

NTN®

HAND

**BEARING UNITS
HANDBOOK**



**HAND
BOOK**

CAT. No. 9011-III/E

The wide variety of NTN Bearing Units



Essentially a double sealed ball bearing installed in a special housing, an NTN Bearing Unit is available in a wide variety of configurations. The spherical fit of the insert bearing O. D. and housing I. D. allows the bearing to compensate for misalignment. Selected units offer NTN's unique ball point set screw, which provides a reliable lock even when exposed to vibration or shock loads.



Stainless Steel Series bearing unit

Reliable corrosion resistance and lubrication retention.

meet the demands of many industries



Ductile Series bearing unit

Tough bearing housings that are light and compact.



Plastic Series bearing unit

Corrosion, water, and chemical resistance.



Steel Series bearing unit

Tough bearing housings with superior mechanical strength.

NTN

Bearing Unit Handbook

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Technical Data

1. Construction and Features of NTN Bearing Units

Essentially a double sealed ball bearing installed in a special housing, an NTN Bearing Unit is available in a wide variety of configurations. The spherical fit of the insert bearing O. D. and housing I. D. allows the bearing to compensate for misalignment.

NTN's unique ball-point set screws for select bearing units reliably lock the bearing units to the shaft even when they are subjected to vibration or impact loads.

NTN bearing units are highly functional, easy to install and can be mounted in a variety of ways. These features and options

are summarized on pages 28 and 29.

The typical bearing housings for NTN bearing units are made of cast iron or steel plate. Cast iron housings are standard. For special purposes, the housings can be supplied in spheroidal graphite cast iron, structural rolled steel, cast stainless steel or resin.

For further details on NTN Bearing Units, refer to the separate catalog "Bearing Units."

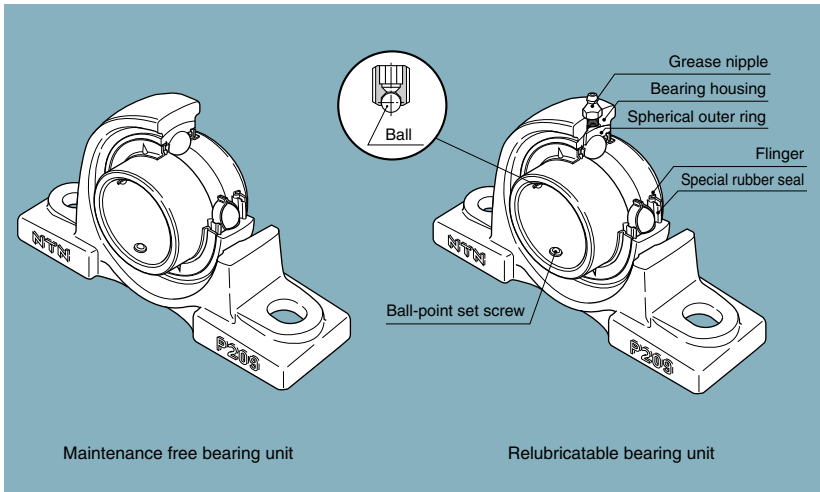


Fig.1.1 Cutaway of Bearing Unit

■ Bearing Unit with Dust Cover

NTN offers bearing units with external dust covers. Available either in pressed steel or cast iron, the dust cover and sealing mechanism provide extra protection for the bearing unit in heavily contaminated environments. Bearing units with dust covers can withstand the most severe environments in flour milling, steel making, casting, plating, and chemical plant applications where heavy dust and moisture are present. These units can also be used on outdoor equipment, such as construction and transport machinery.

The rubber seal in the dust cover has two lips that contact a shaft, as shown in **Fig.1.2 and 1.3**. The grease between the two lips not only enhances sealing performance but also lubricates the contacting faces of the lips to the shaft. The seal lips reliably follow the shaft in the radial direction, even when the shaft is slanted.

When using the bearing unit in a location where it is subjected to splashing water rather than dust, provide a water drain hole (5 to 8 mm) at the lower side of the cover, and apply grease to the ball bearing side face, instead of filling the cover with grease.

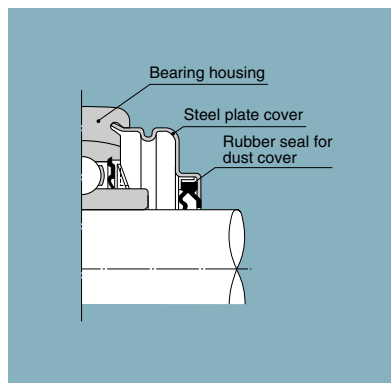


Fig.1.2 Steel plate covered bearing unit

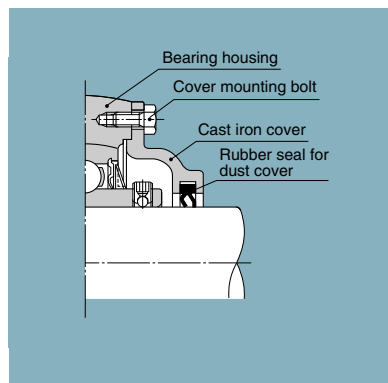


Fig.1.3 Cast iron covered bearing unit

For details on mounting dust covers, refer to pages 45 and 46.

2. Unique Features (Advantages) of NTN Bearing Units

POINT
WORD



**Reliable
installation**

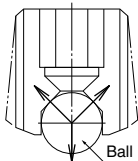
2.1 Hard-to-loosen ball-point set screws

1) Ball-point set screw features

To secure the bearing to the shaft, ball-point set screws are used. An exclusive NTN design, the ball-point set screw has a hardened steel ball at the end of the set screw that reliably locks the bearing to the shaft, even when subjected to vibrations or impact loads.

The major advantages of the ball-point set screw are as follows.

- Reduced fretting corrosion at the tip of the set screw – The hardened steel ball point set screw significantly reduces fretting corrosion. Other kinds cause fretting as they are softer.
- Difficult to work loose – Upon tightening, the steel ball is squeezed back into the tapered portion of the set screw, causing the threads to spread. This expansion of the threads makes it extremely difficult for the set screw to loosen when exposed to vibration and / or shock loads.



- Can be reused repeatedly – the hardened steel ball does not deform when tightened where conventional set screw tips are deformed once they are tightened.

2) Accelerated loosening test for various set screws

2-1) Test procedure

A UC205 bearing was rotated at the speed of $1,750 \text{ min}^{-1}$. Then, it was vibrated via a decagonal cam at 10,000 cycles/min, while a load of 400 kgf was exerted on the bearing. During this procedure, we recorded the amount of time until each set screw became loose, and then compared the results.

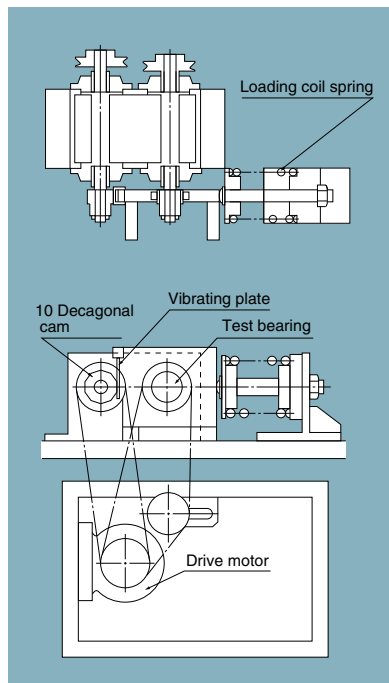
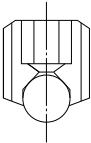
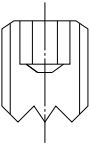
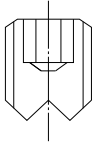
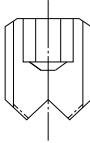


Fig.2.1 Testing equipment for accelerated loosening test

2-2) Test results (number of samples $n = 2$)

Type of set screw	Ball-point	Double-point	Cup-point	Knurled cup point
Manufacturer	NTN	Company A and B	Company C	Company D
Shape				
Tightening torque	40kgf · cm	70kgf · cm	55kgf · cm	40kgf · cm
Loosening occurs after	91 hours	66 hours	12 hours	3 hours

[Conclusion]

The time taken until loosening was longest for ball-point set screws; up to approximately 30 times that of knurled cup point set screws (the tightening torque of the ball-point set screws was same as that of knurled cup point set screws). The loosening time for double-point and cup-point set screws was rather short (respectively 0.7 and 0.1 times that of ball-point set screw), in spite of larger tightening torque values that were respectively 1.8 and 1.4 times that of the ball-point set screws. All tightening torques are based on the "recommended tightening torque for set screws" for the respective manufacturers.

2.2 Prevention of inner ring deformation and cracking due to over-tightening of set screws

One might think that fastening set screws tighter would prevent loosening. However, over-tightening of set screws leads to a heart-shaped deformation of the inner ring circumference, as shown in **Fig.2.2** below. At the same time, the inner ring becomes similarly deformed and the internal clearance gradually gets smaller, eventually

leading to bearing failure. Thus, it is recommended that set screws be fastened at the appropriate torque. To prevent the inner ring from cracking due to over-tightening of set screws, some models are induction-annealed (For details on installation of set-screw bearing units, refer to page 41).

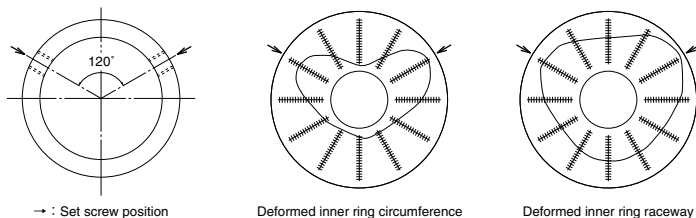


Fig.2.2

POINT
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Reliable sealing performance

2.3 Protrusions on flinger to expel dust

1) NTN bearings have a double-sealing construction that comprises an oil-resistant rubber seal and a flinger. The flinger is fixed on the inner ring, and has four triangular ribs on it. When the inner ring runs at high speed, the ribs blow off dust, serving as a splash guard. They also enhance the flinger rigidity, and prevent the flinger from displacing even when the bearing unit is subjected to vibration or impact loads. The double sealing construction boasts a sealing performance that is much more reliable than standard seals, since the ingress path for dust is long, and because excess grease, which overflows between the seal and the flinger when the bearing is commissioned, serves as a seal.

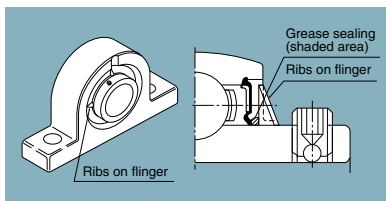


Fig.2.3 Flinger

2) Results of dust-proofing test with various seals

2-1) Test procedure

An hourglass-shaped drum containing dust (activated alumina) was rotated at 50 min^{-1} . The main shaft was then rotated at $1,750 \text{ min}^{-1}$, while a load of 25 kgf was applied to test bearings fitted on both sides of the

drum. We recorded the normal running time of the bearings until they were finally jammed due to excessive accumulated dust inside, and compared the results.

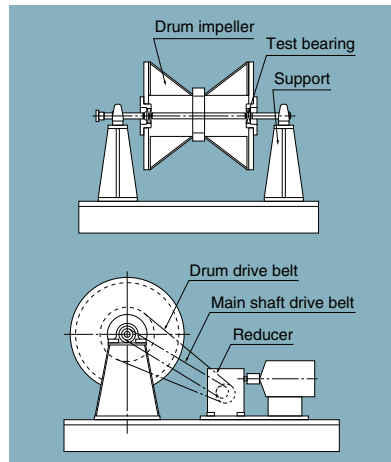


Fig.2.4 Test equipment

2-2) Dust-proofing test results (number of samples $n = 6$)

Bearing	Normal running time	Bearing	Normal running time
UC205	1,308h	UC205U	69h
6205LLU	133h	AEL205	53h
JEL205	668h	AS205	32h

A) Dust-proofing performance of UC205 is 9.8 times as good as that of the 6205LLU.

B) JEL205 was specifically developed for agricultural machinery. NTN JEL201 through JEL212 are accepted in large quantities by John Deere Co[®], the world's leading agricultural machinery manufacturer. The dust-proofing performance of JEL205 is 5 times greater than the 6205LLU.

2.4 Oil inlet angle for larger alignment tolerances



- 1) The oil inlet of the UC type bearing is provided on the outer ring at an inclination of approx. 10° . Thus, the oil groove in the bearing housing can be located near the center of the bearing. Therefore, the resultant tolerance for alignment is as large as $\pm 2^\circ$, as shown in **Fig. A** (in a case of narrower outer ring type, $\pm 1^\circ$). Since the oil inlets of other manufacturers' bearing units are oriented vertically, the oil groove is inevitably located near the end face of the bearing housing, as shown in **Fig. B**. Thus, the distance between the fitting face of bearing and that of the bearing housing leads to the relationship $a > b$ (a =NTN, b =other manufacturers), and the alignment tolerance of other manufacturers' bearing units is smaller than that of NTN bearing units.

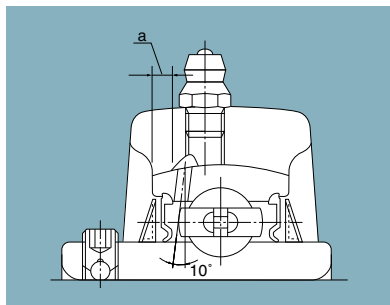


Fig. A (NTN)

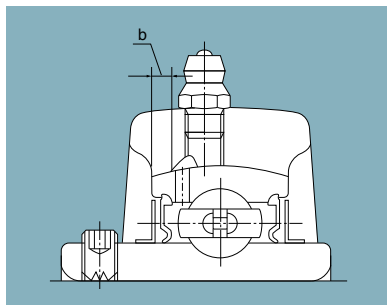


Fig. B (Other manufacture)

As a result, in a self-aligned state, the overlap of fitting faces between bearing and bearing housings leads to the relationship $c > d$. This means that NTN bearings are less prone to grease leakage compared to other manufacturers' products (**Fig. C**) (**Fig. D**).

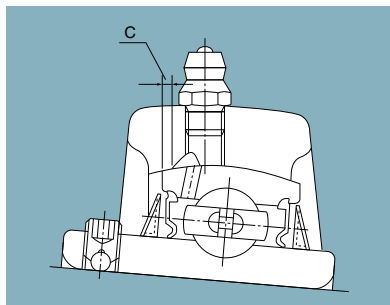


Fig. C (NTN)

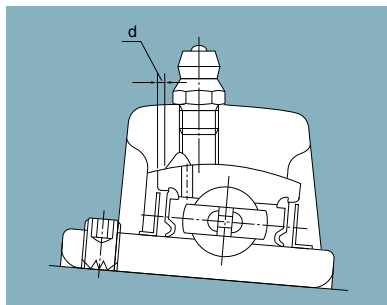


Fig. D (Other manufacture)

- 2) The oil groove of an other manufacture C's bearing is located on the circumference of the bearing (**Fig. E**). Thus, when the bearing is fitted to the bearing housing, the edge of the oil groove may scuff the spherical bore face of the bearing and the resultant steel dust can remain inside the bearing. In contrast, **NTN bearings** have their oil grooves in the bearing housings, so this problem does not arise (**Fig. A**).

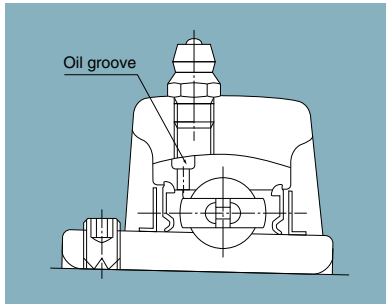


Fig. E (Other manufacture)

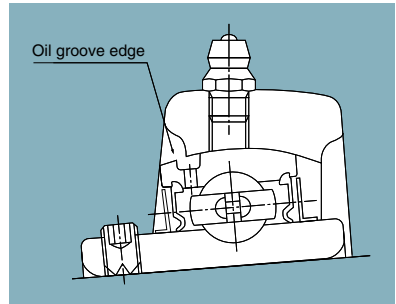


Fig. F (Other manufacture)

2.5 Self-aligning cover seal

- 1) NTN covered bearing units are designed so that the seal lips can follow the shaft even when it is slanted. Therefore, the covered bearing unit can achieve the rated dust-proofing performance of the cover seal even when the bearing is self-aligned to the shaft angle. However, to ensure that rated dust-proofing

performance is not prevented due to uneven contact between the seal lips and the shaft, the alignment tolerance should be limited to $\pm 1^\circ$. Since the seals of other manufacturers' products are fixed, dust-proofing performance becomes unreliable when the bearing is aligned with the shaft angle.

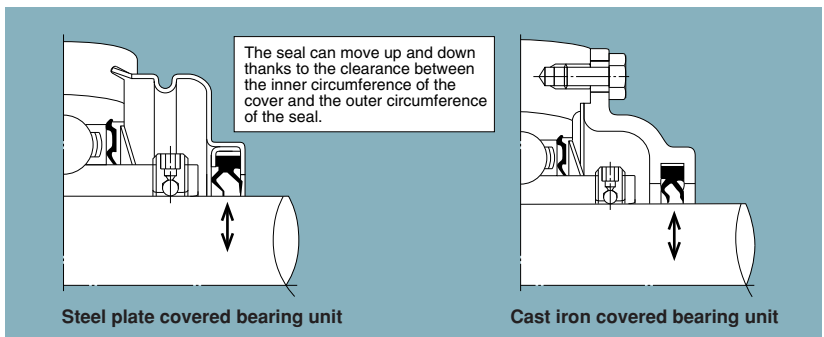


Fig.2.5

2) To prevent the cover from rotating together with the shaft, a cutout is provided on the outer circumference of the cover seal and a retaining plate (in the case of the steel plate covered bearing unit) or a spring pin (in the case

of a cast iron covered bearing unit) is fitted into the cutout. Since other manufacturers' bearing units do not have such a jamming mechanism, their cover seals may rotate together with the rotating shaft.

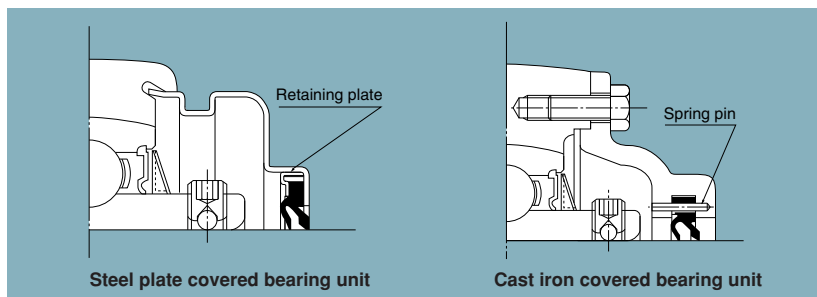


Fig.2.6

2.6 Stable breaking strength with standard bearing housing

1) NTN bearing housings are designed to avoid possible stress concentrations. Their delicate components are precision machined in-house. For these reasons, the breaking strength of NTN bearing housings is superior to that of other manufacturers'

POINT WORD *Light, tough bearing housing*

products as shown in the tables below. Unlike other manufacturers, NTN has committed itself to casting to final finish in manufacturing bearing housings.

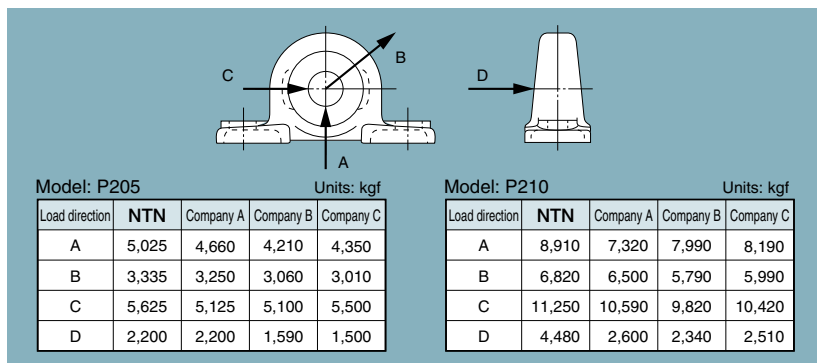


Fig.2.7

Ductile Series bearing unit**2.7 Tough, light, compact Ductile Series bearing units****1) Tough bearing housing**

The bearing housing of the Ductile Series bearing units is made of spheroidal graphite cast iron (FCD450, ductile cast iron). They feature a breaking strength of approx. 30% (average for all Ductile Series bearing units) higher than the conventional gray cast iron (FC200) bearing units. It can be seen from the static breaking stress test results (**Fig. 2.8** on next page) the Ductile Series bearing unit breaking strength is superior against the load in any direction to those of conventional and other manufacturers' products.

2) 40% lighter and compatible

The weight of bearing housings of the Ductile Series are 40% lighter than those of conventional models. Thus, the Ductile Series bearing unit contributes to the overall weight reduction of the machinery. Because the mounting dimensions of Ductile Series bearing units are identical with those of conventional JIS standard products, they are compatible with any JIS product and can be used either in new designs or repair work. The outer dimensions of the bearing units are as small as possible. In particular, the side face width has been reduced to 80% of conventional models. Thus, the Ductile Series bearing units offer comprehensive advantages, including an opportunity to reconsider mounting methods.

3) Applications

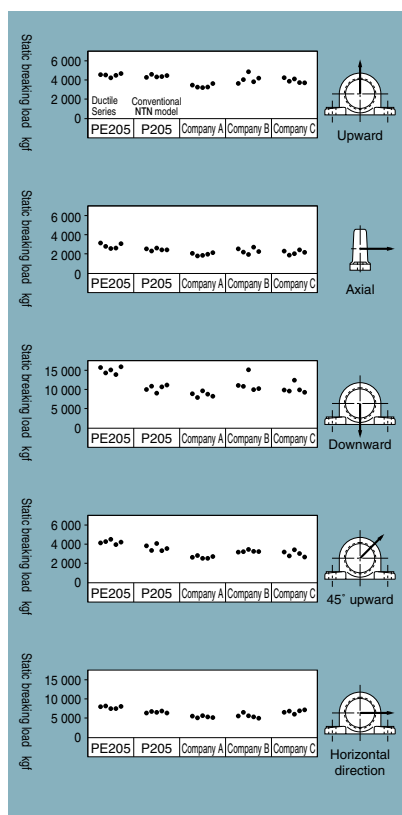
The Ductile Series bearing units are suitable for machines whose installation space and weight must be kept to a minimum, such as packing machines, small blowers, furnaces, food processing

machines, printing machines and agricultural machines. They are also suitable for movable racks and sky parking, where bearing housings are subjected to impact loads.

For further details, refer to the separate catalogue "Bearing Units, Ductile Series."

Pillow block bearing units

(Tightening torque for M10 hex. head bolts: 280 kgf-cm)



Rhombus flange bearing unit

(Tightening torque for M14 hex. head bolts: 780 kgf-cm)

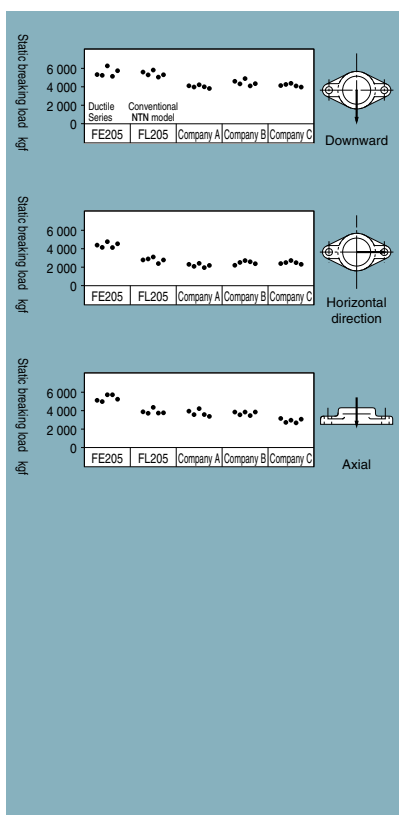


Fig.2.8 Comparison of static breaking strengths for bearing housings

Steel Series bearing units



2.8 High-reliability Steel Series bearing units

1) Highly reliable, tough bearing housings

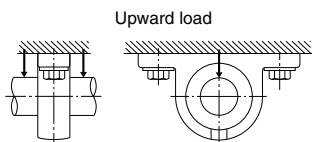
The housing for the Steel Series bearing unit is made of precision gas-cut structural rolled steel and is free from mechanical strength instabilities that are often attributed to cast material. This type of bearing features a level of mechanical strength that cannot be achieved using cast iron or cast steel products.

2) Material of bearing housing

Material code	Tensile test			
	Thickness of steel plate mm	Yield point N/mm ²	Tensile strength N/mm ²	elongation %
SS400	16 min. to 40 max.	235 min.	400~510	21 min
	40 min.	215 min.		23 min.

3) Allowable load on steel bearing housings

The allowable load on steel housings is the critical load. When exerted on the bearing unit, it causes maximum allowable deformation of the bearing housing in any practical application. The load is approximately five times as large as the basic dynamic load rating of the bearing. The actual static breaking strength of **NTN** steel housing is much greater than the load. As is apparent from the test results below, **NTN** steel housings have a static breaking strength much greater than our conventional models (cast steel).



(Remarks) Basic dynamic load rating on bearing C_r

UC210D1=35,000N [3,600Kgf]

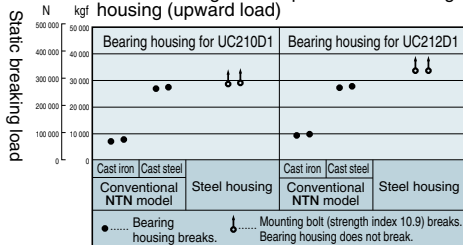
UC212D1=52,500N [5,350Kgf]

※ The diagram above indicates an upward load exerted to a bearing unit. Note that upward load was applied for test purposes only, and is not recommended for actual use.

4) Applications

Excellent load bearing capability and impact resistance make **NTN** Steel Series bearing units an ideal choice for locations where the safety of personnel is a major priority, or where they are subjected to vibrations and impacts under heavy load. Typical applications include conveyors and trucks used in iron and steel works, mining, and waste disposal machinery, as well as overhead cranes. When they are used at sites where there is any risk of injury or death, be sure that proper and reliable safety arrangement is made.

Static breaking load on pillow block bearing housing (upward load)



For further details, refer to the separate catalogue "Bearing Unit Steel Series."

Stainless Series bearing unit**2.9 Reliable, corrosion-resistant stainless steel bearing unit**

- 1) The Stainless Series bearing unit is comprised of a stainless steel ball bearing and housing. It features reliable corrosion resistance that is far superior to that of standard cast iron units.
- 2) The Stainless Series bearing units contain authentic NTN solid grease, which has specially heat-treated lubricating grease and ultra-high polymer polyethylene. As a result, these are virtually free from grease leakage and do not constitute a source of environmental contamination. Thus, they are an optimal choice for food processing machines, packing machines, and textile machines that operate at normal temperatures.
- 3) Compared to conventional grease, the grease in the Stainless Series bearing unit poses virtually no stirring resistance. Bearing rotation torque is lower than that of standard bearings (approx. 1/3 to 1/4). Therefore, the Stainless Series bearing units are an ideal choice for machines that require low torque operation, such as bobbin winding machines, film take-up machines, and packing machines.
- 4) The surface texture of the Stainless Series bearing housing is very smooth owing to a special casting technique. Since the smooth texture prevents foreign matter from adhering to the bearing unit, this type of bearing is ideally suited for the food, meat, poultry and fish processing industries ensuring excellent hygiene. The stainless housing adds additional value for those that require an attractive appearance.

4) Material

Component		Material
Bearing	Raceways	Martensitic stainless steel (SUS440C or equivalent)
	Rolling element	Martensitic stainless steel (SUS440C)
	Slinger and retainer	Austenitic stainless steel (SUS304)
	Rubber seal	Nitrile rubber
	Double-point set screw	Martensitic stainless steel (SUS410)
	Bearing housing	Austenitic stainless cast steel (SCS13)

5) Recommended temperature range and allowable speed

Use bearings containing "solid grease" within a temperature range of -20 to 80°C on the housing. When operating the bearing units for an extended period, use them at 60°C or lower.

Note: Contact with organic solvent, wash oil or other chemicals can degrade the lubricating performance of solid grease.

Value dn : 12×10^4 [dn = Bearing bore dia. d (mm) \times speed n (min⁻¹)]

Note: The recommended temperature range and allowable values (dn) above are applicable to standard type bearing units containing solid grease. If considering a similar bearing unit for use outside this temperature and speed range, consult NTN.

6) Corrosion resistance

◎Excellent ○Good △Fair ▲Poor ×Very poor

Material \ Operating conditions	In atmosphere		In water		Acid		
	Dry air	Humid air	Plain water	Seawater	Nitric acid	Sulfuric acid	Hydrochloric acid
Martensitic stainless steel SUS440C, SUS410	○	△	△	▲	▲	×	×
Austenitic stainless steel SUS304, SCS13	◎	◎	◎	○	◎	○	△
High carbon chrome steel SUJ2	△	▲	▲	×	×	×	×
Carbon steel and cast iron	▲	×	×	×	×	×	×

Remarks: The data above was collected to check the degree of corrosion on the material surface. In certain cases, corrosion can be limited by appropriate rust prevention treatments.

Corrosion resistance test results

Samples		Degree of rusting
Bearing	SUJ2	Rusting in 7 hours
	SUS440C	Spot rusting in 500 hours
Bearing housing	FC200 (coated)	Rusting in 80 hours
	SCS13	Spot rusting in 2000 hours

We observed formation of rust on bearings and bearing units after continuously applying tap water (10 ml/sec.) to the bearing units from directly above.

For further details, refer to the separate catalogue "Bearing Units Stainless Series."

The standard Stainless Series bearing units contain solid grease. If considering stainless steel bearing units with food grade grease or heat-resistant grease, etc., consult NTN.

Plastic Series bearing unit

2.10 Corrosion and chemical resistant

1) Solid Grease included

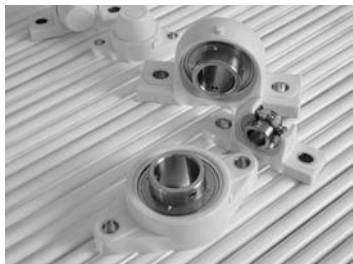
The bearing insert of the Plastic Series is identical to that of the Stainless Series, which contain authentic NTN solid grease. The grease is made from ultra-high polymer polyethylene that is specially heat-treated to solidify. As a result, the NTN Plastic Series bearing units can run at a low torque, are virtually free from grease leakage and do not pose any threat of environmental contamination.

2) Light weight bearing unit

The Plastic Series bearing unit comes with a bearing housing made of polyester resin that contains reinforcing glass fiber, and weighs 30% to 60% less than conventional NTN cast-iron bearing units. The color of the bearing housing is white, to suit clean operating environments.

3) Recommended operating temperature








Use the Plastic Series bearing units only for applications where the temperature range of the housing is -20 to 80°C. For bearing units that need to operate for extended periods,



use at 60°C or lower.

4) Static strength of bearing housing

The table below indicates the average static strength of the bearing housing of the Plastic Series bearing units at a room temperature (23°C ± 5°C). The static strength of the bearing housing varies depending on operating temperature, type of bearing housing, type and direction of loading, etc. A sufficient safety margin should be allowed when selecting Plastic Series bearing units. When used in sites where there are risks of injury or death, be sure to implement proper, reliable safety precautions.

Bearing housing type	Load direction	Static strength of bearing housing N (Kgf)				
		Part number				
		204	205	206	207	208
PR	Downward 	16,600 (1,690)	19,600 (2,000)	28,300 (2,890)	38,300 (3,910)	44,500 (4,540)
	Horizontal 	7,000 (710)	7,400 (760)	8,600 (880)	10,300 (1,050)	12,100 (1,230)
	Upward ※Not recommended for actual use 	5,600 (570)	5,800 (590)	6,000 (610)	6,600 (670)	11,100 (1,130)
	Axial ※Not recommended for actual use 	3,000 (310)	3,200 (330)	4,000 (410)	5,700 (580)	8,500 (870)
FLR	Horizontal 	5,600 (570)	8,000 (820)	10,800 (1,100)	13,800 (1,410)	17,300 (1,760)
	45° upward 	6,600 (670)	8,400 (860)	10,300 (1,050)	12,200 (1,240)	14,000 (1,430)
	Upward 	7,400 (760)	7,600 (780)	8,500 (870)	10,700 (1,090)	15,100 (1,540)

5) Water and chemical-resistant NTN bearing housing

As an engineered plastic, polyester resin absorbs a minimum amount of water (absorption ratio, 0.06% at 23°C for 24 hours), giving a high level of dimensional stability. Being a crystallized polymer, polyester resin is degraded by alkaline solution, but is able to withstand almost any

attack by organic solvents. Thus, the operating environment of the bearing housing must be carefully considered before purchasing this for practical use. The table below shows the chemical resistance of polyester resin samples that have been immersed in various chemical solutions for 30 and 90 days.

	Chemicals	Temperature °C	Residual strength ¹⁾ %			Chemicals	Temperature °C	Residual strength ¹⁾ %	
			No. of days immersed 30 days	90 days				No. of days immersed 30 days	90 days
Acid	10% Hydrochloric acid	23	89	85	Organic solvent	Ethyl alcohol	23	99	96
	36% Sulfuric acid	23	97	97		Methyl alcohol	23	91	82
		60	84	60		Isopropyl alcohol	23	100	100
10% Acetic acid	23	88	88	Acetone		23	86	74	
Alkaline	5% Potassium hydroxide	23	88	10		Methylethyl ketone	23	90	80
	10% Sodium hydroxide	23	※	※		Ethyl acetate	23	96	86
	10% Ammonium hydroxide	23	96	87		Methylene chloride	23	54	54
Oil	Motor oil	23	100	100		Ethylene glycol	23	100	100
	Brake oil	23	100	100		10% Zinc chloride	23	97	94
		23	100	100		10% Calcium chloride	23	98	98
	Gasoline (non-leaded)	23	100	100	5% Sodium chloride	23	97	97	
60		93	90						

Note: The residual strength data in the table is relative to the initial strength of samples taken as 100%.

The samples marked ※ became brittle and therefore no result could be obtained.

Remarks: The values above do not imply guaranteed performance, since they were obtained by immersing the samples in chemical solutions without applying any stress. The residual strength ratio of a material varies according to type, concentration and temperature of liquid, duration of immersion, applied load, etc. Thus, operating conditions must be studied comprehensively before practical use.

6) Corrosion resistance

◎Excellent ○Good △Fair ▲Poor ×Very poor

Material	Operating conditions		In atmosphere		In water		Acid		
	Dry air	Humid air	Dry air	Humid air	Plain water	Seawater	Nitric acid	Sulfuric acid	Hydrochloric acid
Martensitic stainless steel SUS440C, SUS410	○	△	△	△	△	▲	▲	×	×
Austenitic stainless steel SUS303, SCS304	◎	◎	◎	◎	◎	○	◎	○	△
Thermoplastic polyester resin	◎	◎	◎	◎	◎	◎	▲	○	○
Polypropylene, polyethylene	◎	◎	◎	◎	◎	◎	○	○	○
High carbon chrome steel SUJ2	△	▲	▲	▲	×	×	×	×	×
Carbon steel and cast iron	▲	×	×	×	×	×	×	×	×

Remarks: The data above was collected to check the degree of corrosion on the material surface. In certain cases, corrosion can be limited by appropriate rust prevention treatment.

For further details, refer to the separate catalogue "Bearing Unit Plastic Series."

Useful tips*Brief information
about bearing units***Handling of Stretcher Unit****1. Installation**

Be sure to install Stretcher Units to a sufficiently firm and flat mounting seat. If mounted on a mounting seat that is uneven or not firm, the frame will be deformed, and the bearing housing will fail to slide for stroke adjustment.

Fix the Stretcher Unit securely with bolts of the recommended size. When subjected to large horizontal loads, provide a stopper to prevent the frame from slipping on the mounting seat.

2. Load

The load to be applied to the Stretcher Units must be stable and completely horizontal.

If any non-horizontal load (upward, downward, right, or left) is applied to the Stretcher Unit, the frame may be deformed or broken.

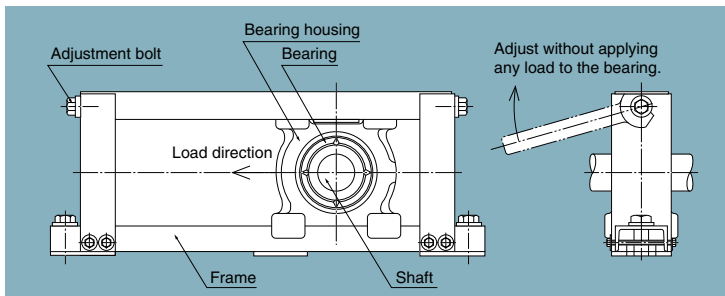
Repeated vibrational loading on the

Stretcher Units leads to gradual loosening of adjustment bolts, resulting in an incorrect bearing unit position or failure of the bearing unit due to fretting.

3. Adjustment of bearing unit position

When adjusting the bearing unit position either way (right or left), first move the bearing so that it is centered over the adjustment range. Only after doing this, fine-tune the location.

When adjusting the bearing unit position in a single direction (for example, when adjusting a belt tension or chain), move the bearing unit so that it is positioned opposite to the adjusting direction, and complete installation procedure. Only after doing this, proceed to fine-tune the bearing unit position.



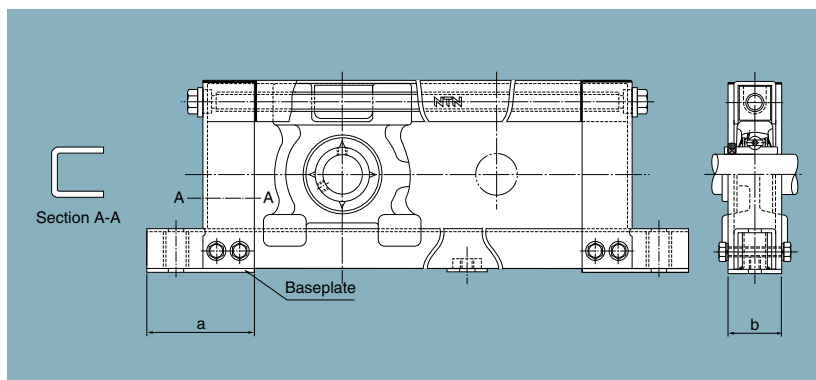
Stretcher Unit[®] / L200

2.11 Deformation-resistant Stretcher Unit frames

The strength of current NTN Stretcher Unit frames is much enhanced as shown below, to protect against possible deformation (beginning in Feb.95, a reinforced model has been available).

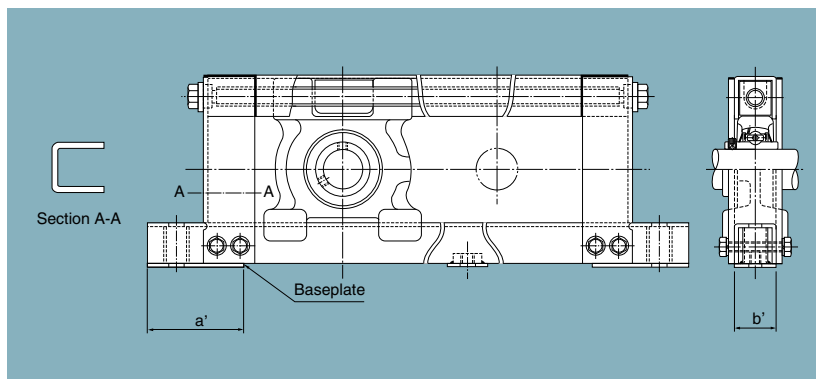
- 1) L200 model.....The vertical frames are more resistant to tilting, since both length (a) and width (b) of the baseplate are now greater than those of other manufacturers' products ($a > a'$, $b > b'$).

NTN



Remarks: Lubricated or covered Stretcher Units are also available.

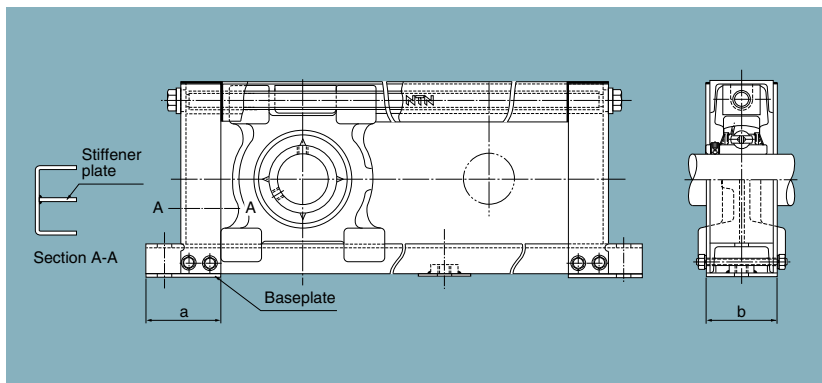
Other manufacturers' products



Stretcher Unit® /M200

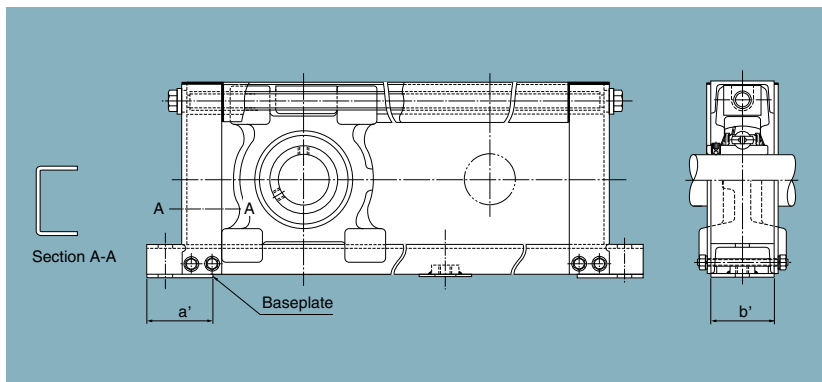
- 2) M200 mode
 ◎ Vertical frames are more resistant to tilting, since both length (a) and width (b) of the baseplate are now greater than those of other manufacturers' products ($a > a'$, $b > b'$).
 ◎ A stiffener plate is welded to the inside of each right and left vertical frames to protect the frames against possible deformation.

NTN



Remarks: Lubricated or covered Stretcher Units are also available.

Other manufacturers' products

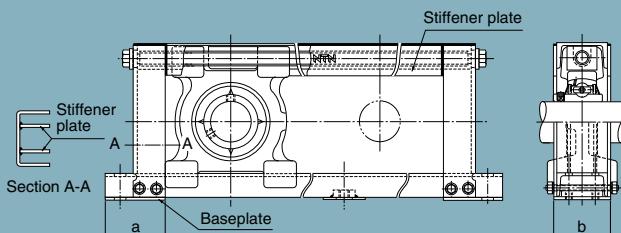


Stretcher Unit[®] /M300

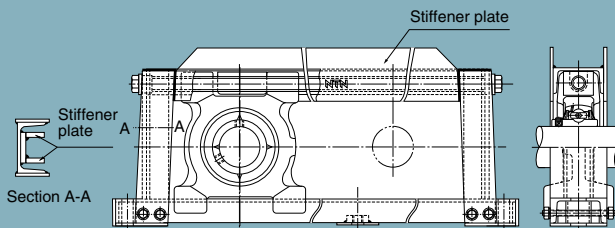
- 3) M300 type
 ○The vertical frames are more resistant to tilting, since both the length (a) and the width (b) of the base plate are now greater than those of other manufacturers' products ($a > a'$, $b > b'$).
 ○Two stiffener plates are welded to the inside of each right and left vertical frames to protect the vertical frame against possible deformation.
 ○Stiffener plates are welded to both sides of the upper frame to protect the upper frame against possible deformation.

NTN

Applicable to
M313 through 318

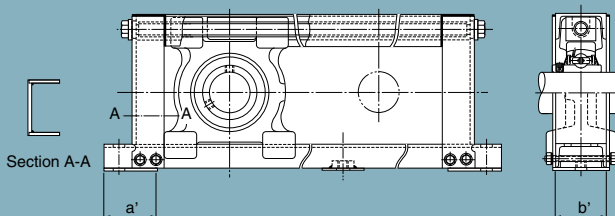


Applicable to
M319 and 320



Remarks: Lubricated or covered Stretcher Units are also available.

Other
manufacturers'
products



Triple-sealed bearing

2.12 Reliable, dust and water-proof triple-sealed bearing

1) Types

- **High-torque, triple-sealed bearing**

(Cylindrical-bore, set-screw type) UC201D1LLS through UC212D1LLS

(Square-bore type for agricultural machines) 1AS08-11/8, 4AS09-11/4, etc.

- **Low-torque triple-sealed bearing**

(Cylindrical-bore, set-screw type) UC201D1LLJ through UC218D1LLJ

UK201DLLJ through UK218DLLJ

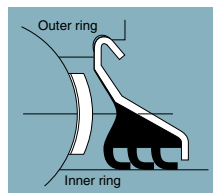
2) Features

The triple-sealed bearing is provided with a bearing seal having three lips. The special seal offers reliable dust and water-proofing performance superior to standard bearings and offers longer bearing life.

Although the high-torque, triple-sealed bearing unit boasts the best sealing performance, it should be used only at low speed, because the bearing generates a high friction torque. The low-torque triple-sealed bearing unit is identical to the high-torque sealed-bearing unit but incorporates improved seal lips and generates lower frictional torque. Thus, it can be used under ordinary operating conditions.

Although the high-torque, triple-sealed bearing unit boasts the best sealing performance, it should be used only at low speed, because the bearing generates a high friction torque. The low-torque triple-sealed bearing unit is identical to the high-torque sealed-bearing unit but incorporates improved seal lips and generates lower frictional torque. Thus, it can be used under ordinary operating conditions.

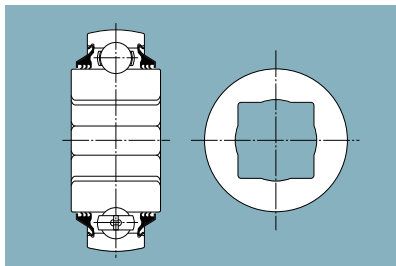
- Allowable speed High-torque triple-sealed bearing unit $\cdots dn$ value: 21000
Low-torque triple-sealed bearing unit $\cdots dn$ value: 36000



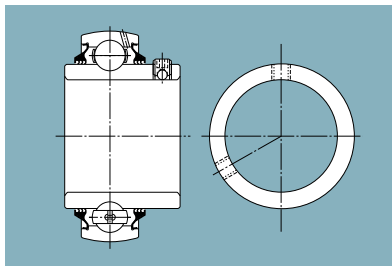
Triple seal

(3) Applications

Triple-sealed bearing units are suitable for machines used in locations subjected to splashing water and heavy dust, such as agricultural machines, fruits sorters, car washers, and conveyors. The high-torque triple-sealed bearing unit has been specifically developed for agricultural machines, and has been accepted in large quantities by John Deere Co[®], the world's leading manufacturer of agricultural machinery.



High-torque triple-sealed bearing
(Example: 1AS08-11/8)



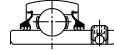

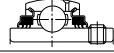
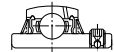
Low-torque triple-sealed bearing
(Example: UC206D1LLJ)

4) Dust-proofing performance

4-1) Dust-proofing test

An hourglass-shaped drum containing dust (activated alumina) was rotated at 50 min^{-1} . Then, the main shaft was rotated at $1,750 \text{ min}^{-1}$, while a load of 25 kgf was applied to the test bearings fitted on both sides of the drum. We recorded the normal running time of bearings before they finally siezed due to accumulated dust inside them, and compared the results.

4-2) Dust-proofing test results

Type of triple seal	Manufacturer	Part number of bearing being tested	Cross section of bearing	No. of samples	Average running time
High-torque type	NTN	UR206-104LLS ¹⁾		2	7243h
Low-torque type	NTN	UC206D1LLJ		4	5510h
	Company A	UC206L III		6	1959h
Standard type	NTN	UC206D1		6	986h


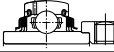
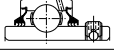
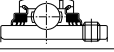
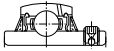
Note 1: When testing UR206-104LLS, the main shaft of UR206-104LLS was rotated at 700 min^{-1} .

5) Resistance against muddy water

5-1) Muddy water resistance test

Rotate the test bearings in muddy water, and measure the time to be siezed.

5-2) Muddy water resistance test results

Type of triple seal	Manufacturer	Part number of bearing being tested	Cross section of bearing	No. of samples	Average running time
High-torque type	NTN	1AS08-11/8		3	2603h
	Company B	G1108KPPB3		3	1437h
Low-torque type	NTN	UC208D1LLJ		2	3016h
	Company A	UC208L III		3	51h
Standard type	NTN	UC208D1		3	513h

3. Part Number

3.1 Ball bearing part number

Example designation

UC 2 05 D1 W5

Supplementary suffix code (set screw)
Lubrication code
Bore dia. No. (bearing bore dia.)
Dia. series code
Bearing type code

Diameter series code

Series 2	Light load
Series X	Medium load
Series 3	Heavy load

Bore code number and bore diameter

# 00	10mm (CS200LLU)
# 01	12mm
# 02	15mm
# 03	17mm
For bore dia. of #04 and above, bore code No. multiplied by 5.	

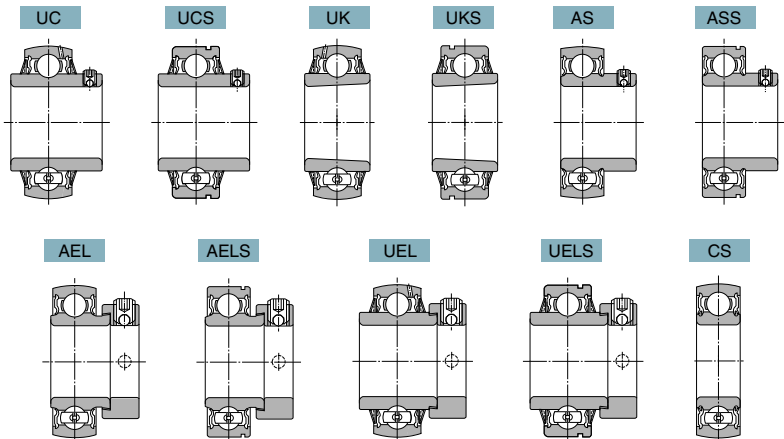
Bearing type code

UC (JIS)	Spherical outside face, cylindrical bore (w/set screws)
UK (JIS)	Spherical outside face, tapered bore (adapter type)
AS	UC type, minus flinger (LLU type)
CS	Rubber sealed type, inner and outer ring widths equal.
UEL (JIS)	UC type w/eccentric collar
AEL (JIS)	UEL type, minus flinger (LLU type)
UCSXXXN	UC type, straight outer face (w/set screws)
UKSXXXN	UK type, straight outer face (adapter type)
ASSXXXN	AS type, straight outer face
UELSXXXN	UEL type, straight outer face
AELSXXXN	AEL type, straight outer face

Note: No lubrication code is included in part number of other manufacturers' products, since their products are lubricated as standard.

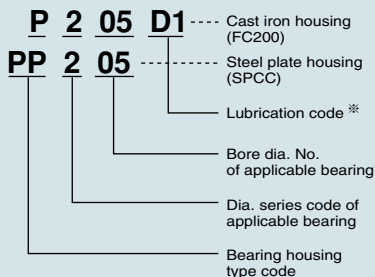
Supplementary suffix code (set screws)

No code	w/2 ball-point set screws (mm); standard products w/mm size bore
No code	w/2 ball-point set screws (inch); standard products w/inch size bore
W5	w/hex. socket head cap dog point set screw W5: w/2 pcs.
W6	w/hex. socket head cap key bolt set screw W6: w/ 2 pcs.
W7-n	w/2 special set screws



3.2 Bearing housing part number

Example designation



Note: No lubrication code is included in the part numbers of other manufacturers' products, since their products are lubricated as standard.

Bearing housing type code (JIS standard products)

Cast iron housing	P. F. FL. FC. FS. T. C
Steel plate housing	PP. PF. PFL

Bearing housing type code (NTN series)

Cast iron housing	IP. HP. UP. FA. HB. FH. L. M. PB. FB. FU. FLU. PE. FE
Stainless steel housing	PM. FM
Resin housing	PR. FLR
Rolled steel housing	PG. FG. FLG. FCG. FSG. TG

Note 1: Paint coating on cast iron bearing housing:
 Melamine resin base paint
 (Munsell code: 5G 4/2)

2: Steel plate type PP is galvanized. Type PF and PFL are black oxidized.

3.3 Dust cover part number

1) Cast iron cover

Example designation

C - 2 0 5

Open cover

CM - 2 0 5

Closed cover

Type

C-, CK-, CM-204~218	C-, CK-, CM-305~328
---------------------	---------------------

Note: CK- indicates the open cover for UK type bearings.

Cover mounting bolt (common to all cover types)

Cover part number C-, CK-, CM-	Mounting bolt
204~211	M 5×12
211~218	M 6×15
305~309	
310~322	M 8×20
324~328	M10×25

2) Steel plate cover

Example designation

S - 2 0 5

Open cover

SM - 2 0 5

Closed cover

Type

S-, SK-, SM-204~213

Note: SK- indicates the open cover for UK type bearings.

3.4 Shouldered shaft part numbers

If a bearing unit is installed in an area subjected to a relatively large axial load, it is recommended that a shouldered shaft be used as shown in Fig. 3.1. When using a cast iron covered bearing unit together with a shouldered shaft, it is recommended that the shaft diameter and an appropriate covered bearing unit be determined by referring to Table 3.1. The fillet radius of the shouldered shaft should have dimensions as specified in Table 3.2.

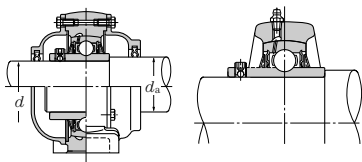


Fig. 3.1

Table 3.1 Covered bearing units for shouldered shafts and recommended shaft dia.

Unit part No.		d_a mm
10C-UCP206	10C-UCT206	$d+10$
10C-UCP218	10C-UCT217	

Unit part No.		d_a mm
10C-UCP305	10C-UCT305	$d+10$
10C-UCP311	10C-UCT311	
15C-UCP312	15C-UCT312	$d+15$
15C-UCP324	15C-UCT324	
20C-UCP326	20C-UCT326	$d+20$
20C-UCP328	20C-UCT328	

Remarks 1: Part number of closed covered bearing unit
[Example] 10CM-UCP206

2: When considering covered bearing units for shouldered shafts not listed in the table above, consult NTN.

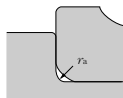


Table 3.2 Recommended fillet radius on shouldered shaft

Part No. of bearing	$r_{(as)}^{(1)}$ max mm	Part No. of bearing	$r_{(as)}^{(1)}$ max mm
UC201D1~UC203D1	0.6	UC305D1~UC306D1	1.5
UC204D1~UC206D1	1	UC307D1~UC309D1	2
UC207D1~UC210D1	1.5	UC310D1~UC311D1	2.5
UC211D1~UC215D1	2	UC312D1~UC316D1	2.5
UC216D1~UC218D1	2.5	UC317D1~UC324D1	3
		UC326D1~UC328D1	4

Note 1: Max. allowable fillet radius on shouldered shaft

3.5 Typical supplementary prefix and suffix codes

1) Supplementary prefix code

Code	Meaning
P	Galvanized cover
5	Inner dia. of cover: 5 mm greater
10	Inner dia. of cover: 10 mm greater
15	Inner dia. of cover: 15 mm greater
20	Inner dia. of cover: 20 mm greater
Zn	Special cover (including seal)

2) Supplementary suffix

Code	Meaning
F	No recess in bottom, nor mounting bolt holes
F1	No recess in bottom, but w/mounting bolt holes
F2	No mounting bolt holes
F3-n	w/hole in the knock-pin position
F7	No recess on the mounting bolt holes, but w/mounting bolt holes
G-n	Altered dia., shape, pitch, machining precision of mounting bolt holes
U	Double-sided steel plate no-contact shield
W0	No set screw
W5	w/hex. socket head cap dog point set screw (W5: w/2 pcs.)
W6	w/hex. socket head cap key bolt set screw (W6: w/2 pcs.)
Y-n	Bearing housing, cover, and frame are painted in the user-specified color.

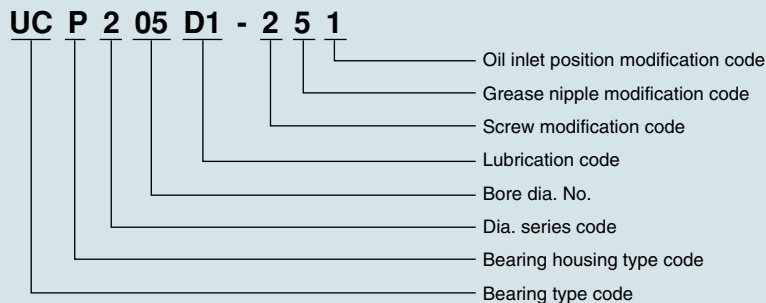
Notes 1: Bearing unit for shouldered shaft 5C- (+5mm) can be custom made.

2: No steel plate covered bearing units are available for use with shouldered shafts.

3.6 Bearing unit part numbers

Example designation

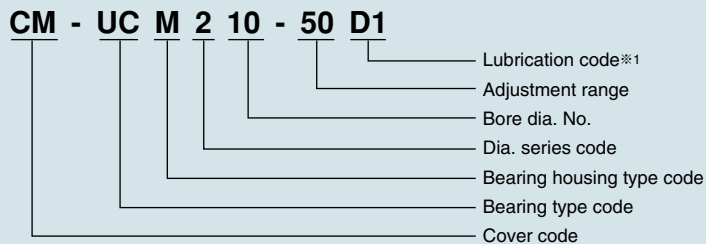
1) Ball bearing + bearing housing



2) Ball bearing + bearing housing + dust cover





































3) Ball bearing + bearing housing + frame + dust cover



*1 No lubrication code is included in part number of other manufacturers' products, since their products are lubricated as standard.

3.7 Bearing Unit Type Code

Pillow block unit	Cast iron pillow block type		Cylindrical bore, set screw type	UCP, S-UCP, C-UCP, SM-UCP, CM-UCP type
	Spheroidal graphite cast iron pillow block type		Cylindrical bore, set screw type Tapered bore, adapter type	UCPE, UKPE type (Ductile Series)
	General structural rolled steel pillow block type		Cylindrical bore, set screw type	UCPGtype (Steel Series)
	Stainless steel pillow block type		Cylindrical bore, set screw type	F-UCPM type (Stainless Series)
	Glass fiber reinforcing resin pillow block type		Cylindrical bore, set screw type	F-UCPR, F-RM-UCPR type (Plastic Series)
	Thick pillow block type		Cylindrical bore, set screw type	UCIP type
	High-center pillow block type bearing		Cylindrical bore, set screw type	UCHP type
	Narrow pillow block type		Cylindrical bore, set screw type	UCUP type
	Light pillow block type		Cylindrical bore type	ASPB, AELPB, CSPB...LLU type
	Steel plate pillow block type		Cylindrical bore, set screw type	AELPP, AELRPP type
			Cylindrical bore, eccentric collar type	ASPP, ASRPP type
Flange type unit	Square flange type		Cylindrical bore, set screw type	UCF, S-UCF, C-UCF, SM-UCF, CM-UCF type
	Square flange type w/spigot joint		Cylindrical bore, set screw type	UCFS, C-UCFS, CM-UCFS type
			Tapered bore, adapter type	UKFS, C-UKFS, CM-UKFS type
	Round flange type w/spigot joint		Cylindrical bore, set screw type	UCFC, S-UCFC, C-UCFC, SM-UCFC, CM-UCFC type
			Tapered bore, adapter type	UKFC, S-UKFC, C-UKFC, SM-UKFC, CM-UKFC type
	Rhombus flange type		Cylindrical bore, set screw type	UCFL, S-UCFL, C-UCFL, SM-UCFL, CM-UCFL type
			Tapered bore, adapter type	UKFL, S-UKFL, C-UKFL, SM-UKFL, CM-UKFL type
	Spheroidal graphite cast iron rhombus flange type		Cylindrical bore, set screw type Tapered bore, adapter type	UCFE, UKFE type (Ductile Series)
	General structural rolled steel square flange type		Cylindrical bore, set screw type	UCFG type (Steel Series)
	Stainless steel rhombus flange type		Cylindrical bore, set screw type	F-UCFM type (Stainless Series)
	Glass fiber reinforcing resin rhombus flange type		Cylindrical bore, set screw type	F-UCFLR, F-RM-UCFLR type (Plastic Series)
	Modified rhombus flange type		Cylindrical bore, set screw type	UCFA type
	Modified flange type		Cylindrical bore, set screw type	UCFH type
Light cast iron rhombus flange type		Cylindrical bore type	ASFB, AELFB, CSFB type...LLU type	

Flange type unit	Steel plate round flange type		Cylindrical bore, set screw type	ASPF, ASRPF type
			Cylindrical bore, eccentric collar type	AELPF, AELRPF type
	Steel plate rhombus flange type		Cylindrical bore, set screw type	ASPFL type
			Cylindrical bore, eccentric collar type	AELPFL type
Take-up type unit	Take-up type		Cylindrical bore, set screw type	UCT, S-UCT, C-UCT, SM-UCT, CM-UCT type
			Tapered bore, adapter type	UKT, S-UKT, C-UKT, SM-UKT, CM-UKT type
Cartridge type unit	Cartridge type		Cylindrical bore, set screw type	UCC type
			Tapered bore, adapter type	UKC type
Stretcher Unit®	Angle steel frame		Cylindrical bore, set screw type	UCT, S-UCT, C-UCT, SM-UCT, CM-UCT type
	Light channel steel frame type		Cylindrical bore, set screw type	UCL, S-UCL, C-UCL, SM-UCL, CM-UCL type
	Channel steel frame type		Cylindrical bore, set screw type	UCM, S-UCM, C-UCM, SM-UCM, CM-UCM type
	Steel plate mini type		Cylindrical bore, set screw type	ASPT type
Cylindrical bore, eccentric collar type			AELPT type	
Hanger type unit	Hanger type		Cylindrical bore, set screw type	UCHB type
Eccentric collar type unit	Pillow block type		Cylindrical bore, eccentric collar type	UELPL, UELPL type
	Flange type		Cylindrical bore, eccentric collar type	UELFU, UELFC, UELFLU type
	Take-up type		Cylindrical bore, eccentric collar type	UFLT type
	Cartridge type		Cylindrical bore, eccentric collar type	UELC type

Remarks 1: For ball bearings with inch system shaft dia., consult NTN.

2: The codes "S-" and "C-" at the head of the type codes indicate steel plate covered bearing units and cast iron covered bearing units, respectively.

3: Single-sided closed covered bearing units made of steel and cast iron are also available.

These bearing units are identified with the codes "SM-" (steel plate) and "CM-" (cast iron) at the head of the type codes, respectively.

4: The code "RM-" at the head of the type codes indicates single-side closed resin covered unit (Plastic Series bearing unit).

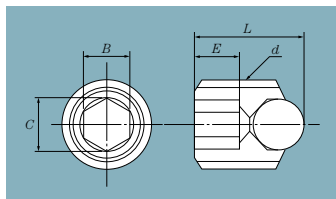
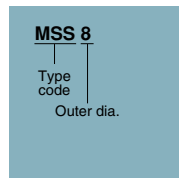
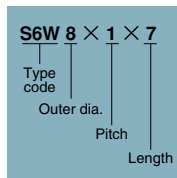
5: UC type stainless steel bearings are also available. For further details, consult NTN (Stainless Series bearing unit).

3.8 Component part numbers

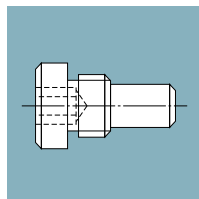
1) Set screw

	Descriptions	Type code
1.	Ball-point set screw (for metric system bearing units)	MSS
2.	Ball-point set screw (for inch system bearing units)	S8W
3.	Hex. socket head cap dog point set screw	S5W
4.	Hex. socket head cap key bolt set screw	S6W
5.	Other set screws	S7W

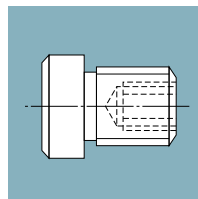
Note: Dimensions of certain similar screws from other manufacturers' may differ from those of NTN set screws.



Ball-point set screw



Hex. socket head cap dog point set screw



Hex. socket head cap key bolt set screw

2) Standard ball-point set screw (mm size)

Units: mm

Part No.	d	L	B	C	E	Applicable unit
MSS 5	M5×0.8	7±0.4	2.5 ^{+0.08} _{+0.02}	2.9	3	UC201~UC205, AS201~AS205
MSS 6	M6×0.75	8±0.4	3 ^{+0.08} _{+0.02}	3.6	3	UC206~UC207, UCX05, UC305~UC306 AS206~AS207, EL201~EL205
MSS 8	M8×1.0	10±0.4	4 ^{+0.10} _{+0.02}	4.7	4	UC208~UC211, UCX06~UCX08, UC307 AS208~AS210, EL206, EL305~EL307
MSS10	M10×1.25	12±0.4	5 ^{+0.14} _{+0.02}	5.9	5	UC212~UC216, UCX09~UCX12 EL207~EL215, EL308~EL312, UC308~UC309
MSS12	M12×1.5	13±0.5	6 ^{+0.14} _{+0.02}	7	5.5	UC217~UC218, UCX13~UCX17, UC310~UC314 EL313~EL314
MSS14	M14×1.5	15±0.5	6 ^{+0.14} _{+0.02}	7	6	UCX18, UC315~UC316
MSS16	M16×1.5	18±0.5	8 ^{+0.18} _{+0.03}	9.4	7	UCX20, UC317~UC319, EL315~EL317
MSS18	M18×1.5	20±0.5	8 ^{+0.18} _{+0.03}	9.4	8	UC320~UC324
MSS20	M20×1.5	25±0.5	10 ^{+0.18} _{+0.03}	11.7	10	UC326~UC328, EL318~EL322

Note: Part number of standard ball-point set screws (mm size) includes type code and outer diameter number.

3) Standard ball-point set screw (inch size)

Units: mm

Part No.	<i>d</i>	<i>L</i>	<i>B</i>	<i>C</i>	<i>E</i>	Applicable unit
S8W 4.826X32X7	No.10 -32UNF	7±0.4	2.381 +0.08 +0.02	2.9	3	UC201~UC205, AS201~AS205
S8W 1/4×28×8	1/4-28UNF	8±0.4	3.175 +0.08 +0.02	3.8	3	UC206~UC207, UC305~UC306, UCX05 AS206~AS207, EL201~EL205
S8W 5/16×24×10	5/16-24UNF	10±0.4	3.969 +0.10 +0.03	4.7	4	UC208~UC211, UCX06~UCX08, UC307 AS208~AS210, EL206, EL305~EL307
S8W 3/8×24×12	3/8-24UNF	12±0.4	4.762 +0.10 +0.03	5.6	5	UC212~UC216, UCX09~UCX12 UC308~UC309, EL207~EL215, EL308~EL312
S8W 1/2×20×13	1/2-20UNF	13±0.5	6.350 +0.10 +0.03	7.5	5.5	UC217~UC218, UCX13~UCX17 UC310~UC314, EL313~EL314
S8W 9/16×18×15	9/16-18UNF	15±0.5	6.350 +0.10 +0.03	7.5	6	UCX18 UC315~UC316
S8W 5/8×18×18	5/8-18UNF	18±0.5	7.938 +0.13 +0.04	9.4	7	UCX20, UC317~UC319 EL315~EL317
S8W 3/4×16×25	3/4-16UNF	25±0.5	9.525 +0.13 +0.04	11.2	8	EL318~EL320

Note: The models given under "Applicable unit" have inch bores.

4) W5 hex. socket head cap dog point set screw

Part No.	Applicable unit	Part No.	Applicable unit
S5W 5×0.8 × 8.5	UC204~205, AS201~205	S5W 12×1.5×16.5	UC217~18, UC310~12, X13~17
5×0.8 ×11	UC201~203	12×1.5×18	UC313~14
6×0.75×10	UC206~7, AS206~7	14×1.5×20	UC315~316, X18
6×0.75×11.5	UC305~6, X05	16×1.5×23	UC317~319, X20
8×1 ×11.5	UC208~11, UC307, X06~8	18×1.5×25	UC320~321
10×1.25×13.5	UC212~15, UC308, X09~10	18×1.5×29	UC322~324
10×1.25×15	UC216, UC309, X11~12	20×1.5×33	UC326~328

Note: Use one set screw per bearing, unless otherwise specified.

5) W6 hex. socket head cap key bolt set screw

Part No	Applicable unit
S6W 5×0.8 × 5-1	UC201~203, AS201~203
5×0.8 × 5	UC204~205, AS204~205
6×0.75× 6	UC206~207, UCX05, UC305~306, AS206~207
8×1 × 7	UC208~211, UCX06~X08, UC307, AS208
10×1.25× 9	UC212~216, UCX09~X12, UC308~309
12×1.5 ×11	UC217~218, UCX13~X17, UC310~314
14×1.5 ×13	UCX18, UC315~316
16×1.5 ×16	UCX20, UC317~319
18×1.5 ×18	UC320~324
20×1.5 ×25	UC326~328

Note: Use one set screw per bearing, unless otherwise specified.

6) Dust cover seal

Cover seal part numbers

Type	Type code	Nominal size
Nitrile rubber seal	CL	Metric size, inch size
Silicone rubber seal	CLA	
Fluoride rubber seal	CLB	

- Notes 1: Use serial numbers to distinguish between items with identical part numbers but different compositions.
2: Standard rubber material is nitrile rubber. Seals in other materials are available by special order.

Cover seal part numbers are arranged as follows.

(Example)

Type code	Nominal size
CL	25
CLA	1 1/8

7) Allen key wrench

Allen key wrench part numbers

Type code	Nominal size
HRS	mm size, inch size

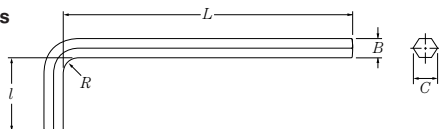
Note: Use serial numbers to distinguish between items with identical part numbers but different compositions.

Allen key wrench part numbers are arranged as follows.

(Example)

Type code	Nominal size
HRS	3
HRS	1/8
HRS	5-1

Table of Allen key wrench sizes



Units: mm

Part No.	B	C	L	l	R	Applicable unit
* HRS2.5	2.5	2.9	60	8	2.5	UC201~UC205, AS201~AS205
** HRS $\frac{3}{32}$	2.381	2.8	60	15	2.5	
* HRS3	3	3.5	65	8	3	UC206~UC207, UC305~UC306, UCX05 AS206~AS207, EL201~EL205
** HRS $\frac{1}{8}$	3.175	3.7	65	20	3	
* HRS4	4	4.6	70	9	4	UC208~UC211, UCX06~UCX08, UC307 AS208~AS210, EL206, EL305~EL307
** HRS $\frac{3}{32}$	3.969	4.6	72	25	4	
* HRS5	5	5.8	75	10	5	UC212~UC216, UCX09~UCX12, UC308~UC309 EL207~EL215, EL308~EL312
** HRS $\frac{1}{16}$	4.762	5.5	80	28	5	
* HRS6	6	6.9	85	12	6	UC217~UC218, UCX13~UCX18, UC310~UC316 EL313~EL314
** HRS $\frac{1}{4}$	6.350	7.35	90	32	6	
* HRS8	8	9.2	95	18	8	UCX20, UC317~UC324 EL315~EL317
** HRS $\frac{5}{16}$	7.938	9.2	100	36	8	
* HRS10	10	11.5	110	22	10	UC326~UC328, EL318~EL320 EL318~EL320
** HRS $\frac{3}{8}$	9.525	11	112	40	10	

Note: Items marked * apply to bearing units whose bore dia. is given in metric units.
Items marked ** apply to units whose bearing inner dia. is given in inches.

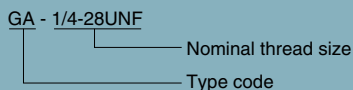
8) Grease nipple

NTN standard lubricated type bearing units are provided with brass grease nipples as listed in the table below, for greasing with a grease gun. On request, we can supply bearing housings having tapered pipe threads for centralized lubrication in addition to button-head or pin-head grease fittings.

Bearing housing type and applicable grease nipple

Bearing housing type	NTN standard grease nipple type
Pillow block type	GA type
Flange type	GA type
Take-up type	GB type
Hanger type	GA type
Cartridge type	GA type

Grease nipple part numbers



Bearing housing series and nominal size of grease nipple thread

Nominal size of thread d	Series 2	Series X	Series 3
$\frac{1}{4}$ -28UNF	203~209	X05~X08	305~309
$G\frac{1}{8}$ (PF $\frac{1}{8}$)	210~215	X09~X14	310~315
$G\frac{1}{4}$ (PF $\frac{1}{4}$)	216~218	X15~X20	316~328

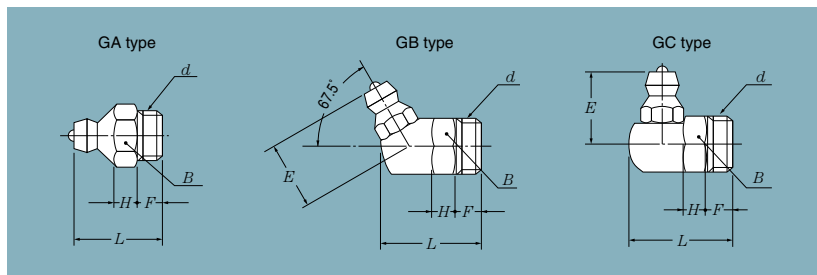
Note: Threads for grease nipple on cartridge-type bearing units are $\frac{1}{4}$ -28UNF.
Threads on C310D1 to C328D1 are $G\frac{1}{8}$ (PF $\frac{1}{8}$).

Grease nipple type codes

Type	Type code	Type modifications code
Upright type	GA	D1-01
60°	GB	D1-04
90°	GC	D1-05
30°	GD	D1-02
45°	GE	D1-03
Button head type	GF	D1-06
Pin type	GG	D1-07

Note: When altering standard grease nipple types, use the type modification codes above.

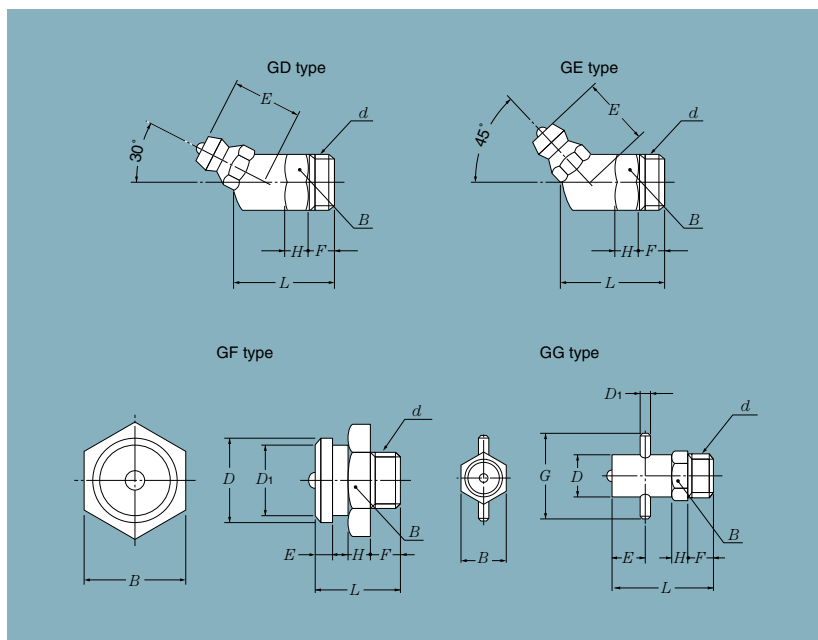
The following types of grease nipples are available. Use them according to purposes.



Grease nipple dimensions table - GA, GB, GC, GD, and GE type

Units: mm

Part No.	d	B (dimension across flats)	L	H	E	F
GA- $\frac{1}{4}$ -28UNF	$\frac{1}{4}$ -28UNF	7	13.5	2	—	5
GA-PF $\frac{1}{8}$	PF $\frac{1}{8}$	10	17.5	4	—	5.5
GA-PT $\frac{1}{8}$	PT $\frac{1}{8}$	10	17.5	4	—	5.5
GA-PF $\frac{1}{4}$	PF $\frac{1}{4}$	14	25	6	—	11
GA-PT $\frac{1}{4}$	PT $\frac{1}{4}$	14	25	6	—	11
GB- $\frac{1}{4}$ -28UNF	$\frac{1}{4}$ -28UNF	8	15.5	2	9.3	5
GB-PF $\frac{1}{8}$	PF $\frac{1}{8}$	10	19.8	4	13.5	5.5
GB-PT $\frac{1}{8}$	PT $\frac{1}{8}$	10	19.8	4	13.5	5.5
GB-PF $\frac{1}{4}$	PF $\frac{1}{4}$	14	26	6	13.5	11
GB-PT $\frac{1}{4}$	PT $\frac{1}{4}$	14	26	6	13.5	11
GC- $\frac{1}{4}$ -28UNF	$\frac{1}{4}$ -28UNF	8	15.5	2	10.5	5
GC-PF $\frac{1}{8}$	PF $\frac{1}{8}$	10	19.8	4	13.5	5.5
GC-PT $\frac{1}{8}$	PT $\frac{1}{8}$	10	19.8	4	13.5	5.5
GC-PF $\frac{1}{4}$	PF $\frac{1}{4}$	14	26	6	13.5	11
GC-PT $\frac{1}{4}$	PT $\frac{1}{4}$	14	26	6	13.5	11
GD- $\frac{1}{4}$ -28UNF	$\frac{1}{4}$ -28UNF	8	15.5	2	9.6	5
GD-PF $\frac{1}{8}$	PF $\frac{1}{8}$	10	19.8	4	13.5	5.5
GD-PT $\frac{1}{8}$	PT $\frac{1}{8}$	10	19.8	4	13.5	5.5
GD-PF $\frac{1}{4}$	PF $\frac{1}{4}$	14	26	6	13.5	11
GD-PT $\frac{1}{4}$	PT $\frac{1}{4}$	14	26	6	13.5	11
GE- $\frac{1}{4}$ -28UNF	$\frac{1}{4}$ -28UNF	8	15.5	2	9.6	5
GE-PF $\frac{1}{8}$	PF $\frac{1}{8}$	10	19.8	4	13.5	5.5
GE-PT $\frac{1}{8}$	PT $\frac{1}{8}$	10	19.8	4	13.5	5.5
GE-PF $\frac{1}{4}$	PF $\frac{1}{4}$	14	26	6	13.5	11
GE-PT $\frac{1}{4}$	PT $\frac{1}{4}$	14	26	6	13.5	11


Grease nipple dimensions table - GF type

Units: mm

Part No.	d	B (dimension across flats)	L	H	D	D_1	E	F
GF- $\frac{1}{4}$ -28UNF	$\frac{1}{4}$ -28UNF	17	15	4	15	12	3	5
GF-PF $\frac{1}{8}$	PF $\frac{1}{8}$	17	14	4	15	12	3	4
GF-PT $\frac{1}{8}$	PT $\frac{1}{8}$	17	14	4	15	12	3	4
GF-PF $\frac{1}{4}$	PF $\frac{1}{4}$	17	21	4	15	12	3	11
GF-PT $\frac{1}{4}$	PT $\frac{1}{4}$	17	21	4	15	12	3	11
GF-PF $\frac{3}{8}$	PF $\frac{3}{8}$	17	21	4	15	12	3	11

Grease nipple dimensions table - GG type

Units: mm

Part No.	d	B (dimension across flats)	L	H	D	D_1	G	E	F
GG-PF $\frac{1}{8}$	PF $\frac{1}{8}$	10	23	4	9.8	3	18	8	4
GG-PT $\frac{1}{8}$	PT $\frac{1}{8}$	10	23	4	9.8	3	18	8	4
GG-PF $\frac{1}{4}$	PF $\frac{1}{4}$	14	30	4	9.8	3	18	8	11
GG-PT $\frac{1}{4}$	PT $\frac{1}{4}$	14	30	4	9.8	3	18	8	11

Note: GG type grease nipples are nickel plated.

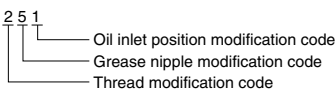
9) Grease nipple and oil inlet modification codes

	Descriptions	Code
Thread modifications	Standard oil inlet and nipple thread	—0
	Oil inlet 1/4-28UNF ● Changed to grease nipple 1/4-28UNF	—1
	Oil inlet PF1/8 (G1/8) ● Changed to grease nipple PF1/8 (G1/8)	—2
	Oil inlet PF1/8 (G1/8) ● Changed to grease nipple PT1/8 (R1/8)	—3
	Oil inlet PT1/8 (Rc1/8) ● Changed to grease nipple PT1/8 (R1/8)	—4
	Oil inlet PF1/4 (G1/4) ● Changed to grease nipple PF1/4 (R1/4)	—5
	Oil inlet PF1/4 (G1/4) ● Changed to grease nipple PT1/4 (R1/4)	—6
	Oil inlet PT1/4 (Rc1/4) ● Changed to grease nipple PT1/4 (R1/4)	—7
	Oil inlet 1/8-27NPT ● Changed to grease nipple 1/8-27NPT	—8
Grease nipple modifications	Standard grease nipple	0
	Changed to upright grease nipple	1
	Changed to 30° grease nipple	2
	Changed to 45° grease nipple	3
	Changed to 60° (B type) grease nipple	4
	Changed to 90° (C type) grease nipple	5
	Changed to button head grease nipple	6
	Changed to pin grease nipple	7
	Changed to nipple joint	8
	No grease nipple	9
Oil inlet modifications	Standard oil inlet position	0
	Changed to 30° right from standard position	1
	Changed to 45° right from standard position	2
	Changed to 60° right from standard position	3
	Changed to 75° right from standard position	4
	Changed to 90° right from standard position	5
	Changed to 30° left from standard position	6
	Changed to 45° left from standard position	7
	Changed to 60° left from standard position	8
Changed to 180° left from standard position	9	

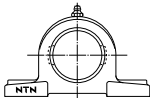

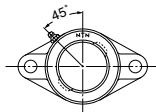
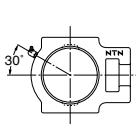
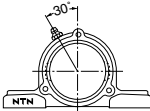
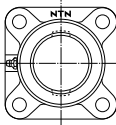
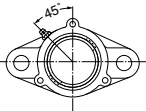
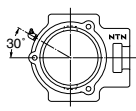

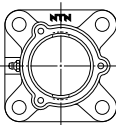

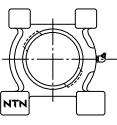
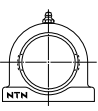
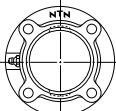
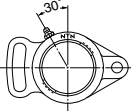
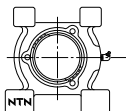
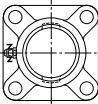



Notes 1: The modifications codes of grease nipples and oil inlets should conform to the lubrication codes (D1 and D2).

2: To add a suffix to a bearing unit or bearing housing code, arrange the thread modification code, grease nipple modification code, oil inlet location modification code in this order.

(Example) U C P 2 0 8 D 1 - 2 5 1



4. Grease Nipple Locations

			
P,IP type (including S cover type)	C-F type	FL type (including S cover type)	T type (including S cover type)
			
C-P, C-IP type	FS type Including F204 and F205	C-FL type	C-T type
			
HP type	C-FS type	FH type	M,L type (including S cover type)
			
UP type	FC type (including S cover type)	FA type	C-M, C-L type
			
Excluding #204 and #205 F type (including S cover type)	C-FC type	HB type	C type

Notes 1: Standard grease nipple type is GA. Items marked ※, however, have GB type as standard.

2: PE, PG, PL, PM, and PR types are categorized as P type.

3: FG and FU types are categorized as P type.

4: FE, FM, FLU, FLR types are categorized as FL type.

5. Packed Grease and Operating Temperature Range

5.1 Packed grease

Type	Grease			Code	Operating temperature range °C
	Brand	Thickener	Base oil		
Standard type	Alvania Grease S3	(Li soap base)	Mineral oil	D1	-15~+100
Heat resistant type	Toray Silicone SH44M	(Li soap base)	Silicone oil	HT2D1	Ordinary temperature to +200
Cold resistant type	Toray Silicone SH33L	(Li soap base)	Silicone oil	CT1D1	-60 to normal temperature

Note: Bearings containing food grade grease or fluoride grease are also available. For further details, consult NTN.

Solid grease for bearings

"Solid grease" is a lubricant composed mainly of lubricating grease and ultra-high polymer polyethylene. Solid grease has the same viscosity as grease at ordinary temperature, but by applying a special heat treatment process, this special grease solidifies retaining a large proportion of lubricant within the bearing. The result of this solidification is that the grease does not leak easily from the bearing unit, even when the bearing is subjected to strong vibrations or great centrifugal force.

The spot-pack type bearing, in which solid grease is injected into the retainer, is the standard prelubricated bearing.

Primary advantages:

- (1) Clean environment due to minimal grease leakage
 - (2) Low bearing torque with spot-pack type solid grease
- Grease code: / LP03
 - Recommended operating temperature range: -20 to 80 °C

For more details, refer to the separate catalogue "Bearings with solid grease."

5.2 Recommended operating temperature range

NTN's standard bearing units are capable of operating in most temperatures since they are equipped with a contact rubber seal, a unique flinger and the appropriate amount of lithium soap based grease. However, for applications at considerably higher or lower

temperature, appropriate heat resistant or cold resistant bearing units must be selected according to the operating conditions, considering bearing clearance, sealing construction, and grease type.

The recommended operating temperature range and applicable bearing units are as summarized in the table below.

Recommended operating temperature range and applicable ball bearing type

Type	Code	Value d_n	Environmental conditions	Operating temperature °C	Lubrication intervals	
					Operating hours	Time interval
Standard type	D1	40,000 or lower	Normal	-15~ 80	1,500~3,000	6 to 12 months
Standard type	D1	70,000 or lower	Normal	-15~ 80	1,000~2,000	3 to 6 months
Standard type	D1	70,000 or lower	Normal	80~100	500~ 700	1 month
Heat resistant type	HT2D1	70,000 or lower	Normal	100~170	300~ 700	1 month
Heat resistant type	HT2D1	70,000 or lower	Normal	170~200	100	1 week
Heat resistant type	CT1D1	70,000 or lower	Normal	-50~ 80	1,000~2,000	3 to 6 months
Standard type	D1	70,000 or lower	Dusty	-15~100	100~ 500	1 week to 1 month
Standard type	D1	70,000 or lower	Humid	-15~100	30~ 100	1 day to 1 week

6. Bearing Fit to Housing Comparison

Spherical bore dia. over incl.	NTN	ASAHI (NACHI)	FYH (KOYO)
30 ~ 52	K7	H7	J7
52 ~ 180	J7	H7	J7
180 ~ 300	H7	H7	J7

7. Bearing Internal Clearance

1) Radial internal clearance of ball bearing (cylindrical bore)

 Units: μm

Nominal bearing bore dia. d mm		C2		CN (normal)		C3		C4	
Greater than	Smaller than	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
10	18	0	9	3	18	11	25	18	33
18	24	0	10	5	20	13	28	20	36
24	30	1	11	5	20	13	28	23	41
30	40	1	11	6	20	15	33	28	46
40	50	1	11	6	23	18	36	30	51
50	65	1	15	8	28	23	43	38	60
65	80	1	15	10	30	25	51	46	71
80	100	1	18	12	36	30	58	53	84
100	120	2	20	15	41	36	66	60	97
120	140	2	23	18	48	41	81	71	114

Notes 1: The clearances above are net clearances, without considering elastic deformation due to measuring load.

2: With tapered bore bearings, internal clearances are each one level greater than those of cylindrical bore bearings.

2) Ball bearing types and radial internal clearance

Type	Code	Radial internal clearance	
		Cylindrical bore type	Tapered bore type
Standard type	D1	CN	C3
Heat resistant type	HT2D1	C4	C5
Cold resistant type	CT1D1	CN	C3

8. Handling of Bearing Units

Although NTN's bearing units boast simple handling, inappropriate handling can lead to premature failure of the units. Accidents occurring to bearing units are often caused by improper installation or handling of bearing units. If handled correctly, most accidents can be prevented.

8.1 Installation of bearing housing

Pillow block, flange, and take-up type bearing units

NTN bearing units can be easily installed with a diversity of mounting methods, allowing full design performance to be achieved. When installing them, however, observe the following precautions to ensure that the bearings will work properly for their full design life.

- 1) Bearing housing mounting face must be sufficiently rigid.
- 2) Bearing housing mounting face must be as flat and smooth as possible (when placing the bearing housing on the frame, the housing must be stably seated without any excessive play) (Fig.8.1).

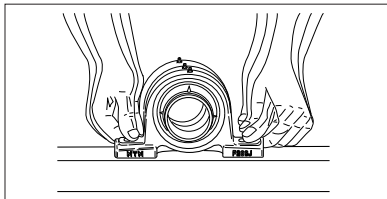


Fig.8.1

Installing a bearing housing to an uneven frame deforms the bearing housing, causing the bearing to become deformed too, possibly resulting in premature failure of the bearing.

- 3) The tolerance of the angle between the bearing housing mounting face and the

shaft should be $\pm 2^\circ$ max. (for narrower outer ring type, $\pm 1^\circ$ max.) for convenience of grease injection. For covered units, the tolerance should be $\pm 1^\circ$ max. (Fig.8.2).

- 4) The pillow block type and flange type bearing housings are provided with knock-pin seats for correct positioning.

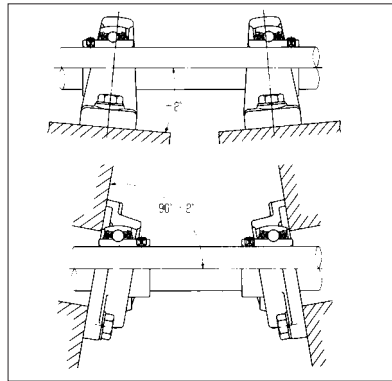


Fig.8.2

Cartridge type bearing unit

For normal operating conditions, the cartridge type bearing housing fit must be H7. The housing bore must be finished so that the bearing unit can move freely in the axial direction.

Take-up type bearing unit

To install the take-up type bearing unit, fit the unit in the guide rail on a frame, and secure the inner ring of the bearing to the shaft. Then, install the adjusting bolt and nut, and lock the bearing unit with a tapered pin. Then finally, correctly position the bearing unit.

For dimensions and machining precision of the guide rail, adjusting bolt and nut, refer to the separate catalogue "Bearing Unit."

8.2 Fitting bearing units to shafts

1) Installation of set screw type bearing unit

To install the set screw type bearing unit to the shaft, equally tighten two set screws to the recommended torque.

NTN ball-point set screws, having the construction as shown in **Fig.8.3**, are hard to loosen even when subjected to vibrations or impact loads. If fitting clearance between the inner ring and the shaft is small, make a flat (as shown in **Fig.8.4**) approx. 0.2 to 0.5 mm deep on an area of the shaft to which the ball point of the set screw is seated. This arrangement allows the tight-fit bearing to be easily removed from the shaft.

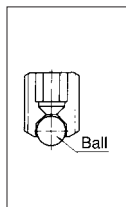


Fig.8.3

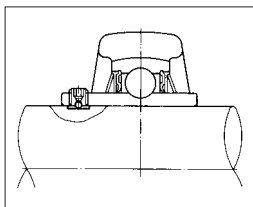


Fig.8.4

Install the bearing unit to the shaft according to the steps below.

- 1) First, make sure that the set screw does not protrude from the bearing bore face.
- 2) Hold the bearing unit with hands squarely to the shaft, and fit it over the shaft straight. Do not turn it. NEVER exert any impact to the bearing unit, nor hit the flinger (**Fig.8.5**).

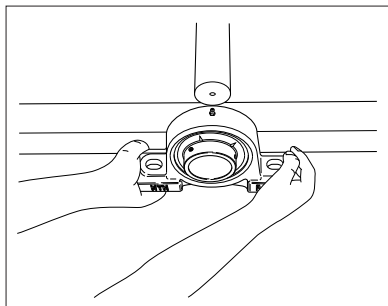


Fig.8.5

- 3) Securely fit an Allen key wrench to the hexagonal socket of a set screw. Then, tighten the two set screws equally with a tightening torque that can be found in **Table 8.1** (**Fig.8.6**).
- 4) Securely install the bearing housing to the specified position of the machines. Note that steps 3) and 4) may be performed in reverse order.

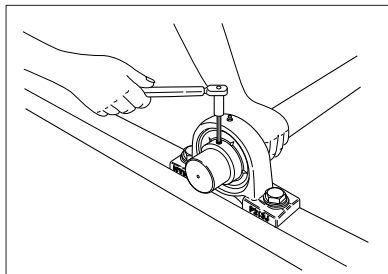


Fig.8.6

Table 8.1 Recommended torques for tightening set screws

Designation of the bearings of applicable units			Designation of set screws		Tightening torques N·m {lbi} (Max)
			millimeter	inch	
AS201~203	—	—	MSS5	S8W4.826×32×7	3.4 {35}
UC201~205 AS204~205	—	—	MSS5	S8W4.826×32×7	3.9 {40}
UC206 AS206	—	UC305~306	MSS6	S8W1/4×28×8	4.9 {50}
UC207 AS207	UCX05	—	MSS6	S8W1/4×28×8	5.8 {60}
UC208~210 AS208~210	—	—	MSS8	S8W5/16×24×10	7.8 {80}
UC211	UCX06~X08	UC307	MSS8	S8W16/5×24×10	9.8 {100}
UC212	UCX09	—	MSS10	S8W3/8×24×12	16.6 {170}
UC213~215	—	UC308~309	MSS10	S8W3/8×24×12	19.6 {200}
UC216	UCX10	—	MSS10	S8W3/8×24×12	22.5 {230}
—	UCX11~X12	—	MSS10	S8W3/8×24×12	24.5 {250}
UC217~218	UCX13~X15	UC310~314	MSS12	S8W1/2×20×13	29.4 {300}
—	UCX16~X17	—	MSS12	S8W1/2×20×13	34.3 {350}
—	UCX18	UC315~316	MSS14	S8W9/16×18×15	34.3 {350}
—	UCX20	UC317~319	MSS16	S8W5/8×18×18	53.9 {550}
—	—	UC320~324	MSS18	S8W3/4×16×25	58.8 {600}
—	—	UC326~328	MSS20	—	78.4 {800}

2) Installation of adapter type bearing (tapered bore)

The adapter type bearing unit can be reliably secured to the shaft even when it is subjected to impact loads and vibrations. Under any operating conditions, this bearing unit can be used on a straight shaft whose fit grade is as poor as h9. Remember, however, this bearing unit must not be used on a shaft that is subjected to great axial load.

Fit the adapter type unit to the shaft according to the procedure below.

- 1) Fit the sleeve onto the shaft and position it so that its tapered section is roughly centered to the bearing. For easy fitting of the sleeve to the shaft, expand its slot with a flatblade screwdriver. Be sure to install the sleeve so that the nut is positioned opposite to pulley, etc., for easy handling of the bearing unit (**Fig.8.7**).

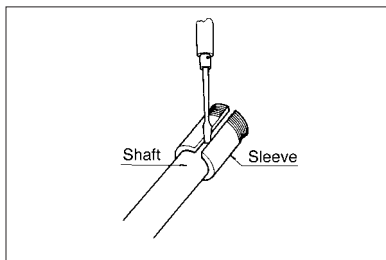


Fig.8.7

- 2) Fit the bearing unit over the sleeve and fit a cylindrical support, which covers the whole circumference of the bearing's inner ring, to the side face of the bearing's inner ring on the nut side. Then, gently tap the larger diameter side of the sleeve in the arrow mark direction along the whole circumference of the

sleeve so that the bearing inner ring is closely seated on the tapered side of the sleeve (**Fig.8.8 (a)**).

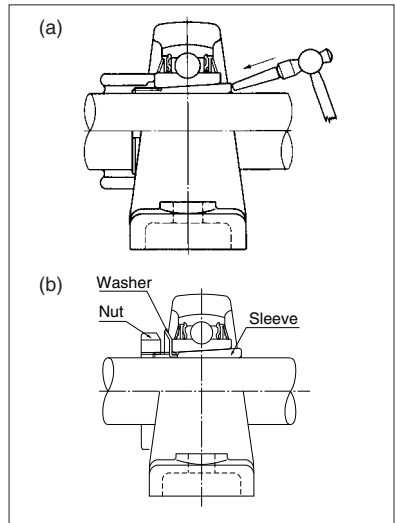


Fig.8.8

- 3) Place the lockwasher, and fully hand-tighten the nut (**Fig.8.8 (b)**).
- 4) Fit a jig or a screwdriver on the bevel of the nut, and tap it with a hammer until the nut turns 60° to 90° (NEVER tap the flinger). Overtightening the nut will decrease bearing clearance and deform the inner ring, possibly resulting in overheating or seizing of the bearing. After tightening the nut, check that the shaft can be smoothly turned by hands.
- 5) To lock the nut, bend a tab of the lockwasher that corresponds with the bevel on the nut. NEVER slacken the nut to fit a tab of the lockwasher to the bevel on the nut.
- 6) Securely install the bearing housing to the specified position of the machine.

3) Installation of eccentric collar type

When installing the eccentric collar type bearing unit, tighten the eccentric collar by turning it in the shaft rotating direction to secure the shaft to the inner ring. As a result, the shaft is reliably coupled with the inner ring and virtually no deformation occurs to the inner ring of the bearing. However, this bearing unit is not recommended for the machines which can run forward and backward, since the eccentric collar can loosen.

Installation procedure of this unit is described below.

- 1) Check the frame to mount the bearing housing sort has rigidity and flatness sufficient for intended operating conditions.
- 2) Check the shaft end for burrs and confirm that the tip of eccentric collar set screw does not stick out of the bearing bore face (Fig.8.9).
- 3) Securely install the bearing housing to the frame.
- 4) Correctly position the bearing unit relative to the shaft so the bearing unit is not subjected to axial loads. Then, fit the eccentric collar to the bearing unit.
- 5) Fit the concave side of the eccentric cover over the protrusion provided in the inner ring. Then, turn the eccentric collar in the shaft rotating direction by hands to tighten it temporarily (Fig.8.10).
- 6) Fit a rod in the hole on the circumference of the eccentric collar and tap it with a hammer so the collar turns in the shaft rotating direction, as shown in Fig.8.11.
- 7) Tighten the eccentric collar set screws to the shaft. The recommended tightening torque can be found in Table 8.2.

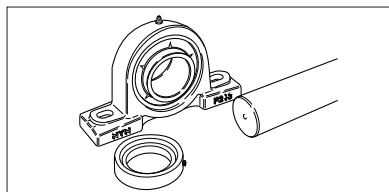


Fig.8.9

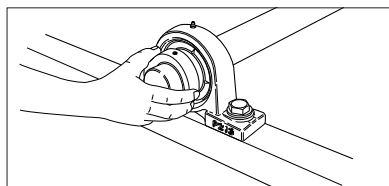


Fig.8.10

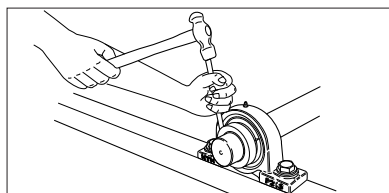


Fig.8.11

Table 8.2 Recommended torques for tightening set screws of the eccentric collar

Designation of the bearings of applicable units		Designation of set screws		Tightening torques N·m {lbf} (Max)
		millimeter	inch	
UEL204~205, AEL201~205	—	MSS6	S8W1/4×28×8	7.8 {80}
UEL206, AEL206	UEL305~307	MSS8	S8W5/16×24×10	9.8 {100}
UEL207, AEL207	—	MSS10	S8W3/8×24×12	11.7 {120}
UEL208~210, AEL208~210	—	MSS10	S8W3/8×24×12	15.6 {160}
UEL211, AEL211	—	MSS10	S8W3/8×24×12	19.6 {200}
UEL212~215, AEL212	UEL308~312	MSS10	S8W3/8×24×12	29.4 {300}
—	UEL313~314	MSS12	S8W1/2×20×13	34.3 {350}
—	UEL315~317	MSS16	S8W5/8×18×18	53.9 {550}
—	UEL318~322	MSS20	S8W3/4×16×25	78.4 {800}

4) Installation of covered bearing unit

For covered bearing units, selecting the shaft and fitting the shaft and bearing housing are identical with those for the standard bearing units. The cover can be easily fitted without any special tool or jig. The installation procedure is described below.

- 1) Remove the steel plate cover from the bearing unit. The cover can be easily removed with hands. If it cannot be easily removed, use a screwdriver as shown in **Fig.8.12**.

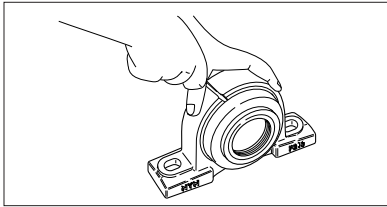


Fig.8.12

- 2) To enhance dust and moisture resistance, completely fill the area between the two lips of the rubber seal in the cover with grease. Also, put grease into the cover inside space, to approx. 2/3 its volume (apply cup grease unless otherwise specified) (**Fig.8.13**).

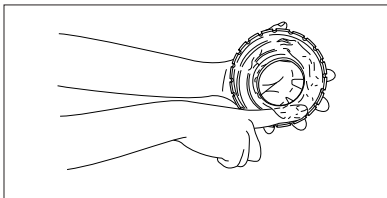


Fig.8.13

- 3) Chamfer the shaft end to protect the lips of the rubber seal against possible damage. Then, fit the greased cover over the shaft. To do so, fit the inner ring to the shaft, and then tighten the mounting bolts of the housing. The installation procedure sequence may be reversed for convenience in installation (first, tighten the mounting bolts of the housing, and then fit the inner ring to the shaft).
- 4) Fit the cover that is fitted over the shaft, into the spigot of the bearing housing. When fitting the cover, NEVER directly hit it with a steel hammer. First, place a block, made of synthetic resin or wood, over the cover. Then, from 45° direction, tap it with a hammer around the circumference of the cover to exert a uniform impact on the cover to fit it into the groove on the bearing housing (**Fig.8.14**).

Fasten the cast iron cover with three set bolts.

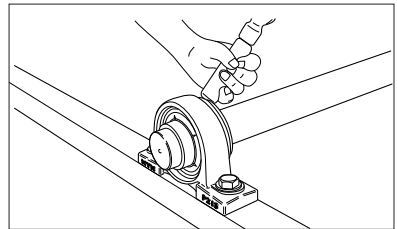


Fig.8.14

- 5) Put grease in the other cover in a manner similar to step 2), and fit the cover over the shaft. If the cover is a closed type, put some grease in advance in the spigot section of the bearing housing (**Fig.8.13**).

- 6) Fit the cover that is fitted over the shaft into the spigot of the bearing housing, in a manner similar to step 4)(**Fig.8.15**).

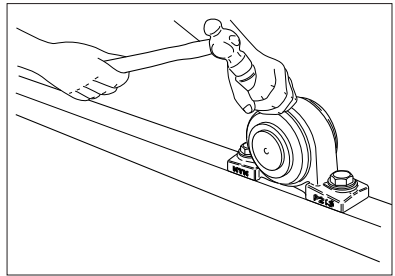


Fig.8.15

Steel plate cover designed for easy installation and removal

- 1) NTN steel plate covered unit has a cover fitting groove as illustrated below (**Fig.8.16**). Fit the cover in the cover fitting groove and tap it with a synthetic resin or wooden hammer from a 45° direction. Then, the cover is securely fitted by reaction force (**Fig.8.17**)(note that #204 is a press-fitted type).
- 2) For easy removal of the cover, a groove is cut on the outer side of the cover. When removing the cover, fit a flatblade screwdriver into this groove, and then pry the cover to remove it. Other manufacturers' bearing covers are all press-fitted, making fitting and removal of covers difficult.

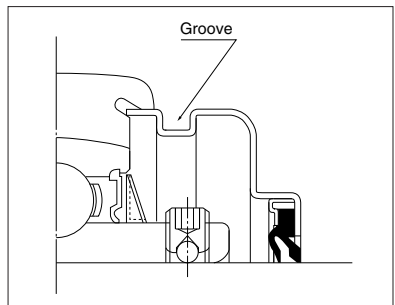


Fig.8.16

From 45° direction, tap around the circumference of the cover to apply a uniform impact on the cover.

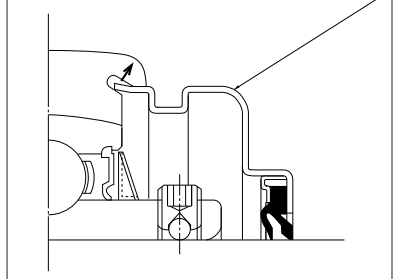


Fig.8.17

8.3 Removing a bearing unit

If any problem with the bearing unit necessitates removal and replacement of the bearing, reverse the installation procedure. Before removing the unit, make sure of the following.

- 1) **Consider the set screw type:** slacken the set screws, so that the screw point does not scratch on the shaft when removing the unit.
- 2) **Consider the adapter type:** straighten the bent tab of the lock washer, and turn back the nut by two or three turns. Then, place a metal block on the nut side face, and tap it with a hammer around the circumference to remove the sleeve (**Fig.8.18**). NEVER tap the cover if only a portion of nut threading remains engaged. Otherwise, the thread of the nut can be damaged.

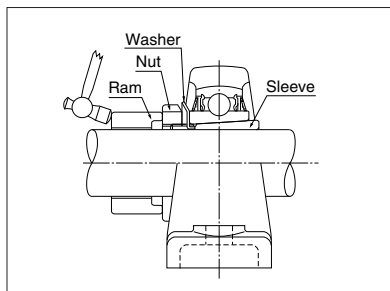


Fig.8.18

8.4 Replacing a bearing

When the bearing of the NTN bearing unit is inoperative due to any faults, replace the bearing alone. The housing can be reused. The replacement procedure is described below.

First, fully tighten the set screws to prevent them from being caught on the bearing housing when the bearing is tilted. Next, insert the handle of a hammer into the bore face of the bearing, and pry the bearing open with the handle of a hammer. If it is completely tilted to 90°, draw it out on the cutout side of the bearing. To fit a new bearing to the housing, perform the procedure above in reverse order.

Useful tips*Brief information
about bearing units***Floating-side bearings**

In applications where bearing units are installed at greater intervals, or the bearing-shaft arrangement is subjected to temperature rises, use one bearing unit as the fixing-side bearing that is permanently secured to the shaft so it can bear both axial and radial loads.

Use the other bearing unit as a floating-side bearing that is subjected only to radial load to compensate for the thermal expansion of the shaft and possible bearing-to-bearing dimensional errors resulting from assembly.

A bearing system lacking a floating-side bearing will be subjected to excessive axial load, possibly leading to premature failure. For such bearing systems, a cartridge type bearing unit, as shown in **Fig. A** is recommended. To simplify installation work on this bearing unit, a keyway is provided on

the shaft as illustrated in **Figs. B and C**, and the tip of dog point set screw or keybolt is fitted in the keyway as a guideway. Remember, however, noise can occur at the guideway. Therefore, it is important to determine whether this arrangement is suitable for your machine.

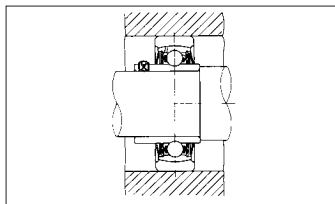


Fig. A Cross-section of cartridge type bearing unit installed

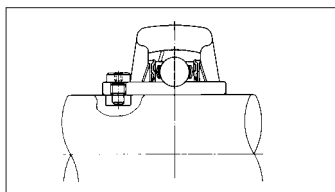


Fig. B Cut a keyway on the shaft, and install with dog point set screw.

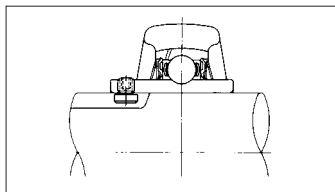


Fig. C Cut a keyway on the shaft, and install with keybolt.

Recommended tightening torque of hex. bolts for installing bearing housings

Nominal size of bolt	Tightening torque N · m (kgf · cm)
M 6	5 { 55 }
M 8	14 { 140 }
M10	27 { 280 }
M12	47 { 480 }
M14	76 { 780 }
M16	118 { 1 200 }
M18	162 { 1 650 }
M20	225 { 2 300 }
M22	314 { 3 200 }
M24	392 { 4 000 }
M27	588 { 6 000 }
M30	784 { 8 000 }

Remarks: Tensile strength of bolt should be 40 kgf/mm² (4T).

9. Compatibility table for part numbers of different manufacturers

9.1 Bearing unit

Type	Manufacturer	NTN	ASAHI-NACHI	NSK	FYH-KOYO
Pillow block type	Steel plate covered type	S-UCP2...D1	UCP2...C	ZUCP2...P	UCP2...C
		SM-UCP2...D1	UCP2...E	ZUCP2...PE	UCP2...CD
		S-UKP2...D1	UKP2...C	ZUKP2...P	UKP2...C
		SM-UKP2...D1	UKP2...E	ZUKP2...PE	UKP2...CD
	Cast Iron covered type	C-UCP2...D1	CUCP2...C	CUCP2...C	UCP2...FC
		CM-UCP2...D1	CUCP2...CE	CUCP2...CE	UCP2...FCD
		C-UCP3...D1	CUCP3...C	CUCP3...C	UCP3...C
		CM-UCP3...D1	CUCP3...CE	CUCP3...CE	UCP3...CD
		C-UKP2...D1	CUKP2...C	CUKP2...C	UKP2...FC
		CM-UKP2...D1	CUKP2...CE	CUKP2...CE	UKP2...FCD
		C-UKP3...D1	CUKP3...C	CUKP3...C	UKP3...C
		CM-UKP3...D1	CUKP3...CE	CUKP3...CE	UKP3...CD
	High center type	UHP2...D1	UCPH2	UCPH2	UCPH2
		UCUP2...D1	UCPA2	UCPA2	UCPA2
	Narrow type	UHP2...D1	UCPA2	UCPA2	UCPA2
	Eccentric collar type	UEL2...D1	UGP2 [※]	EWP2	NAP2
	Light cast iron type	ASP2	BLLP	UBLP2	BLP2
		AELP2		ENLP2	ALP2
		CSP2			
	Steel plate type	ASPP2	BPP	UBPP2	SBPP2
		AELPP2		ENPP2	SAPP2
	Steel plate type w/rubber	ASRPP2	BPR	UBPPR2	
		AELRPP2			

Item marked ※ differ from similar products in total ball bearing width.

Continued on next page

Continued from previous page

Type	Manufacturer	NTN	ASAHI·NACHI	NSK	FYH·KOYO
Flange type	Square flange steel plate covered type	S-UCF2...D1	UCF2...C	ZUCF2...P	UCF2...C
		SM-UCF2...D1	UCF2...E	ZUCF2...PE	UCF2...D
		S-UKF2...D1	UKF2...C	ZUKF2...P	UKF2...C
		SM-UKF2...D1	UKF2...E	ZUKF2...PE	UKF2...D
	Square flange cast iron covered type	C-UCF2...D1	CUCF2...C	CUCF2...C	UCF2...FC
		CM-UCF2...D1	CUCF2...CE	CUCF2...CE	UCF2...FD
		C-UCF3...D1	CUCF3...C	CUCF3...C	UCF3...C
		CM-UCF3...D1	CUCF3...CE	CUCF3...CE	UCF3...D
		C-UKF2...D1	CUKF2...C	CUKF2...C	UKF2...FC
		CM-UKF2...D1	CUKF2...CE	CUKF2...CE	UKF2...FD
		C-UKF3...D1	CUKF3...C	CUKF3...C	UKF3...C
		CM-UKF3...D1	CUKF3...CE	CUKF3...CE	UKF3...D
	Square flange cast iron cover w/spigot joint type	C-UCFS3...D1	CUCFS3...C	CUCFS3...C	UCFS3...C
		CM-UCFS3...D1	CUCFS3...CE	CUCFS3...CE	UCFS3...D
		C-UKFS3...D1	CUKFS3...C	CUKFS3...C	UKFS3...C
		CM-UKFS3...D1	CUKFS3...CE	CUKFS3...CE	UKFS3...D
	Round flange steel plate w/spigot joint type	S-UCFC2...D1	UCFC2...C	ZUCFC2...P	UCFC2...C
		SM-UCFC2...D1	UCFC2...E	ZUCFC2...PE	UCFC2...D
		S-UKFC2...D1	UKFC2...C	ZUKFC2...P	UKFC2...C
		SM-UKFC2...D1	UKFC2...E	ZUKFC2...PE	UKFC2...D
Round flange cast iron cover w/spigot joint type	C-UCFC2...D1	CUCFC2...C	CUCFC2...C	UCFC2...FC	
	CM-UCFC2...D1	CUCFC2...CE	CUCFC2...CE	UCFC2...FD	
	C-UKFC2...D1	CUKFC2...C	CUKFC2...C	UKFC2...FC	
	CM-UKFC2...D1	CUKFC2...CE	CUKFC2...CE	UKFC2...FD	

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Type	Manufacturer	NTN	ASAHI-NACHI	NSK	FYH-KOYO	
Flange type	Rhombus flange steel plate covered type	S-UCFL2...D1	UCFL2...C	ZUCFL2...P	UCFL2...C	
		SM-UCFL2...D1	UCFL2...E	ZUCFL2...PE	UCFL2...D	
		S-UKFL2...D1	UKFL2...C	ZUKFL2...P	UKFL2...C	
		SM-UKFL2...D1	UKFL2...E	ZUKFL2...PE	UKFL2...D	
	Rhombus flange cast iron covered type	C-UCFL2...D1	CUCFL2...C	CUCFL2...C	UCFL2...FC	
		CM-UCFL2...D1	CUCFL2...CE	CUCFL2...CE	UCFL2...FD	
		C-UCFL3...D1	CUCFL3...C	CUCFL3...C	UCFL3...C	
		CM-UCFL3...D1	CUCFL3...CE	CUCFL3...CE	UCFL3...D	
		C-UKFL2...D1	CUKFL2...C	CUKFL2...C	UKFL2...FC	
		CM-UKFL2...D1	CUKFL2...CE	CUKFL2...CE	UKFL2...FD	
		C-UKFL3...D1	CUKFL3...C	CUKFL3...C	UKFL3...C	
		CM-UKFL3...D1	CUKFL3...CE	CUKFL3...CE	UKFL3...D	
	Modified rhombus flange type	UCFA2...D1	UCFA2	UCFA2	UCFA2	
		UCFH2...D1	UCFK2	UCFK2	UCFB2	
	Modified flange type	Eccentric collar type	UELF2...D1	UGF2 [※]	EWFC2	NAF2
			UELFC2...D1		EWFL2	NAFC2
			UELFL2...D1	UGFL2 [※]		NAFL2
			UELFU2			NANF2
			UELFLU2			NANFL2
	Light cast iron type	ASFB2	BLFL	UBLF2	BLF2	
AELFB2			ENLF2	ALF2		
CSFB2						
Steel plate type	ASPF2	BPF	UBPF2	SBPF2		
	ASPFL2	BPFL	UBPFL2	SBPFL2		

Total width of ball bearings for bearing units marked ※ differs from that of similar NTN products.

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Type		Manufacturer	NTN	ASAHI·NACHI	NSK	FYH·KOYO	
Flange type	Steel plate type		AELPF2		ENPF2	SAPF2	
			AELPFL2		ENPFL2	SAPFL2	
Take-up type	Steel plate covered type		S-UCT2···D1	UCT2···C	ZUCT2···P	UCT2···C	
			SM-UCT2···D1	UCT2···E	ZUCT2···PE	UCT2···CD	
			S-UKT2···D1	UKT2···C	ZUKT2···P	UCT2···C	
			SM-UKT2···D1	UKT2···E	ZUKT2···PE	UKT2···CD	
	Cast iron covered type		C-UCT2···D1	CUCT2···C	CUCT2···C	UCT2···FC	
			CM-UCT2···D1	CUCT2···CE	CUCT2···CE	UCT2···FCD	
			C-UCT3···D1	CUCT3···C	CUCT3···C	UCT3···C	
			CM-UCT3···D1	CUCT3···CE	CUCT3···CE	UCT3···CD	
			C-UKT2···D1	CUKT2···C	CUKT2···C	UKT2···FC	
			CM-UKT2···D1	CUKT2···CE	CUKT2···CE	UKT2···FCD	
			C-UKT3···D1	CUKT3···C	CUKT3···C	UKT3···C	
			CM-UKT3···D1	CUKT3···CE	CUKT3···CE	UKT3···CD	
		Hanger type		UCHB2···D1	UCECH2	UCEH2	UCHA2
			Stretcher	w/steel frame	UCL2···D1	UCL2+WL	UCL2+WLA
UCM2···D1	UCTU2+WU	UCTU2+WUA			UCTU2		
UCM3···D1	UCTU3+WU	UCTU3+WUA			UCTU3		
UCT2···D1	UCT2+WB	UCT2+WB			UCTH2		
Steel plate mini type	ASPT2			UBTPU2	SBPTH2		
	AELPT2						

9.2 Stainless Series bearing unit

NTN	FYH	ASAHI
F-UCPM204/LP03	UCP204HIS6	MUCP204
F-UCPM205/LP03	UCP205HIS6	MUCP205
F-UCPM206/LP03	UCP206HIS6	MUCP206
F-UCPM207/LP03	UCP207HIS6	MUCP207
F-UCPM208/LP03	UCP208HIS6	MUCP208
F-UCPM209/LP03	UCP209HIS6	MUCP209
F-UCPM210/LP03	UCP210HIS6	MUCP210
F-UCFM204/LP03	UCFL204HIS6	MUCFL204
F-UCFM205/LP03	UCFL205HIS6	MUCFL205
F-UCFM206/LP03	UCFL206HIS6	MUCFL206
F-UCFM207/LP03	UCFL207HIS6	MUCFL207
F-UCFM208/LP03	UCFL208HIS6	MUCFL208
F-UCFM209/LP03	UCFL209HIS6	MUCFL209
F-UCFM210/LP03	UCFL210HIS6	MUCFL210

Notes 1: Although NTN's Stainless Series bearing units are oilless type, lubricated bearing units are also available.

2: When considering use of food grade grease, add "/L791" suffix instead of "/LP03".

(Example: F-UCPM204/L791)

3: Bearing units from FYH and ASAHI are lubricated as standard.

9.3 Plastic Series bearing unit

NTN	FYH	ASAHI
F-UCPR204/LP03	UCVP204S6	No similar unit
F-UCPR205/LP03	UCVP205S6	//
F-UCPR206/LP03	UCVP206S6	//
F-UCPR207/LP03	UCVP207S6	//
F-UCPR208/LP03	UCVP208S6	//
F-UCFLR204/LP03	UCVFL204S6	No similar unit
F-UCFLR205/LP03	UCVFL205S6	//
F-UCFLR206/LP03	UCVFL206S6	//
F-UCFLR207/LP03	UCVFL207S6	//
F-UCFLR208/LP03	UCVFL208S6	//

Notes 1: Although NTN's standard Plastic Series bearings are oilless type, lubricated bearing units are also available. (Standard bearing housings are lubricated type.)

2: When considering use of food grade grease, add "/L791" suffix instead of "/LP03".

(Example: F-UCPM204/L791)

3: Bearing units from FYH are lubricated as standard.

9.4 Ball bearing

Type	NTN	ASAHI·NACHI	NSK	FYH·KOYO
Spherical outer face	UC2···D1	UC2	UC2	UC2
	UK2···D1	UK2	UK2	UK2
	UEL2···D1	UG2··· +ER ^{※1}	EW2	NA2
	AS2	B	UB2	SB2
	AEL2		EN2	SA2
	CS2		CS2	SC2
Cylindrical outer face	UCS···D1	UR2 ^{※2}	UR2 ^{※2}	RB2 ^{※2} ^{※3}
	UKS2			
	UELS2			
	ASS2			
	AELS2			

Items marked ※1 differ from similar products in total width of ball bearing.

Items marked ※2 differ from similar products in the width of outer ring.

Items marked ※3 have no oil inlet.

9.5 Codes for special specifications, etc.

	NTN		ASAHI-NACHI		FYH-KOYO		NSK	
Bearing housing	N	Cast steel ※1 (production discontinued)	K		SC		K	
	N1	Ductile			H4			
	G	Gas cut SS400	MP		H5			
	E	Light ductile						
Seal	LLJ	Triple seal on both sides (low torque type)			L III	Triple seal		
	LLS	Triple seal on both sides (high torque type)						
Grease	Standard	Alvania Grease S3	D1	Alvania Grease S3	D1	Gold No.3		
	Semi-heat resistant		HR4	Superlube No.3	D3K2	Superlube No.2		
	HT2	Toray Silicone SH44M	HR5	Superlube No.3	D1K2	Toray Silicone SH41	T3	
	CT1	Toray Silicone SH33L	CR2A	AeroShell Grease 7	D2K2	Toray Silicone SH33M	T1	
Lubrication type	D1	Lubricated type						
		Dry type	G00		E4		GOO	

※1 Steel Series products are available to supersede Cast Steel Series products.

9.6 Table of NTN and other manufacturers' similar bore code numbers of inch size bearings

Nominal shaft dia. inch	Bore dia. mm	Bore code No.		
		NTN	FYH · ASAHl	NSK
$\frac{1}{2}$	12.7	01-008	01- 8	01- 8S
$\frac{9}{16}$ $\frac{5}{8}$	14.288 15.875	02-009 02-010	— 02-10	02- 9S 02-10S
$\frac{11}{16}$	17.462	03-011	—	03-11S
$\frac{3}{4}$	19.05	04-012	04-12	04-12S
$\frac{13}{16}$ $\frac{7}{8}$ $\frac{15}{16}$ 1	20.638 22.225 23.812 25.4	05-013 05-014 ¹⁾ 05-015 05-100	— 05-14 ¹⁾ — 05-16	05-13S 05-14S ¹⁾ 05-15S 05-16S
$1\frac{1}{16}$ $1\frac{1}{8}$ $1\frac{3}{16}$ $1\frac{1}{4}$	26.988 28.575 30.162 31.75	06-101 06-102 06-103 06-104	— 06-18 — —	06-17S 06-18S 06-19S 06-20S
$1\frac{1}{4}$ $1\frac{5}{16}$ $1\frac{3}{8}$ $1\frac{7}{16}$	31.75 33.338 34.925 36.512	07-104 07-105 07-106 07-107	07-20 — 07-22 —	07-20S 07-21S 07-22S 07-23S
$1\frac{1}{2}$ $1\frac{9}{16}$	38.1 39.688	08-108 08-109	08-24 —	08-24S 08-25S
$1\frac{5}{8}$ $1\frac{11}{16}$ $1\frac{3}{4}$	41.275 42.862 44.45	09-110 09-111 09-112	09-26 — 09-28	09-26S 09-27S 09-28S
$1\frac{13}{16}$ $1\frac{7}{8}$ $1\frac{15}{16}$ 2	46.038 47.625 49.212 50.8	10-113 10-114 10-115 10-200	— 10-30 — 10-32	10-29S 10-30S 10-31S 10-32S
2 $2\frac{1}{16}$ $2\frac{1}{8}$ $2\frac{3}{16}$	50.8 52.388 53.975 55.562	11-200 11-201 11-202 11-203	— — 11-34 —	11-32S 11-33S 11-34S 11-35S

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Nominal shaft dia. inch	Bore dia. mm	Bore code No.		
		NTN	FYH · ASAHI	NSK
2 $\frac{1}{4}$	57.15	12-204	12-36	12-36S
2 $\frac{3}{8}$	60.325	12-206	12-38	12-38S
2 $\frac{1}{2}$	61.912	12-207	—	—
2 $\frac{1}{2}$	63.5	13-208	13-40	13-40S
2 $\frac{11}{16}$	68.262	14-211	—	14-43S
2 $\frac{3}{4}$	69.85	14-212	14-44	14-44S
2 $\frac{15}{16}$	74.612	15-215	—	15-47S
3	76.2	15-300	15-48	15-48S
3 $\frac{1}{8}$	79.375	16-302	16-50 ²⁾	16-50S
3 $\frac{1}{4}$	82.55	17-304	17-52	17-52S
3 $\frac{7}{16}$	87.312	18-307	—	18-55S
3 $\frac{1}{2}$	88.9	18-308	18-56	18-56S
3 $\frac{3}{4}$	95.25	19-312	19-60 ²⁾	19-60S
3 $\frac{15}{16}$	100.012	20-315	—	20-63S
4	101.6	20-400	20-64	20-64S

Note 1: Bore code No. above are applicable to the series 2, 3, and X of UC type bearings.

Example When bore code No. is 05-014, the part No. of bearings are as follows.

	NTN	FYH · ASAHI	NSK
Series 2	UC205-014D1	UC205-14	UC205-14S
Series 3	UC305-014D1	UC305-14	UC305-14S
Series X	UCX05-014D1	UCX05-14	—

2: The bore code No. marked with 2) are of ASAHI products.

3: The inch size bore bearings of AS, AEL, and UEL types are also available. Consult NTN.

10. Service Life of Grease

NTN Bearing Units are pre-filled with appropriate amounts of grease and do not need to be relubricated during operation under normal operating conditions. Even if they need to be relubricated, small amount of grease (approx. 1/2 to 1/3 of bearing internal volume) is sufficient for relubrication.

The service life of grease varies greatly depending not only on type and dimensions of the bearing, operating conditions, operating temperature, ingress of dust, moisture, and gas, but also on the kind of mineral oil and soap base of the grease.

Fig.10.2 gives a scale chart for calculating the service life of grease contained in NTN Bearing Units. The scale chart has been developed based on our long years of experience, and on test results, while reflecting substantial safety margins. This

chart applies only to normal operating conditions. By using this scale chart, the service life of grease can be determined as described in the example on the next page, once the type, bore diameter, and ratio of allowable to actual bearing speed ratio are found. However, this calculated grease service life does not imply any guarantee.

The actual service life of a particular grease will vary according to many different factors as previously described and the calculated life should be treated only as a guideline that reflects quite large safety margins.

As operating temperature increases, the service life of grease will become shorter. The amount by which service life is reduced depends on grease type. However, in general, the service life can be determined as given in **Fig.10.2** for the operating temperature range of -15°C to 100°C .

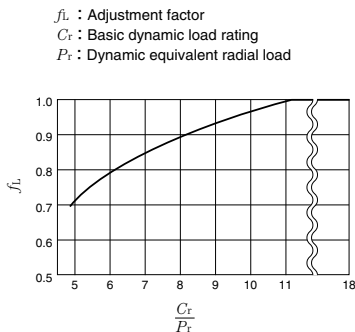


Fig.10.1 Value of adjustment factor f_L according to bearing load

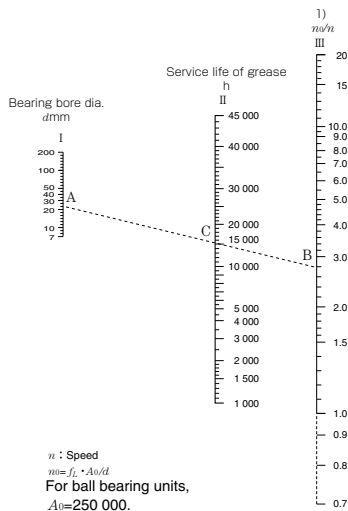


Fig.10.2

Example:

Find the service life of grease for UCP205 when the radial load is 1 000 N and speed is 3 600 min⁻¹. First, find the n_0 .

The basic dynamic rated load of UCP205

$$C_R = 14\,000 \text{ N.}$$

$$\text{From Fig.10.1, } \frac{C_R}{P_R} = \frac{14\,000}{1\,000} = 14$$

$$f_L = 1.00.$$

With ball bearing unit, $A_0 = 250\,000$.

Therefore,

$$n_0 = f_L \cdot \frac{A_0}{d} = 1.00 \times \frac{250\,000}{25} = 10\,000$$

$$\frac{n_0}{n} = \frac{10\,000}{3\,600} = 2.78.$$

On the chart in **Fig.10.2**, join point A that corresponds to bore diameter $d=25$ and point B that corresponds to $n_0/n=2.78$ with a straight line to find the intersection point C. Point C indicates a service life of 15 000 hours.

11. Allowable Speed

The allowable speed for running a ball bearing safely for long periods depends on the dimensions of the bearing, the load exerted on the bearing, and the peripheral speed of the seal contact. **Fig.11.1** shows the allow-

able speed, reflecting these factors. For higher speed applications, it is recommended that bearing units with non-contact seals be used. For further details, consult NTN.

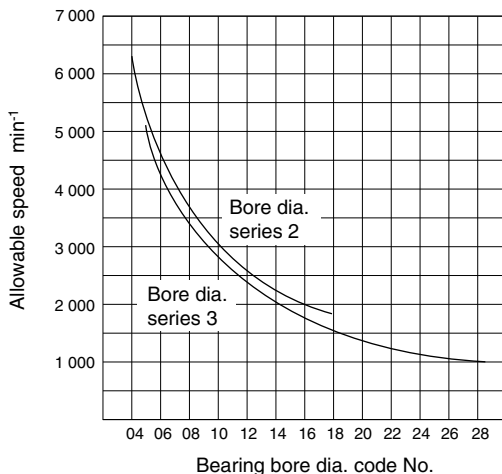


Fig.11.1 Allowable speed of ball bearings