	2	±0.100	**B-F10-28**
10	+0.035 +0.013	15	+0.041 +0.023	10	±0.100	18	±0.100	2	±0.100	**B-F10-30**
10	+0.020 0	15	+0.050 +0.030	13	±0.100	18	±0.100	2.5	±0.100	**B-F10-32**
10	+0.035 +0.013	15	+0.041 +0.023	15	±0.100	18	±0.100	2	±0.100	**B-F10-80**
10	+0.036 0	15 14	−0.016 −0.043 0 −0.100	5.5	±0.150	20	±0.150	2.5	±0.150	**B-F10-67※**
10	+0.035 +0.013	15 14	+0.041 +0.023 0 −0.100	6	0 −0.100	18	±0.100	2	±0.100	**B-F10-1026K※**
10	+0.040 +0.025	16	+0.041 +0.023	6	±0.100	22	±0.100	3	±0.100	**B-F10-37**
10	+0.040 +0.020	16	0 −0.027	9	±0.100	20	±0.100	1.5	±0.200	**B-F10-38**

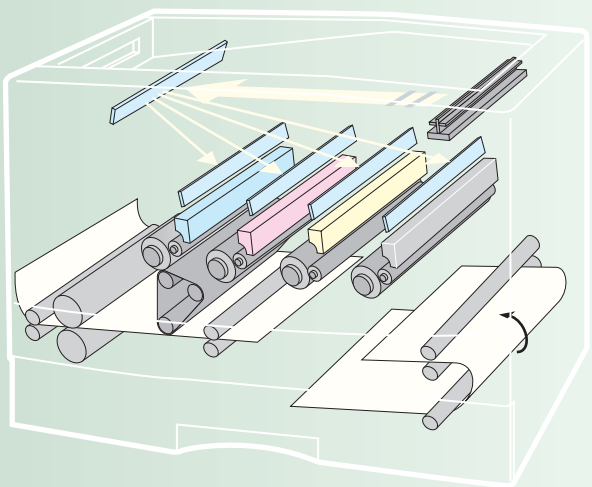
Note: Items indicated with an asterisk (*) have a special shape. Please contact **NTN** for details.
Please contact **NTN** with regard to the type of oil.
The material is copper based (H).

d 10mm

Dimensions mm										Product code
Bore		Outer diameter		Length		Flange outer diameter		Flange thickness		
ϕd		ϕD		ℓ		ϕF		t		
10	+0.055 +0.040	16	+0.046 +0.028	10	±0.180	22	±0.170	3	±0.200	**B-F10-54**
10	+0.020 +0.005	16	+0.025 +0.005	12	+0.300 −0.100	19	±0.150	2	+0.100 −0.200	**B-F10-40**
10	+0.090 +0.070	16	+0.040 0	12	±0.100	19	+0.040 0	2	±0.100	**B-F10-41**
10	+0.023 +0.015	16	+0.036 +0.018	15	±0.100	19	±0.200	5	±0.100	**B-F10-73**
10	+0.040 +0.025	16	+0.041 +0.023	16	±0.100	22	±0.100	3	±0.100	**B-F10-42**
10	+0.015 0	16	+0.046 +0.028	16	±0.150	22	±0.200	3	±0.100	**B-F10-65**
10	+0.040 +0.025	16	+0.041 +0.023	17	±0.150	22	±0.150	3	±0.100	**B-F10-44**
10	+0.015 0	16	+0.046 +0.028	20	±0.150	22	±0.150	3	±0.100	**B-F10-45**
10	+0.070 +0.050	16 15	+0.025 +0.005 0 −0.150	6	±0.200	19	±0.100	2	±0.100	**B-F10-36※**
10	+0.040 +0.020	18 16	0 −0.020 0 −0.100	5	±0.100	22	±0.300	1.5	±0.050	**B-F10-103※**
10	+0.020 +0.005	22 20.5	−0.030 −0.055 0 −0.100	11.6	±0.100	26	±0.100	2	±0.100	**B-F10-111※**

Ⅳ Torque Limiters

1. Torque Limiter Units (NTS Type) ·····47
2. Torque Limiter Units (NTB 14 Type) ·····49



1. Torque Limiter Units (NTS Type)

1.1 Structure and torque generating mechanism

The **NTN** torque limiter unit (NTS type) is made up of an inner ring, coil spring, external resin part and lid.

When the torque that acts between the inner ring and external resin parts is small, the inner ring and external part move together. When the torque increases, the mechanism is designed to rotate relatively while maintaining a certain level of torque.

The principle behind the generating of the torque is the use of the tensioning force that the coil spring applies to the inner ring. The tensioning force controls the rotational torque in the direction of the generated torque.

As the internal construction in **Figure 1** shows, there is a difference in diameter in the coil spring. The small diameter section is connected to the torque generating section and the larger diameter section is connected to the torque adjustment section.

The torque is set when the lid rotates relative to the external resin part and the large diameter section is twisted. The force of the twisting reduces the diameter of the small diameter section, so that tensioning force is applied to the inner ring.

Therefore, even if the contact state of the small diameter section spring inner diameter and inner ring external diameter changes, the twisting force stored in the large diameter section automatically corrects this, so that stable torque is generated for a long period.

Note that this **NTN** torque limiter unit (NTS type) cannot be used in the reverse direction of the direction the torque is generated.

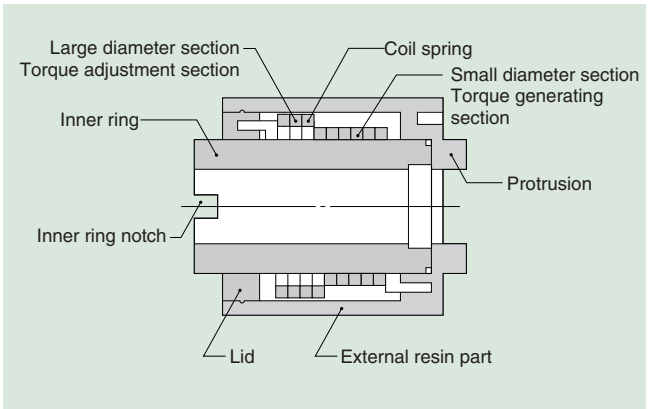


Fig. 1 Internal construction

Table 1 Component Parts and Materials

Component parts	Materials	
	NTS16B	**NTS18D**
External resin part	POM	
Lid	POM	
Coil spring	Spring steel	
Inner ring	Sintered iron	
Lubricant	Chemical attack preventing oil (Impregnated in the inner ring)	

1.2 Standard Shape

The standard shape of the **NTN** torque limiter unit (NTS type) is shown in **Figure 2**. **Table 2** shows the dimensions of the various sections and the torque settings. Please contact **NTN** for inquiries about shapes other than the standard shapes.

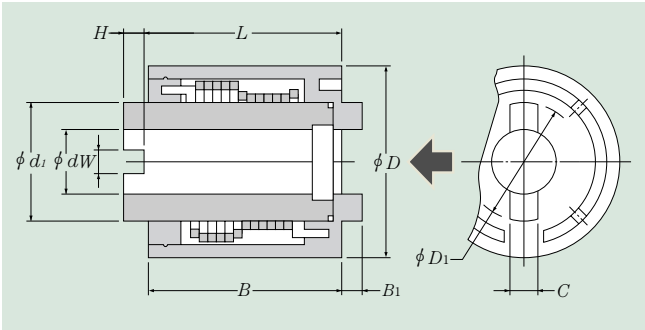


Fig. 2 Standard Shape

Table 2 Dimensions and Torque Settings

Model code	**NTN** standard shape dimensions mm										Torque settings mN·m{gf·cm}
	D	B	d	d_1	B_1	C	D_1	W	H	L	
NTS16B	16	18	6	9	1.9	2.9	11	2.1	2	18.3	9.8～19.6 {100～200}
NTS18D	18	18	6	11	1.9	2.9	11	2.1	2.5	18.3	19.6～49.0 {200～500}

1) The torque setting may be limited by the operating conditions (rotational speed, temperature, etc.).
2) The minimum dimensions of the external resin part are D and B in **Table 2**. We can also handle dimensions other than these.
3) Rotational direction and identification
The **NTN** torque limiter unit (NTS type) only generates torque in one direction. The direction of the rotation can be identified by the color of the external resin part on the torque limiter. **Table 3** indicates the direction of the rotation and the identification method (color).
When ordering this part, be sure to add R or L to the product code.

Table 3 Identifying the Rotational Direction (Example: NTS18DR)

Product code	Rotational direction※	Identification method (color)
NTS16B or NTS18D	Clockwise rotation (R type)	External resin part: Black
		Lid: Black
	Counterclockwise rotation (L type)	External resin part: Grey
		Lid: Grey

※The direction of rotation is determined in the following way: Viewing the unit from the direction of the arrow in **Figure 2**, with the inner ring is fixed, turning the external resin part clockwise (right rotation) is the R type, and turning it counterclockwise (left rotation) is the L type.

4) See **Figure 3** for the usable range of the **NTN** torque limiter unit (NTS type). Please contact **NTN** for inquiries about using this product outside its usable range.

1.3 Guidelines for usable ranges

Based on the results of operation tests conducted using the **NTN** durability testing machine, the usable range of the **NTN** torque limiter unit (NTS type) is as indicated in Figure 3. In addition, Figure 4 shows a typical example of durability test results.

Please consider these usable ranges as guidelines only. Please contact **NTN** for inquiries about using this product outside its usable range.

(Test conditions and judgment conditions)

- Operating cycle: 2 seconds ON, 0.2 seconds OFF
- Operating time: 1000 hours
- Judgment method: Judged when the generated torque is within ±15% of the initial setting value.

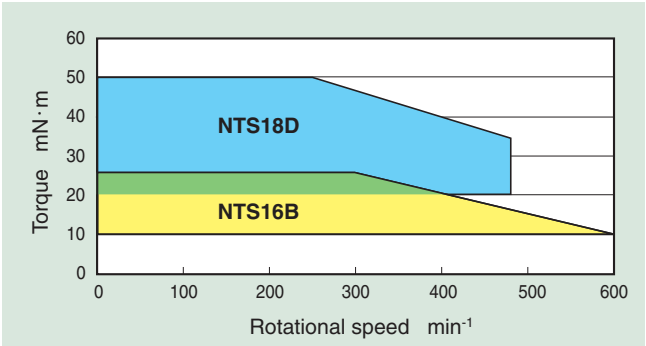


Fig. 3 Guidelines for the Usable Range

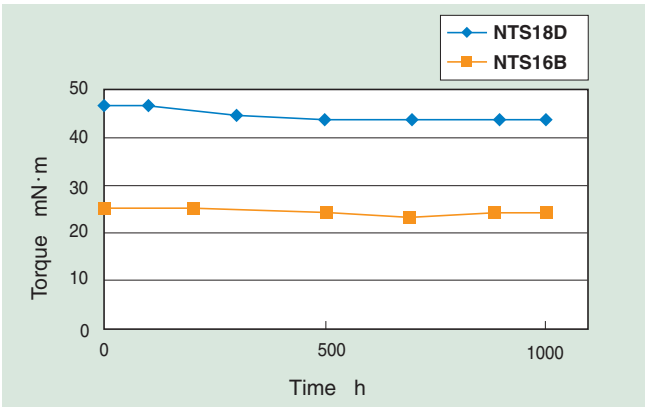


Fig. 4 Typical Example of Durability Test Results

1.4 Usage precautions

1) Rotational direction (Cannot be rotated in the locking direction)

The torque generating spring is connected to the external resin part with a hook. If the unit is rotated in the locking direction, the spring may be damaged. (**Fig. 5**)

2) Installation

If a radial load is applied from the outside, there may be a fluctuation in torque. Therefore, we recommend studying the method in **Figure 6** when installing the torque limiter.

When inserting a shaft into the torque limiter from the direction of the arrow in **Figure 7**, inserting the shaft at an angle may push the inner ring out.

3) Other precautions

- Do not pull the inner ring out in the axial direction.
- Do not drop the torque limiter or subject to other impact.
- The **NTN** torque limiter unit (NTS type) has an inner ring impregnated with lubricant. Therefore, do not let the inner ring of the torque limiter come into contact with paper, cloth or other material.

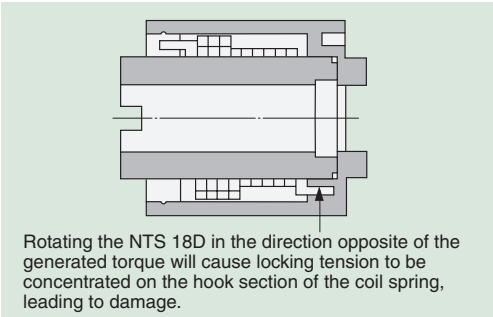


Fig. 5 Coil Spring Damage Caused by Rotating the Wrong Way

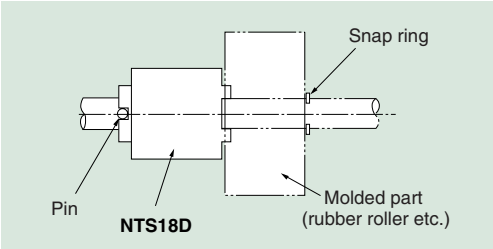


Fig. 6 Installation Example

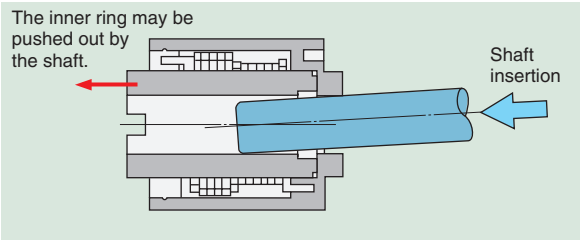


Fig. 7 Shaft Installation

1.5 Necessary conditions in manufacturing

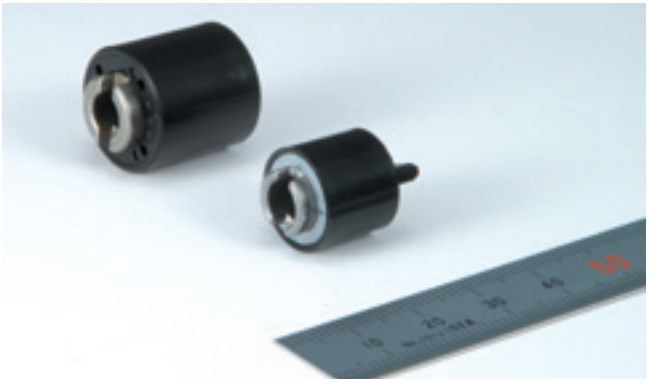
Table 4 shows the necessary items for manufacturing the **NTN** torque limiter unit (NTS type).

Table 4 Necessary Items for Manufacturing

Necessary items	Description
Shape	Possible to use with the standard **NTN** shape. If a shape other than the standard shape is required, be sure to submit the desired shape. Be sure to inform us of the required torque and torque tolerance.
Torque setting and tolerance	The torque tolerance is ±15% of the standard torque requirement. Please contact **NTN** and inquire about values lower than this.
Torque generating direction	Be sure to indicate the R or L type.
Rotational speed	Please inform us of the rotational speed during torque limiter operation (when slipping occurs). The torque setting is determined by the rotational speed to be used. However, for rotational speeds under 50 min^{-1}, the torque setting will always be set for 50 min^{-1}.
Operating cycle	Please inform us of the operating cycle (ON time, OFF time).
Service life	Please inform us of the required service life. In general, the service life is 1,000 hours (2 seconds ON, 0.2 second OFF).
Operating temperature	Please inform us of the ambient operating temperature. The operating temperature guidelines for the NTS type is -10˚C to 50˚C. Please contact **NTN** and inquire if outside the temperature range (guidelines).

2. Torque Limiter Units (NTB 14 Type)

Structural product dimensions of ϕ14×12 have been achieved. (External resin part)
This will help to reduce the space usage in devices.



Comparison of the NTS 18D and NTB 14
(Left: NTS 18D; Right: NTB 14 Type)

2.1 Features

1) Small (NTS 18 type: ϕ18×18 mm→NTB 14 type: ϕ14 ×12 mm)
The external diameter and length of the external resin part are smaller than those of the **NTN** torque limiter unit (NTS type). By making this unit smaller, it can now be used as part of paper feeding rubber rollers.

2) Bidirectional rotation
A new design allows rotation in both directions. This will simplify removal of paper when there are paper jams.

2.2 Durability

A typical example of durability test results is shown in **Figure 1.**
We have confirmed that the performance is equivalent to conventional units. (At 300 hours)

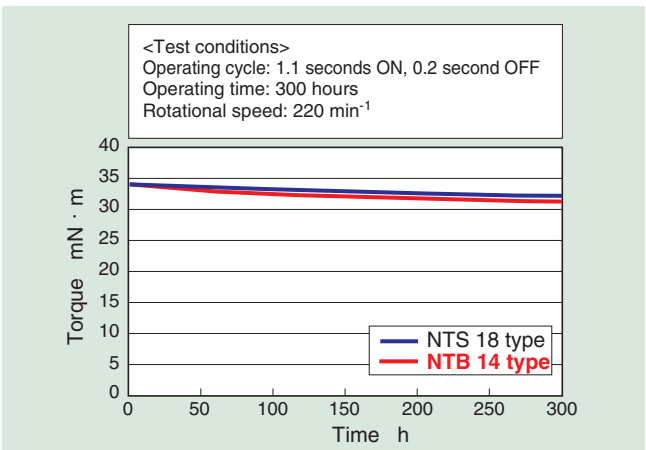


Fig. 1 Typical Example of Durability Test Results

2.3 Standard shape

Figure 2 shows the standard shape of the **NTN** torque limiter unit (NTB 14 type). **NTN** can also make non-standard shapes.

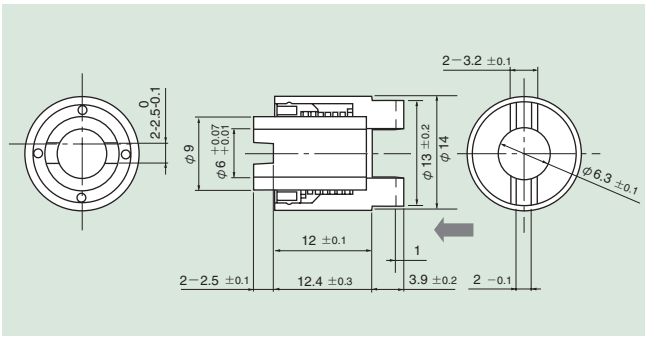


Fig. 2 Standard Shape of the NTB 14 Type

1) Product code of the standard shape: NTB14-1
2) Torque setting: 24.5–39.2 mN·m {250–400 gf·cm}
3) **Table 1** shows the component parts and materials.

Table 1 Component Parts and Materials

Component parts	Materials used
	NTB14
External resin part	POM (color: black)
Lid	POM (color: white)
Coil spring	Spring steel
Inner ring	Sintered iron
Lubricant	Chemical attack preventing oil (Impregnated in the inner ring)

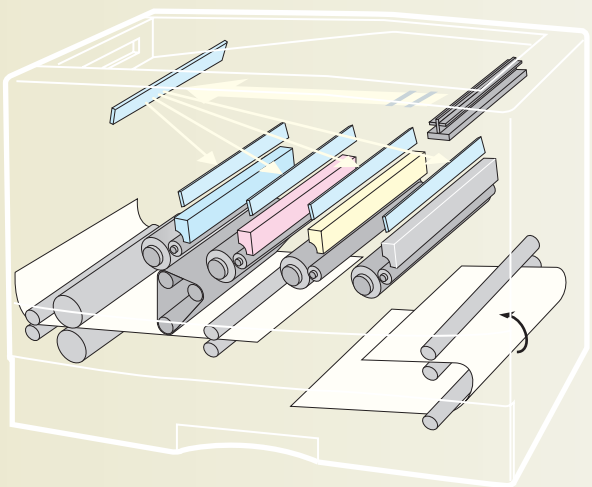
4) The direction of rotation is determined in the following way: Viewing the unit from the direction of the arrow in **Figure 2**, with the inner ring being fixed, turning the external resin part clockwise (right rotation) is the R type, and turning it counter-clockwise (left rotation) is the L type.
When ordering this part, be sure to add R or L to the product code.
Example: NTB14-1R

2.4 Handling of Torque Limiter Unit

1) The inner ring must remain assembled with the unit at all times.
2) The Torque Limiter Unit is not able to accept shock loads or drop impacts.
3) The inner ring of NTB 14 type is impregnated with lubricant. Therefore, the inner ring should not be allowed to contact paper, cloth, or other material that may wick the lubricant away.

V Clutches

1. NTN One-way Clutch ····· 51
2. One-way Clutch Unit Specifications ····· 55
3. Technical Data ····· 55
4. One-way Clutch ····· 56
5. One-way Clutch Units ····· 60
6. Torque Diodes ····· 62
7. Introduction to Products Being Developed ····· 64



1. NTN One-way Clutch

1.1 Features of the one-way clutch

The one-way clutch only drives in one direction and is idle in the other direction. The drive and idle directions can be switched.
NTN has a wide variety of one-way clutches to meet various needs.

●Stable idle rotation

Because the force of the spring that holds the roller is adjusted accurately, roller movement is slight when idle, so that the idle torque is stable.
Please contact **NTN** if the required idle rotation is fast.

●Cross section height is small and the unit is compact

The HF and HFL types have thin external rings made of steel plate that has been made by precision extrusion. This has allowed these shell type one-way clutches to have a low cross section height and compact design.

●Simple handling

The one-way clutch series has the clutches press fit tightly into the housing inner diameter, so that there is no need for a fixing device in the axial direction. In addition, torque can be transmitted with this fit alone, thus making handling simple.

●No need for a radial load bearing (excluding the HF type)

Because radial load bearings are built into both sides of the clutch unit (HFL type: needle roller with cage; NHF type: oil-impregnated bearing), external radial load bearings are not needed.

●Excellent clutch accuracy

Each roller is precisely supported by a spring and they are fabricated with high precision so that they always engage together, thereby achieving excellent clutch accuracy. The delay angle that exists until rotational torque is completely transmitted includes both the sliding angle and the displacement angle that is created by the elastic deformation of the contact section between the rollers, shaft and external ring. This value will differ depending on the size of the clutch and load torque, but the average value of the delay angle up to the torque capacity (listed in the Dimensions Table) is 3 degrees or less. (Based on **NTN** measurements.)

HF type

HFL type

NHF type

1.2 Features of the one-way clutch unit

●Compact design possible by using units

This product is comprised of a unit that includes external parts and the one-way clutch. The NCZC type and NCUX type have an even smaller width and allow effective use of space, so that the overall design can be made even more compact.

●Resin external parts that can be made to the designated shape

The gears, pulleys, rubber roller receptacles and other external parts are made of resin, and can be made in various shapes and dimensions per your requirements.

●High degree of freedom concerning the selection of shafts used

The clutch functions satisfactorily even if the shaft tolerance is large. In addition, shafts can be made from a wide variety of steels. (However, if a soft material is used, the torque capacity will decrease.)

●Can be used at high temperatures

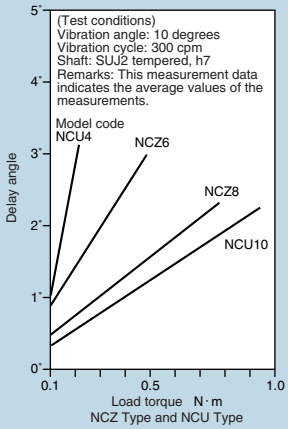
The NCZ type does not use any resin parts in the clutch interior. Therefore, it can be used in high temperature conditions (140˚C or less). (However, please consult with **NTN** if the part is to be used at 100˚C or more.)

NCU type

NCZ type

Delay angle

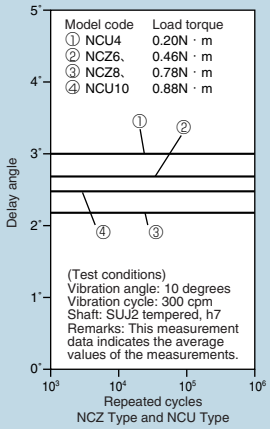
The delay angle refers to the difference ($\theta_i - \theta_o$) between the input shaft rotational angle (θ_i) and output shaft rotational angle (θ_o). The delay angles of NTN one-way clutch units differ depending on the type and the torque that is applied to the one-way clutches. The figure below shows the general trend. (Based on **NTN** measure ments.)



Relations between Load Torque and Delay Angle

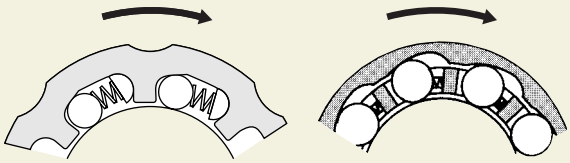
Service life

Even when torque is applied up to the torque capacity in **NTN** one-way clutch units and the units are engaged over one million times, we have confirmed that there is little change in the delay angle. (Based on **NTN** measurements.)



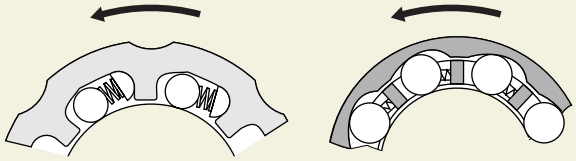
Changes in Delay Angle Caused by Repeated Operation

1.3 Operating mechanism



Clutch engaged

When the outer ring tries to turn clockwise with respect to the shaft, the spring is activated and the rollers advance to the engagement position of the outer ring cam surface, then the wedge action between the outer ring cam surface and shaft drives the shaft.



Clutch idle

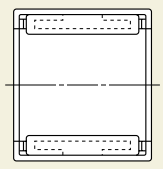
When the outer ring turns counterclockwise with respect to the shaft, the shaft turns clockwise with respect to the outer ring, so that the rollers are released from the outer ring cam surface and the outer ring is disengaged from the shaft.

1.4 Types and construction

NTN one-way clutches

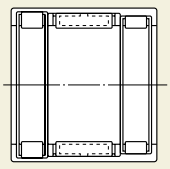
One-way clutches

HF type
Partially INA products



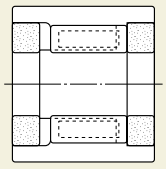
The clutch unit is made up of a needle roller, cage and spring. The outer ring is a shell shape that is made by precision extrusion of thin steel plate.
As a radial load, use **NTN** BEARPHITE oil-impregnated bearings or shell shaped needle roller bearings.

HFL type
Partially INA products



The HF type has needle rollers with cages built into both sides for radial loads.

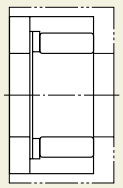
NHF type



The clutch unit is made up of a needle roller, cage and spring. The outer ring is a solid unit with **NTN** BEARPHITE oil-impregnated bearings built into both sides for radial loads.

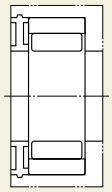
One-way clutch units

NCU type



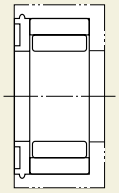
The main unit is made up of an outer ring, lid, roller, cage and spring. The outside has resin external parts including a gear, pulley and roller receptacle to make up the unit.

NCZ type



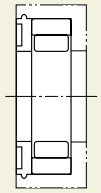
The main unit is made up of an outer ring with cage, lid, roller and steel single piece ring spring. The outside has resin external parts including a gear, pulley and roller receptacle to make up the unit.

NCZC type



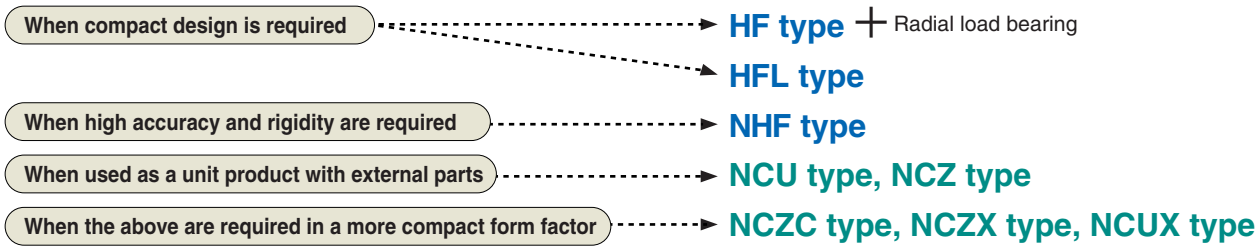
The outer diameter dimension has been made as small as possible to reduce the amount of space needed in the outer diameter direction. The outside has resin external parts including a gear, pulley and roller receptacle to make up the unit.

NCZX type
NCUX type



The width has been made as small as possible in order to cope with the need for smaller units. The outside has resin external parts including a gear, pulley and roller receptacle to make up the unit.

1.5 Selection guidelines



■Lubrication

Oil lubrication is best for these one-way clutches, but, in general, grease lubrication is usually used. **NTN** one-way clutches are filled with suitable grease, so that they can be installed immediately. In general use there is no need to resupply grease; however, if grease is resupplied, note that too much grease can interfere with clutch operation. Please consult with **NTN** for the type of lubricant to use.

■Allowable operating temperature

HF type、HFL type ···· Oil lubricant : −10～120˚C
Grease lubricant : −10～ 70˚C
NHF type ····· −10～100˚C
NCU type、NCUX type ····· −10～100˚C
NCZ type、NCZC type、NCZX type ····· −10～140˚C

Please consult with **NTN** when using these units outside their allowable operating temperatures or when using the NCZ type at over 100˚C.

■Engagement direction

●HF type, HFL type, NHF type

The NHF type has an arrow (→) on the outer diameter surface or oil-impregnated bearing edge, and the HF type and HFL type have arrows on the outer ring sides. Turning the outer ring in the direction of the arrow will engage the clutch.

●NCU type, NCZ type, NCZC type, NCZX type, NCUX type

Turning the external resin part in the direction of the arrow (→) on the side of the external resin part will engage the clutch.

■Selection precautions

NTN checks the functions of its one-way clutches under many different test conditions. However, the service life may be reduced if they are used with heavy load torques, high oscillation cycles or minute oscillations, if the shaft is not hard, and if a large radial load acts on the one-way clutch unit.
In addition, if the idling rotational speed is high or the clutch is used often in idle, there is a possibility that lock problems might occur.

Please consult with **NTN** when using these units under these special conditions.

■Shaft and housing (HF type, HFL type, NHF type) /external resin parts (NCU type, NCZ type, NCZC type, NCZX type, NCUX type) specifications

Type		One-way clutch			One-way clutch unit		
		HF type	HFL type	NHF type	NCU type	NCZ type, NCZC type	NCZX type, NCUX type
Shaft	Material	Tempered steel, case hardened steel (Hardness HRC58–64; effective depth 0.4 mm or greater for carburizing)			Carbon steel, stainless steel, tempered steel, case hardened steel (Surface hardness if tempered: HRC50 or greater)		
	Dimensions Tolerance	h5(h6)		h7	NCU4 ···h9 NCU10···h10	NCZ6、8 } ···h9 NCZC6、8 }	NCZX6、8···h9 NCUX4·····h8
	Cylindricality	One-half of tolerance		One-half of tolerance	One-half of tolerance		
	Roughness	0.2a（Ra）		0.4a（Ra）	0.3～1.6a（Ra）		
Housing (HF type, HFL type, NHF type) External resin part (NCU type, NCUX type, NCZ type, NCZC type, NCZX type)	Material	Steel, cast iron, light metal alloys			Standard: Polyacetal resin (They can also be made of oil-impregnated polyacetal resin and PBT resin.)		
	Bore Tolerance	Steel, cast iron: N6 (N7) Light metal alloy: R6 (R7)			———		
	Cylindricality	One-half of tolerance		One-half of tolerance	———		
	Roughness	1.6a		1.6a	———		
	Wall-thickness	Steel, cast iron: 0.75 ($D-F_w$) or greater Light metal alloy: 1.5 ($D-F_w$) or greater (See the dimensions table for the $D-F_w$ dimension)		———	———		
Remarks		———			Gear accuracy: Grade 6 is the standard for JGMA engagement accuracy.		

Remark 1) Round off the tip of the shaft to facilitate insertion into the one-way clutch. (Minimum 0.3 mm)

1.6 Installation precautions

Use of a press-fitting mandrel as shown in the figure is convenient for installing a one-way clutch. **When installing an HF type or HFL type, be sure that the side with the mark comes into contact with the mandrel when press fitting. In addition, when installing the NHF type, be sure to press fit the outer ring and use a jig to avoid pressing the oil-impregnated bearing section.**

Precautions for assembly include not twisting the outer ring, not directly striking the outer ring with a hammer, and using an appropriate jig on the outer ring side when press fitting.

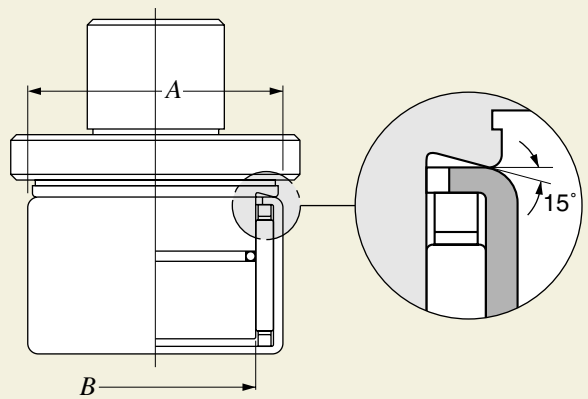
When assembling in a press for mass production, using a mandrel with an O-ring as shown in the figure will prevent the one-way clutch from falling off and facilitate insertion.

The dimensions of the mandrel are shown below.

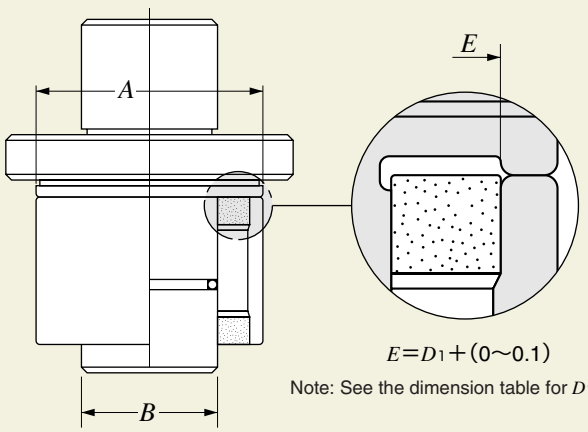
$A = D - (0.2 \text{ to } 0.3)$ mm (in the case of NHF, A is greater than D)
$B = d$ or $F_W - (0 \text{ to } 0.025)$ mm
D : Outer diameter of the one-way clutch, mm
d : Bore of the oil-impregnated bearing, mm
F_W: Inscribed circle diameter of the roller, mm
(See the dimensions table)

Shaft assembly can be facilitated by turning the shaft in the direction that the clutch is disengaged.

If the shaft cannot be turned during installation, installation can be facilitated by attaching a tapered guide (chamfered) to the end of the shaft.

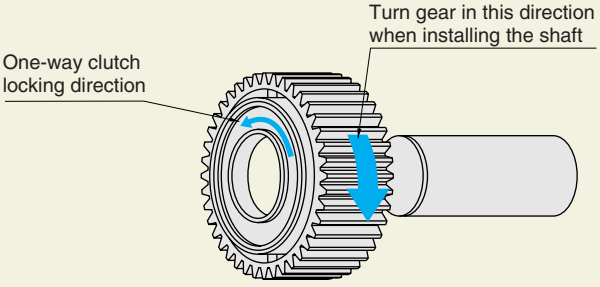


HF type, HFL type



NHF type

When installing or removing the one-way clutch or one-way clutch unit, turn the gear in the direction of the arrow in the figure (idle direction) to prevent damaging the shaft.



1.7 Handling of One Way Clutch

The One Way Clutch is not able to accept shock loads or drop impacts.

2. One-way Clutch Unit Specifications

2.1 Name codes

NCZ □ □ □ - □□

① ② ③ ④ ⑤

① Type code: NCZ type, NCZX type, NCZC type, NCU type, NCUX type

② Shaft diameter

③ Lubrication code: See the table below

Lubrication code	Type of lubricant	Operating temperature guidelines
None	Standard grease (sealed)	~100˚C
D	Chemical attack preventing lubricating oil (oil-impregnated)	~100˚C
A	High temperature grease or lubricant oil (oil-impregnated)	100~140˚C

④ Resin part shape codes: C: cam; G: gear; P: pulley; R: roller; Z: other

⑤ Additional numbers

* Only standard grease is used for lubricating NCU type and NCUX type.

2.2 Resin materials used

The resin materials that have been used are listed.

Operating temperature guidelines	Resin material	Grade (UL fire resistant)	
~100˚C	POM (Duracon) Polyplastics	General purpose	M90-44, M90S (UL94HB)
		Easy sliding	NW-02 (UL94HB)
	POM (Tenac) Asahi Kasei Chemicals	General purpose	LA543 (UL94HB)
100˚C~	PPS (Fortron) Polyplastics	Unfilled	0220A9 (UL94VO) ···Reference

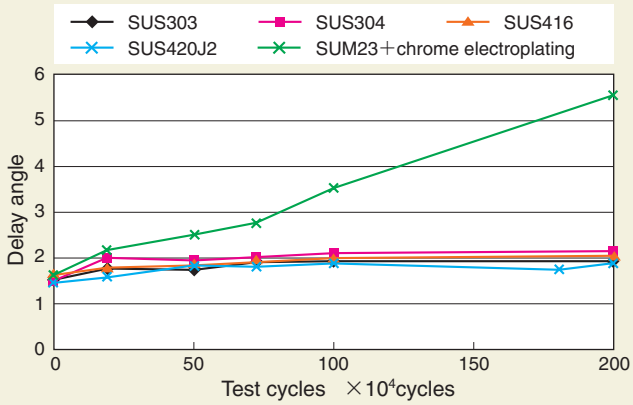
1) We can also use any other designated material, so please consult with **NTN**.
2) We will provide the resin part shapes that are designated.
3) If the lid must not be easily removable and requires rotational strength, it is sometimes impossible to achieve this because of operating temperatures, the resin materials used, and wall thickness, so please consult with **NTN**.

3. Technical Data

3.1 Durability test results for various shaft materials

The shafts used for office equipment are usually non-tempered shafts. The durability test results for non-tempered shafts are shown.

(Test conditions)
Test clutch : NCZ6
Load torque : 0.49N · m {5kg · fcm}
Oscillation cycle: : 300cpm
Oscillation angle : 10 degrees
Temperature : Room temperature
Shaft used : Non-tempered



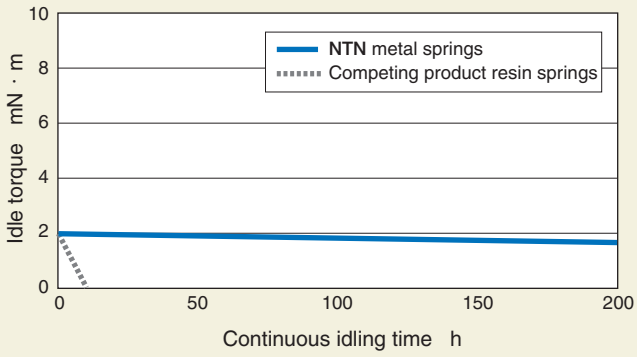
If the shaft is made from stainless steel (SUS), we have confirmed durability for over a million cycles even if non-tempered. Conversely, SUM + electroplating shafts can lead to lock defects even if the electroplating surface is hard because the electroplating can be damaged and the soft main material is exposed to wear.

These test results are from **NTN** bench tests, and differ from actual operating conditions. Therefore, if non-tempered shafts are to be used, please consult with **NTN**.

3.2 Continuous idling rotation durability test results

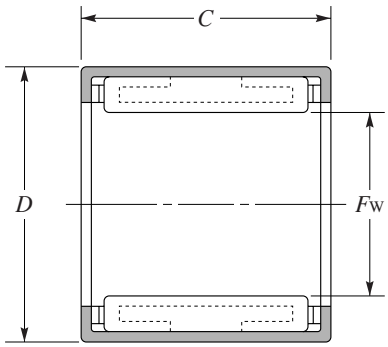
If the units are to be used mostly in idle, reduction in the spring force to push the roller can lead to lock defects. The **NTN** NCZ type uses metal springs, so that lock reliability is better than for competing products that use resin springs.

(Test conditions)
Test clutch : NCZ6 (NTN)
Competing products with resin springs
Radial load : 4.9N {500gf}
Idle rotational speed : 700min^{-1}
Temperature : Room temperature



4. One-way Clutch

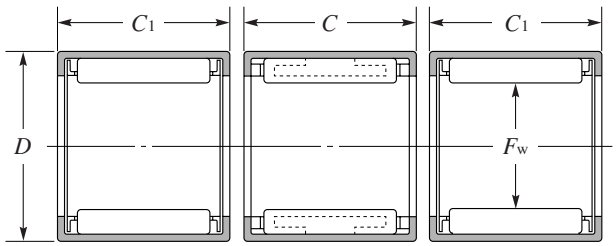
HF type



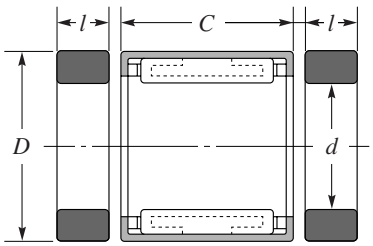
Shaft diameter mm	Name code	Dimensions mm			Torque capacity N·m {kgf·cm}	Mass g (Reference)
		F_w	D	$C\ {}^{0}_{-0.25}$		
6	**HF0612**	6	10	12	1.76 { 18}	2.7
8	**HF0812**	8	12	12	3.15 { 32}	3.4
10	**HF1012**	10	14	12	5.3 { 54}	4.0
12	**HF1216**	12	18	16	12.2 { 124}	12
14	**HF1416**	14	20	16	17.3 { 176}	13
16	**HF1616**	16	22	16	20.5 { 209}	15
18	**HF1816**	18	24	16	24.1 { 246}	16
20	**HF2016**	20	26	16	28.5 { 291}	18
25	**HF2520**	25	32	20	66 { 673}	31
30	**HF3020**	30	37	20	90 { 918}	36
35	**HF3520**	35	42	20	121 {1230}	41

HF type Radial load bearing

Select by referring to the bearings in the table below.



NTN shell-shaped needle roller bearing (HK type)



NTN BEARPHITE oil-impregnated bearing

Shaft diameter mm	One-way clutch name code	**NTN** shell-shaped needle roller bearing (HK type) ❶						**NTN** BEARPHITE oil-impregnated ❷			
		Name code	Dimensions mm			Basic rated load N {kgf}		Name code	Dimensions mm		
			F_w	D	C_1	C_r	C_{or}		d	D	l
6	**HF0612**	**HK0609T2**	6	10	9	2 660 {272}	2 280 {233}	**B-S6-22**	6	10	5
8	**HF0812**	**HK0810C**	8	12	10	3 850 {395}	3 950 {400}	**B-S8-25**	8	12	5
10	**HF1012**	**HK1010** **HK1012**	10	14	10 12	4 500 {460} 5 900 {605}	5 100 {520} 7 250 {735}	**B-S10-21**	10	14	5
12	**HF1216**	**HK1212**	12	18	12	6 600 {675}	7 300 {745}	**B-S12-32**	12	18	5
14	**HF1416**	**HK1412** **HK1416**	14	20	12 16	7 200 {735} 10 700 {1090}	8 500 {865} 14 000 {1430}	**B-S14-13**	14	20	5
16	**HF1616**	**HK1612** **HK1616**	16	22	12 16	7 750 {795} 11 100 {1130}	9 700 {990} 15 300 {1560}	**B-S16-13**	16	22	8
18	**HF1816**	**HK1812** **HK1816**	18	24	12 16	8 300 {845} 11 800 {1210}	10 900 {1110} 17 300 {1760}	**B-S18-8**	18	24	8
20	**HF2016**	**HK2012C** **HK2016** **HK2020C**	20	26	12 16 20	9 250 {945} 13 000 {1320} 16 400 {1670}	13 000 {1330} 20 100 {2050} 27 100 {2760}	**B-S20-19**	20	26	10
25	**HF2520**	**HK2512** **HK2516** **HK2520**	25	32	12 16 20	11 800 {1200} 15 900 {1620} 20 300 {2070}	16 300 {1660} 24 000 {2450} 33 000 {3350}	**B-S25-11**	25	32	10
30	**HF3020**	**HK3012** **HK3016** **HK3020**	30	37	12 16 20	13 000 {1320} 18 100 {1850} 22 300 {2280}	19 500 {1990} 30 000 {3050} 39 500 {4000}	**B-S30-19**	30	37	10
35	**HF3520**	**HK3512** **HK3516** **HK3520**	35	42	12 16 20	14 000 {1430} 19 700 {2000} 24 800 {2530}	22 800 {2320} 35 000 {3600} 47 500 {4850}	**B-S35-7**	35	42	10

❶**NTN** shell-shaped needle roller bearings include the closed end type (BK type) in addition to the open end type (HK type) listed above.

In addition, there are HK and BK types with seals (single seal or double seal).

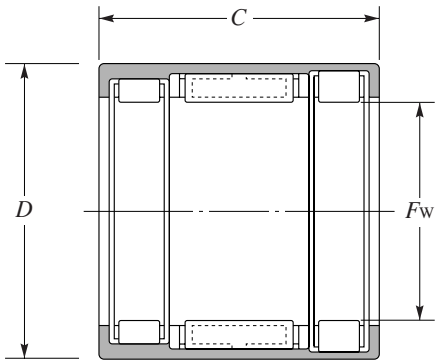
Refer to Cat. No. 2300 “Needle Roller Bearings” for the features and assembly guidelines for shell-shaped needle roller bearings.

❷**NTN** BEARPHITE oil-impregnated bearings are designed for an ideal radial clearance with the housing and shaft tolerances recommended on page 53.

If the width l of the **NTN** BEARPHITE oil-impregnated bearing is a problem due to the available space, please consult with **NTN**.

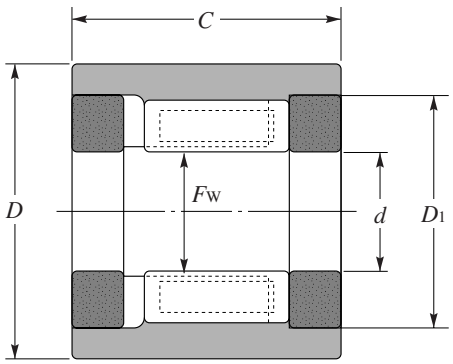
Refer to Cat. No. 5202 “BEARPHITE Oil-impregnated Bearings” for the features, loads, rotational speeds and installation dimensions of oil-impregnated bearing.

HFL type



Shaft diameter mm	Name code	Dimensions mm			Torque capacity N·m {kgf·cm}	Basic rated load N {kgf}		Mass g (Reference)
		F_w	D	$C\ {}^{0}_{-0.25}$		C_r	C_{or}	
8	HFL0822	8	12	22	3.15 {32}	4 050 {413}	4 150 {423}	6.3
10	HFL1022	10	14	22	5.30 {54}	4 300 {438}	4 650 {474}	7.4
12	HFL1226	12	18	26	12.20 {124}	6 300 {642}	6 500 {663}	18
14	HFL1426	14	20	26	17.30 {176}	7 100 {724}	7 700 {785}	20
16	HFL1626	16	22	26	20.50 {209}	7 300 {744}	8 400 {857}	22
18	HFL1826	18	24	26	24.10 {246}	8 300 {846}	10 300 {1050}	24
20	HFL2026	20	26	26	28.50 {291}	8 200 {836}	10 400 {1060}	27
25	HFL2530	25	32	30	66.00 {673}	10 900 {1110}	14 100 {1440}	44
30	HFL3030	30	37	30	90.00 {918}	12 600 {1280}	17 600 {1790}	51
35	HFL3530	35	42	30	121.00 {1230}	13 000 {1330}	19 300 {1970}	58

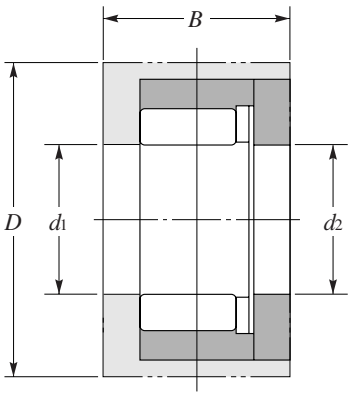
NHF type



Shaft diameter mm F_w	Name code	Dimensions mm d	$D\ ^{+0.020}_{0}$	(D_1)	$C\ ^{0}_{-0.200}$	Torque capacity N·m {kgf·cm}	Mass g (Reference)
4	**NHF04**	4 $^{+0.050}_{+0.020}$	10	8.4	9	0.29 { 3}	3.4
6	**NHF06**	6 $^{+0.055}_{+0.020}$	12	10.4	10	0.69 { 7}	4.7
8	**NHF08**	8 $^{+0.055}_{+0.020}$	16	13.5	13	2.06 {21}	11
10	**NHF10**	10 $^{+0.060}_{+0.020}$	18	15.5	14	3.14 {32}	14
12	**NHF12**	12 $^{+0.065}_{+0.020}$	20	17.5	15	4.61 {47}	18

5. One-way Clutch Units

NCU type, NCZ type, NCZC type (Standard Width Models)

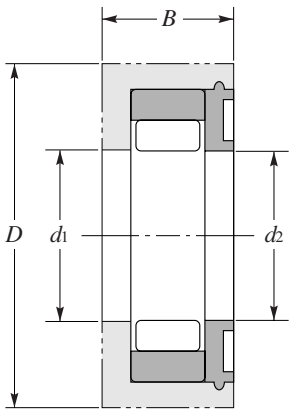


Shaft diameter mm	Name code	Dimensions mm d_1	d_2	D	B	Torque capacity ❶ N·m {kgf·cm}	Idling torque ❷ mN·m {gf·cm}
4	**NCU 4**	$4^{+0.10}_{+0.02}$	$4^{+0.10}_{+0.02}$	12 min	9 min	0.20 {2}	2.94 {30}
6	**NCZ 6**	$6^{+0.10}_{+0.02}$	$6^{+0.12}_{+0.02}$	13.5 min	8 min	0.49 {5}	3.43 {35}
	NCZC 6			13 min	8 min	0.20 {2}	3.43 {35}
8	**NCZ 8**	$8^{+0.10}_{+0.02}$	$8^{+0.10}_{+0.02}$	16 min	8 min	0.78 {8}	4.90 {50}
10	**NCU10**	$10^{+0.10}_{+0.02}$	$10^{+0.10}_{+0.02}$	20 min	10 min	0.88 {9}	4.90 {50}

❶The torque capacity is based on the **NTN** standard test conditions.
❷Idling torque is the value when radial torque is not applied.

Oscillation angle: 10 degrees
Oscillation cycle: 300 cpm, 10^6 times
Shaft used: SUJ2, tempered
Dimension tolerance: h7

NCZX type, NCUX type (Narrow Width Products))



Shaft diameter mm	Name code	Dimensions mm				Torque capacity ❶ N·m {kgf·cm}	Idling torque ❷ mN·m {gf·cm}
		d_1	d_2	D	B		
4	**NCUX 4**	4 $^{+0.10}_{+0.02}$	4 $^{+0.10}_{+0.02}$	11.5 min	5 min	0.10 {1}	2.94 {30}
6	**NCZX 6**	6 $^{+0.10}_{+0.02}$	6 $^{+0.12}_{+0.02}$	13.5 min	5 min	0.20 {2}	3.43 {35}
8	**NCZX 8**	8 $^{+0.10}_{+0.02}$	8 $^{+0.10}_{+0.20}$	16 min	5 min	0.34 {3.5}	3.92 {40}

❶The torque capacity is based on the **NTN** standard test conditions.
❷Idling torque is the value when radial torque is not applied.

Oscillation angle: 10 degrees
Oscillation cycle: 300 cpm, 10^6 times
Shaft used: SUJ2, tempered
Dimension tolerance: h7

6. Torque Diodes

- **If the input shaft is rotated, the output shaft also rotates.**
- **The output shaft cannot cause the input shaft to rotate.**

The following is a description of the free type and lock type, their features and their operating principles.

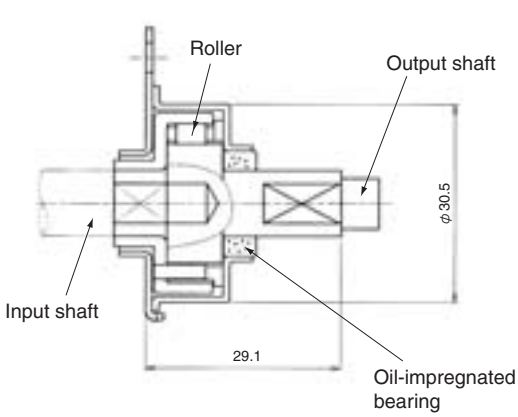
6.1 Free type torque diode (TDF)

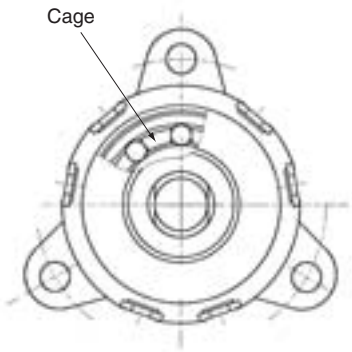
6.1.1 Features

- **When the input shaft is rotated, the output shaft also rotates.**
- **When the output shaft is rotated, it will rotate freely, but the movement is not transmitted to the input shaft.**

6.1.2 Construction

TDF18





6.1.3 Operating principle

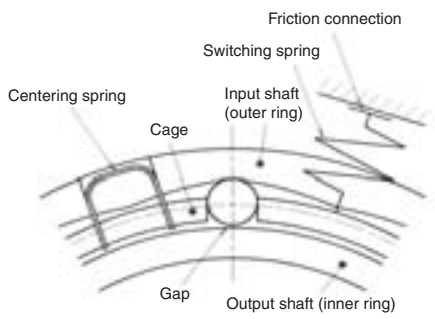


Fig. 1 Initial State (Free Forward/Reverse Rotation)

If there is no drive from the input shaft, the centering spring causes the roller to position itself at the center of the outer ring cam surface. Because there is a gap between the roller and inner ring, they are not locked and the output shaft is free to rotate.

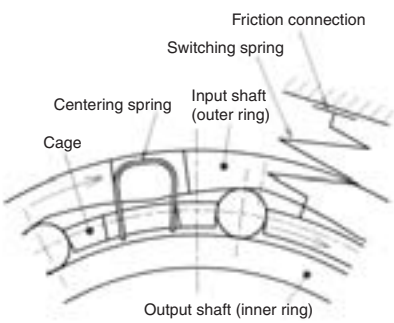


Fig. 2 Input/Output Shafts Locked

When the input shaft is rotated, the resistance from the switching spring causes the roller to lock with the inner and outer rings, and rotation is transmitted to the output shaft.

6.1.4 Technical data

TDF18 specification
Allowed load torque: 4.9 N·m {50kgf·cm}

6.1.5 Uses

Devices to prevent reverse input, automatic/manual switching mechanisms, geared motors, etc.

Do not use these bearings in areas where they may have impact on personal safety.

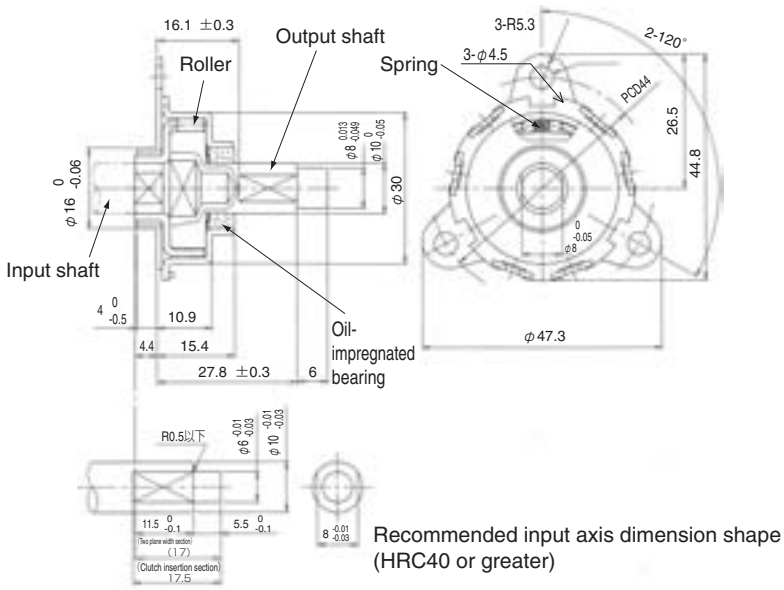
6.2 Lock type torque diode (TDL)

6.2.1 Features

- **When the input shaft is rotated, the output shaft also rotates.**
- **If the output shaft is rotated, the output side is locked and movement is not transmitted to the input shaft.**

6.2.2 Construction

TDL28



6.2.3 Operating principle

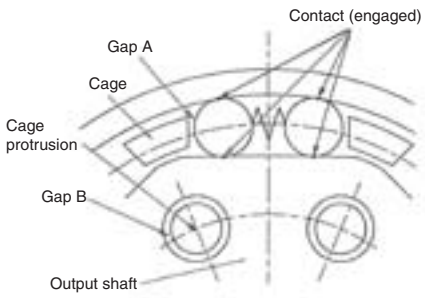


Fig. 1 Initial State (Forward/Reverse Locked)

Unless there is drive from the input shaft, the roller locks the output shaft in both forward and reverse.

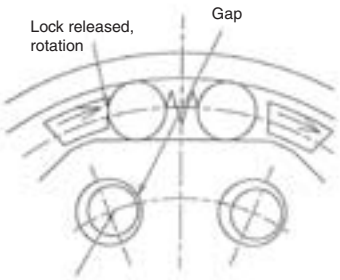


Fig. 2 Cage Rotation (Engagement Released)

When the input shaft (connected to the cage) is turned, the cage kicks out the roller from the cam side and releases the lock.

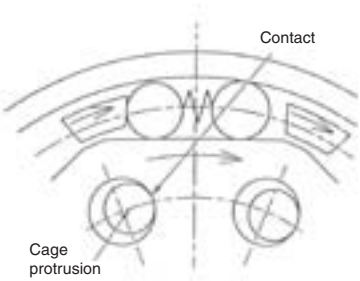


Fig. 3 Output Shaft Rotation

The cage rotates further, and the cage protrusion comes into contact with the output shaft hole, thereby turning the output shaft.

6.2.4 Technical data

TDL28 specification
Allowed load torque: 4.9 N·m {50kgf·cm}

6.2.5 Uses

Devices to prevent reverse input, drop-off preventing mechanism, geared motors, etc.

Do not use these bearings in areas where they may have impact on personal safety.

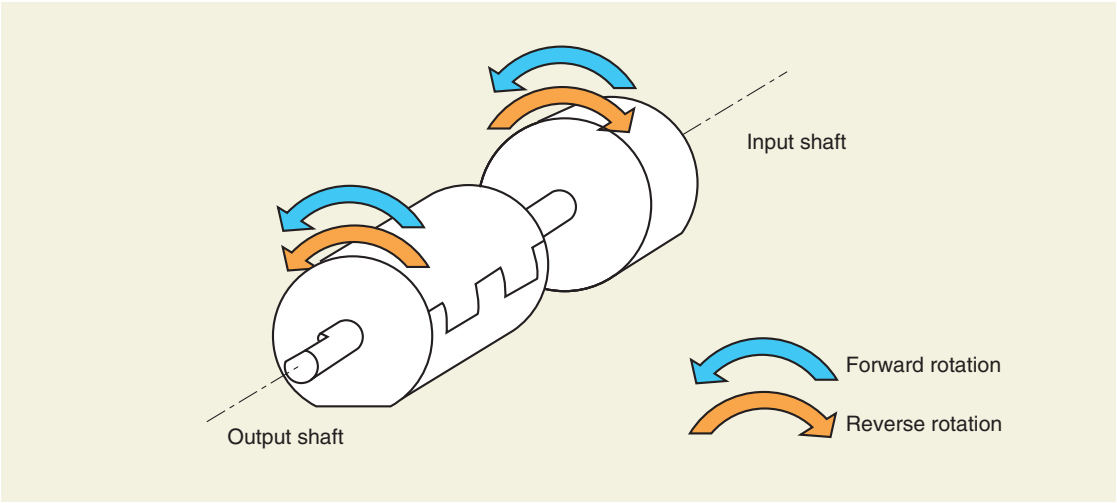
7. Introduction to Products Being Developed-1

Single-direction Rotation Conversion Unit: Mono Drive

Regardless of the rotational direction of the input shaft, the output shaft only rotates in one direction.

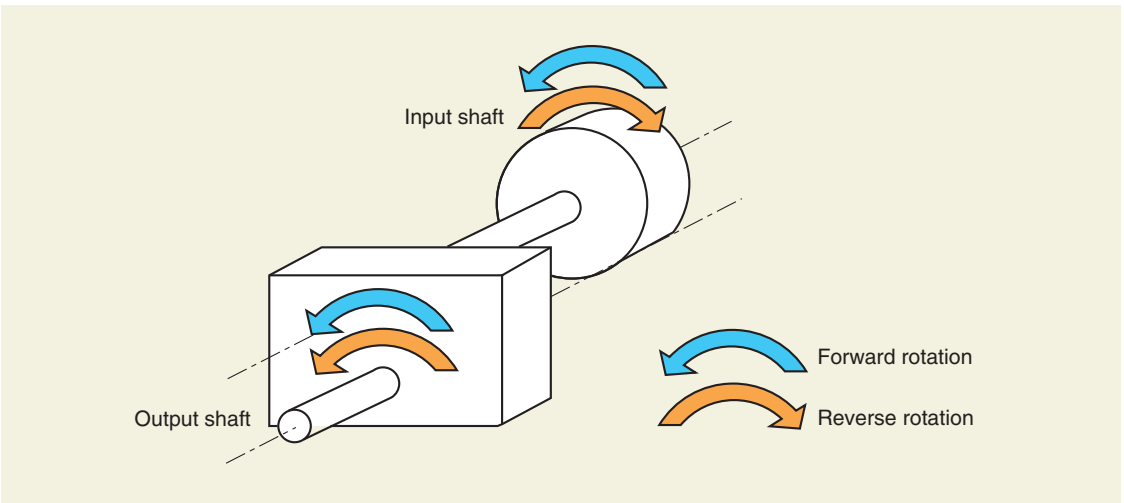
Single shaft type

The input and output shafts are coaxial. Torque capacity: 0.20–0.49 N·m {2～5kgf·cm}



Double shaft type

The input and output shafts are not coaxial. Torque capacity: 0.49 N·m {5kgf·cm}



7. Introduction to Products Being Developed-2

Ultra Small One-way Clutch

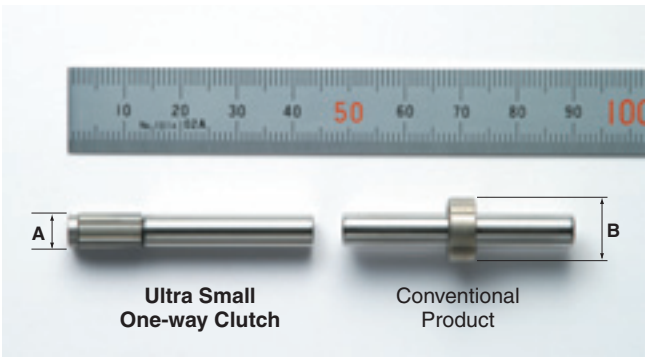
A compact design that combines a one-way clutch and shaft.

Overview

A totally new concept in which a one-way clutch mechanism is built into the shaft. This unit has reduced the size of the unit to about the same as that of a shaft alone.

Compared with conventional models in which one-way clutches are inserted into shafts, the external dimensions have been reduced to 50% (A/B = 0.5), making it practical to use this in hinge units and the like where space is at a premium.

Appearance



Features

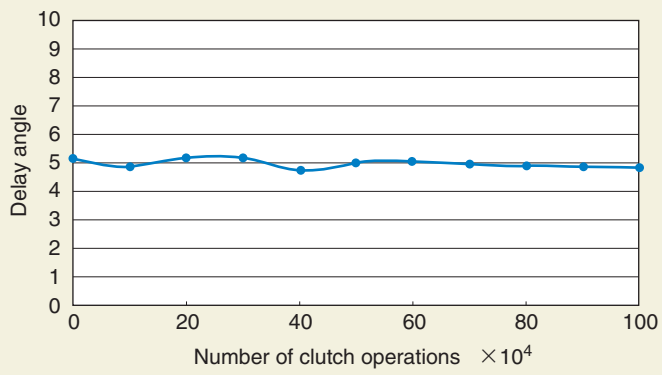
(1) Ultra compact:
An outer diameter of 6 mm realized for the first time in the world. With a 0.2 N·m {2 kgf·cm} unit, the external dimension has been reduced 50% (A/B = 0.5). (**NTN** data)

(2) Reliable lock mechanism:
Highly reliable lock function assured with a roller clutch mechanism using the wedge effect.

(3) Improved assembly:
A protrusion has been added to the outer diameter of the clutch, so that the resin molded parts will stop sliding and fit perfectly.

(4) Extremely durable

Durability test results



(Test conditions)

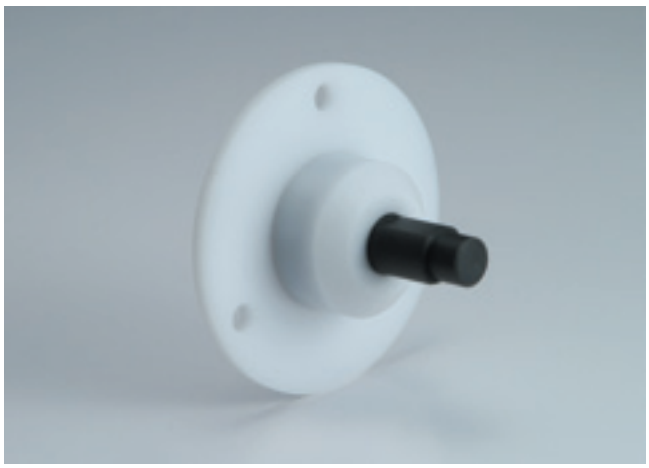
Test cycles: 50 cpm
Load torque: 0.2 N·m {2 kgf·cm}
Durability cycles: One million cycles

7. Introduction to Products Being Developed-3

Compact and Lightweight Torque Diode (Lock Type/TDL16)

Features of the compact and lightweight torque diode (lock type)

- When the input shaft of a torque diode (lock type) is rotated, the output shaft also rotates in both directions, but the output shaft has a function that does not allow it to rotate in both directions. Currently, we supply the TDL28 for this type of use. We have developed the TDL16 which is 80% smaller than the TDL28 (when compared at the outer diameter) and 50% lighter.



Performance

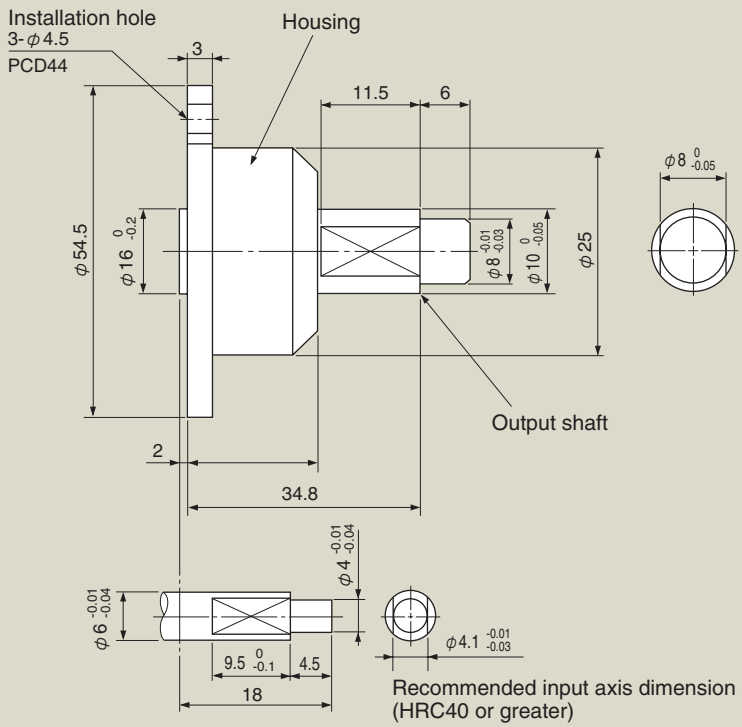
- Allowed load torque: 2.45N・m {25kgf・cm} (The service life will differ depending on the operating rotational speed and continuous operating time.)
  Weight: 35 g (for the shape below)

Usage

- Sorter tray drives
- ADF drives
- Protective mechanismst

※ **Do not use these bearings in areas where personal safety depends on them.**

Dimensions



The housing dimensions and shape can be changed. Please contact **NTN** in such cases.

Catalogs for Office Equipment Related Products

The "**NTN** General Office Equipment Product Catalog" lists products mainly for photocopiers and printers. The following **NTN** product catalogs are available for these products. Please ask your nearest **NTN** branch office or sales office for these catalogs.

Catalog	Catalog No.
●Ball and Roller bearings	
Ball and Roller Bearings	2202/E
Ball Bearing / Shield and Seal Types	3015/E
Miniature and Extra Small Ball Bearings	3013/E
Integrated Rotation Sensor Bearings	3032/E
Bearings for Special Environments / Ultra Final Series	3023/E
Ultra Final Series / Bearings for Clean Environment	3028/E
●Slide Bearings	
BEAREE (High Performance Multi-Purpose Engineering Plastics)	5100/E
Plastic Sliding Screws	5112/E
BEARPHITE Oil-impregnated Sintered Bearings	5202/JE
●Needle Bearings	
Needle Roller Bearings	2300/E
HK-F Type Drawn Cup Needle Roller Bearings	3029/JE
Cam Followers & Roller Followers	3604/JE
●Other	
New Products Guide	9208/E
Bearing Handling	9103/E
Care and Maintenance of Bearings	3017/E
●Handbooks	
Rolling Bearings Handbook	9012/E
Needle Roller Bearings Handbook	9013/E

Remarks: The catalog numbers listed here are the basic numbers. Revision numbers (-II, III, etc.) shall be added to these when there are revisions