

B-I-6.7 Thrust Angular Contact Ball Bearing for Ball Screw

(1) Features

This is highly rigid and accurate ball screw support bearing often used for the machine tool driving mechanism.

- ① High axial rigidity
Uses many balls, and set high contact angle at 60 degrees.
- ② Small friction torque
Friction torque is smaller than that of tapered or cylindrical roller bearing. This contributes to accurate rotation by a small driving power.
- ③ Axial play is pre-adjusted
Combination bearings are already adjusted to a suitable preload. Universal combination bearing (SU) furnishes certain preload for all combinations (DB, DF, and other).
- ④ Simple mounting structure
A duplex combination of bearings can receive axial and radial loads. Therefore, the installation structure is simpler than when both a thrust bearing and a radial bearing are used.
- ⑤ Easy handling
Inner and outer rings are inseparable, and are easy to handle.
- ⑥ Superb polyamide resin retainer
Uses polyamide resin retainer which is superb to friction and furnishes high precision rotations.

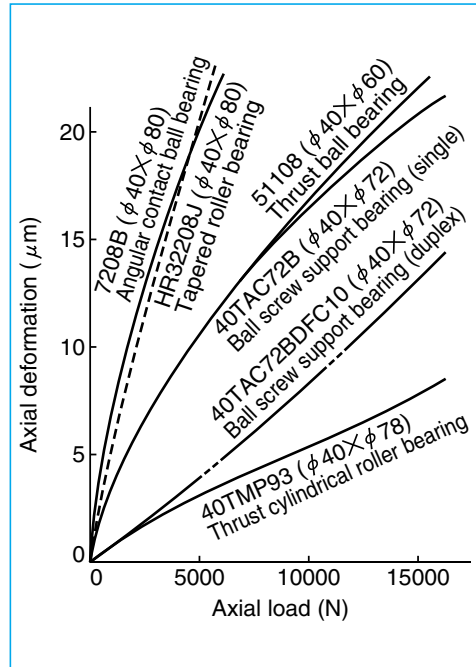


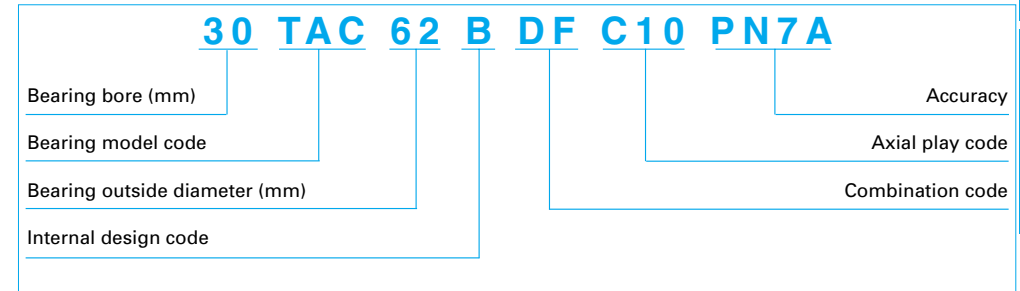
Fig. I-6-1 Axial rigidity of various bearings

Table I-6-12 Comparison with other types of bearings

Bearing type	Bearing rigidity (See Fig. 1.1)	Starting torque	Preload adjustment	Installation structure
Thrust angular contact ball bearing for NSK precision ball screw support unit	High	Low	Not required	Simple
Combined angular contact ball bearing	Low	Low	Not required	Simple
Combination of tapered roller bearings	Low	High	Complicated	Simple
Thrust ball bearing and radial bearing	High	Low	Complicated	Complicated
Thrust cylindrical roller bearing and radial bearing	Extremely high	Extremely high	Complicated	Complicated

Note : Consult NSK when you use these bearings other than the purpose of ball screw support.

(2) Composition of reference number



Remark : As "30 TAC 62 B," any part of the first half of the reference number is referred to as "nominal size" in this catalogue.

(3) Bearing combinations

Generally, a set uses more than two pieces (referred to as 'two rows') of bearings and, thus the preload is applied.

There are two types of combination:

- Bearing combination

Bearings are adjusted as a single combined set. Since the bearing alignment is pre-set, there is no interchangeability;

- Universal combination bearing (SU)

A combination of independent bearings, which is manufactured as a single bearing. Bearings are randomly-matched to obtain required preload by more than one of randomly picked up bearings.

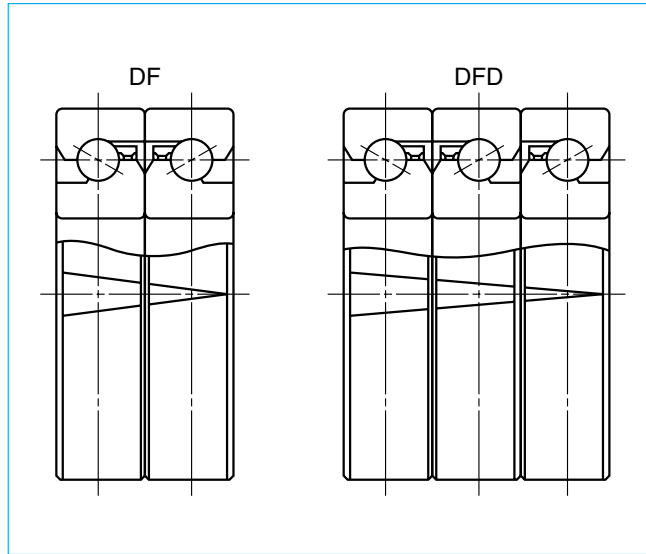


Fig. I-6-2 Examples of combination and "V" mark

1. Bearing combination

- Figure I-6-2 shows examples of combinations. There is "V" mark on the outside surface of the bearing to avoid misarrangement. A complete letter "V" should be formed when all bearings align correctly to form a set.
- DF combination which easily absorbs misalignment with the ball screw nut is used in general.

2. Universal combination bearing (SU)

- Unlike the above case, marks on the bearing outside surface do not form a letter "V." The tip of the "V" on each bearing simply indicates the direction to which axial load can be applied.

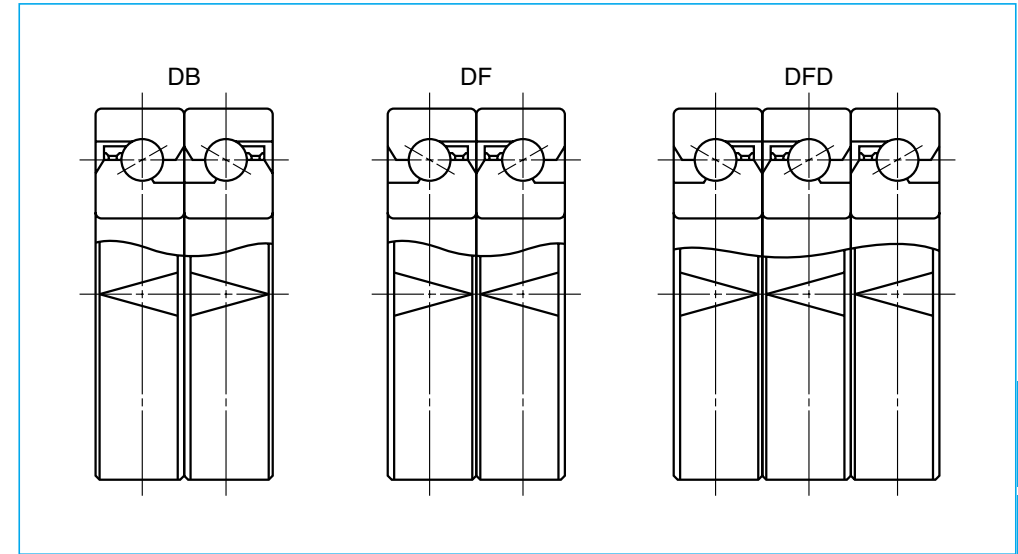


Fig. I-6-3 Example of universal combination (SU) and "V" mark

(4) Preload, rigidity, and starting torque

The table below shows preload, rigidity (spring modulus), and starting torque with grease lubrication. (The starting torque should be 1.4 times higher when oil is used as a lubricant.) Consult NSK for the bearing combinations not included in the Table.

Table I-6-13 Preload, rigidity, and starting torque

Reference number	Duplex combination DF				Triplex combination DFF	
	Axial play code	Preload (N)	Rigidity (N/μm)	Starting torque (N · m)	Axial play code	Preload (N)
15TAC 47B	C10	2150	750	0.14	C10	2950
17TAC 47B	C10	2150	750	0.14	C10	2950
20TAC 47B	C10	2150	750	0.14	C10	2950
25TAC 62B	C10	3150	1000	0.23	C10	4300
30TAC 62B	C10	3350	1030	0.24	C10	4500
35TAC 72B	C10	3800	1180	0.28	C10	5200
40TAC 72B	C10	3900	1230	0.28	C10	5300
40TAC 90B	C10	5000	1320	0.48	C10	6750
45TAC 75B	C10	4100	1270	0.29	C10	5600
45TAC 100B	C10	5900	1520	0.58	C10	8050
50TAC 100B	C10	6100	1570	0.60	C10	8250
55TAC 100B	C10	6100	1570	0.60	C10	8250
55TAC 120B	C10	6650	1760	0.64	C10	9100
60TAC 120B	C10	6650	1760	0.64	C10	9100

(5) Accuracy

① Accuracy grades

Uses NSK standard PN7A and PN7B which are equivalent to JIS4 grade of the radial ball bearing.

Combined bearing ————— PN7A

Universal combination bearing ——— PN7B

However, PN7A is stricter than JIS4 grade regarding axial run out of inner and outer rings. PN7B is stricter

regarding the tolerance of the bore and outside diameter (Table I-6-14).

② Fits

Table I-6-15 shows recommended values of the tolerance of shaft and housing bore.

Table I-6-14 Tolerance: thrust angular contact ball bearing for ball screw support

Unit: μm

Nominal size of bearing bore or outside diameter (mm)		Tolerance of bore				Tolerance of outside diameter				Tolerance of inner ring width		Axial run out of inner or outer ring
		Accuracy grade				Accuracy grade				Accuracy grade		Accuracy grade
		PN7A		PN7B		PN7A		PN7B		PN7A PN7B		PN7A PN7B
over	or less	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	Maximum
10	18	0	-4	0	-4	-	-	-	-	0	-80	2.5
18	30	0	-5	0	-4	-	-	-	-	0	-120	2.5
30	50	0	-6	0	-4	0	-6	0	-4	0	-120	2.5
50	80	0	-7	0	-5	0	-7	0	-5	0	-150	2.5
80	120	0	-8	0	-6	0	-8	0	-6	0	-200	2.5

Remarks : The tolerance of the outer ring width is the same as that of the inner ring width of the same bearing.

Rigidity (N/μm)	Starting torque (N · m)	Quadruplet combination DFF			
		Axial play code	Preload (N)	Rigidity (N/μm)	Starting torque (N · m)
1080	0.20	C10	4300	1470	0.29
1080	0.20	C10	4300	1470	0.29
1080	0.20	C10	4300	1470	0.29
1470	0.31	C10	6250	1960	0.46
1520	0.33	C10	6650	2010	0.49
1710	0.37	C10	7650	2350	0.55
1810	0.38	C10	7850	2400	0.57
1960	0.65	C10	10300	2650	0.96
1910	0.40	C10	8250	2550	0.59
2210	0.78	C10	11800	3000	1.16
2300	0.80	C10	12300	3100	1.18
2300	0.80	C10	12300	3100	1.18
2650	0.86	C10	13200	3550	1.27
2650	0.86	C10	13200	3550	1.27

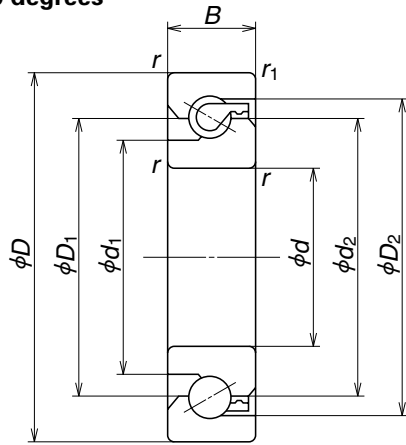
Table I-6-15 Tolerance of shaft bearing seat and housing bore

Unit: μm

Size of shaft or housing bore (mm)	Tolerance of shaft bearing seat h5		Tolerance of housing hole H6		
	upper	lower	upper	lower	
10	18	0	-8	-	-
18	30	0	-9	-	-
30	50	0	-11	+16	0
50	80	0	-13	+19	0
80	120	0	-15	+22	0

****TAC**B**

Nominal contact angle 60 degrees



Dynamic equivalent load $P_a = X F_r \times F_a$

Bearing configuration Combination code Number of the row that receives axial load	Duplex		Triplex			Quadruplet			
	DF	DT	DFD	DTD	DFT	DFF	DFT		
$e=2.17$	One row	Two rows	One row	Two rows	Three rows	One row	Two rows	Three rows	
$F_a/F_r \leq e$	X	1.9	-	1.43	2.33	-	1.17	2.33	2.53
	Y	0.54	-	0.77	0.35	-	0.89	0.35	0.26
$F_a/F_r > e$	X	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
	Y	1	1	1	1	1	1	1	1

External dimensions (mm)					Dimensions (mm)				Permissible rotational speed (min ⁻¹)		Bearing No.
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> Min.	<i>r</i> ₁ Min.	<i>d</i> ₁	<i>d</i> ₂	<i>D</i> ₁	<i>D</i> ₂	Grease lubrication	Oil lubrication	
15	47	15	1	0.6	27.2	34	34	39.6	6000	8000	15TAC 47B
17	47	15	1	0.6	27.2	34	34	39.6	6000	8000	17TAC 47B
20	47	15	1	0.6	27.2	34	34	39.6	6000	8000	20TAC 47B
25	62	15	1	0.6	37	45	45	50.7	4500	6000	25TAC 62B
30	62	15	1	0.6	39.5	47	47	53.2	4300	5600	30TAC 62B
35	72	15	1	0.6	47	55	55	60.7	3600	5000	35TAC 72B
40	72	15	1	0.6	49	57	57	62.7	3600	4800	40TAC 72B
40	90	20	1	0.6	57	68	68	77.2	3000	4000	40TAC 90B
45	75	15	1	0.6	54	62	62	67.7	3200	4300	45TAC 75B
45	100	20	1	0.6	64	75	75	84.2	2600	3600	45TAC 100B
50	100	20	1	0.6	67.5	79	79	87.7	2600	3400	50TAC 100B
55	100	20	1	0.6	67.5	79	79	87.7	2600	3400	55TAC 100B
55	120	20	1	0.6	82	93	93	102.2	2200	3000	55TAC 120B
60	120	20	1	0.6	82	93	93	102.2	2200	3000	60TAC 120B

Note : (1) Values are based on a standard preload (C10).

Basic dynamic load rating C_a			Permissible axial load			Mass (kg) (Reference)
One row sustaining load DF (N)	Two rows sustaining load DT, DFD, DFF (N)	Three rows sustaining load DTD, DFT (N)	One row sustains load DF (N)	Two rows sustain load DT, DFD, DFF (N)	Three rows sustain load DTD, DFT (N)	
21900	35500	47500	26600	53000	79500	0.144
21900	35500	47500	26600	53000	79500	0.144
21900	35500	47500	26600	53000	79500	0.135
28500	46500	61500	40500	81500	122000	0.252
29200	47500	63000	43000	86000	129000	0.224
31000	50500	67000	50000	100000	150000	0.310
31500	51500	68500	52000	104000	157000	0.275
59000	95500	127000	89500	179000	269000	0.674
33000	53500	71000	57000	114000	170000	0.270
61500	100000	133000	99000	198000	298000	0.842
63000	102000	136000	104000	208000	310000	0.778
63000	102000	136000	104000	208000	310000	0.714
67500	109000	145000	123000	246000	370000	1.23
67500	109000	145000	123000	246000	370000	1.16

* "Row" means the quantity of bearings that receive axial load. "Two rows" means two bearings are receiving axial load.