

5. Support Bearings and Support Bearing Units for Precision Ball Screws

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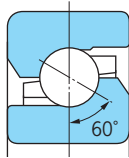
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5. Support bearings and support bearing units for precision ball screws

5.1 Structure and features

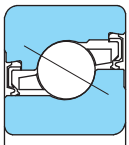
Support bearings for precision ball screws

The SAC type support bearings are angular contact thrust ball bearings specifically for supporting the screw shafts of precision ball screws (see Fig. 5. 1).

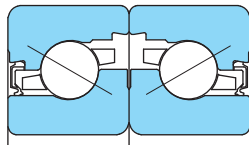


The bearings supporting the precision ball screws correspond to the type with contact seal.

Consult **JTEKT** for details about the type with contact seal and the pair patterns.



Both-side sealed type



Matching example of one-side sealed type

Fig. 5. 1 Structure of support bearings for precision ball screws

These bearings have many, small-diameter balls and thick section inner and outer rings.

The contact angle of these bearings is 60° enabling a high axial load and a certain degree of radial load to be applied simultaneously.

1) Features of support bearings for precision ball screws

- High rigidity
Has higher rigidity against axial load than conventional standard bearings (see Fig. 5. 2).
- Compact and lightweight
Since this bearing eliminates the need for an additional radial bearing or thrust bearing, it allows a compact surrounding design, thereby contributing to a reduction in the weight of the total system.
- High precision
A high-precision bearing suitable for precision ball screws.
- Preload adjustments not required
Preload is preadjusted to ensure an adequate preload after mounting. As a result, complicated adjustments are not required during mounting.
- Low torque
Requires lower friction torque than the tapered roller bearing or thrust roller bearing.

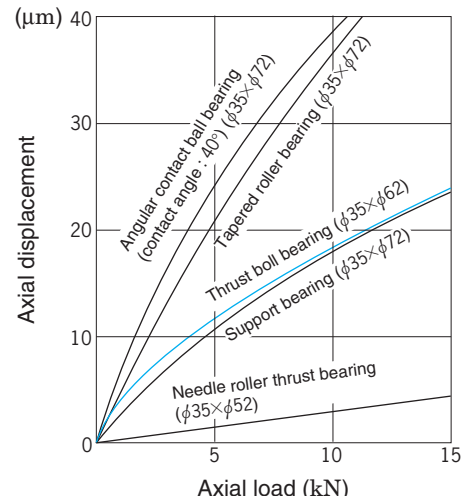


Fig. 5. 2 Relationship between axial load and displacement (comparison between support bearings and other bearings)

*The axial displacements shown above are values of the single-row bearings not preloaded.

2) Matched pair or stack support bearings

Table 5. 1 Types and suffixes of support bearings

Type and suffix of support bearing	
Combination of two	<p>Suffix DB Suffix DF</p>
Combination of three	<p>Suffix DFD</p>
Combination of four	<p>Suffix DFF</p>

- [Remarks]
1. A "V" mark is put on the outside surfaces of the outer rings of matched pair and stack bearings to indicate their combination type. For handling precautions of the type G bearing, refer to the bearing dimension table "1. 2 Matched pair angular contact ball bearings."
 2. Type G bearings are also manufactured, which enable any desired combinations. For descriptions of the type G bearing, refer to the bearing dimension table "1. 2 Matched pair angular contact ball bearings."

Support bearing units for precision ball screws

The support bearing unit for precision ball screws is a unit product combining the SAC type support bearing and a housing machined to a high precision.

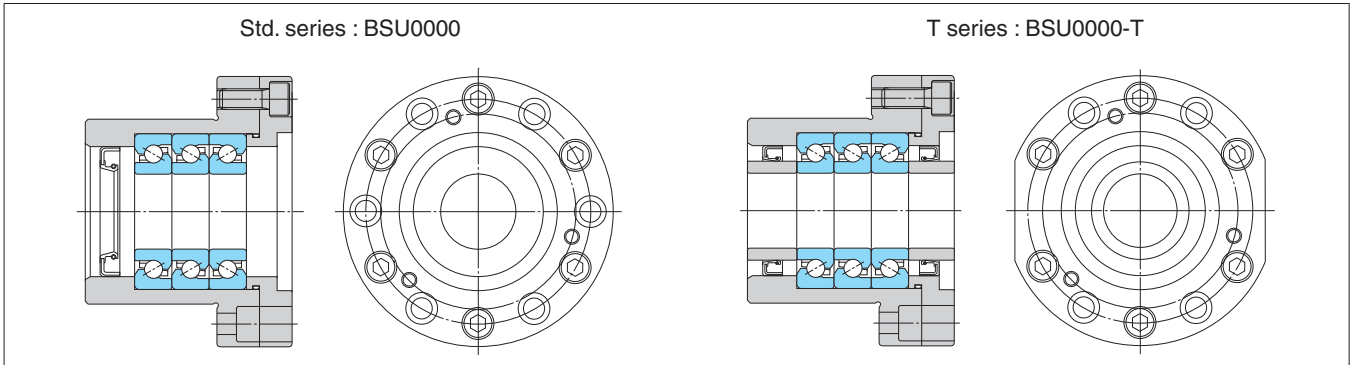


Fig. 5. 3 Series and structures of support bearing units for precision ball screws

1) Types of matched pair or stack bearing

Table 5. 2 Types of matched pair or stack bearing

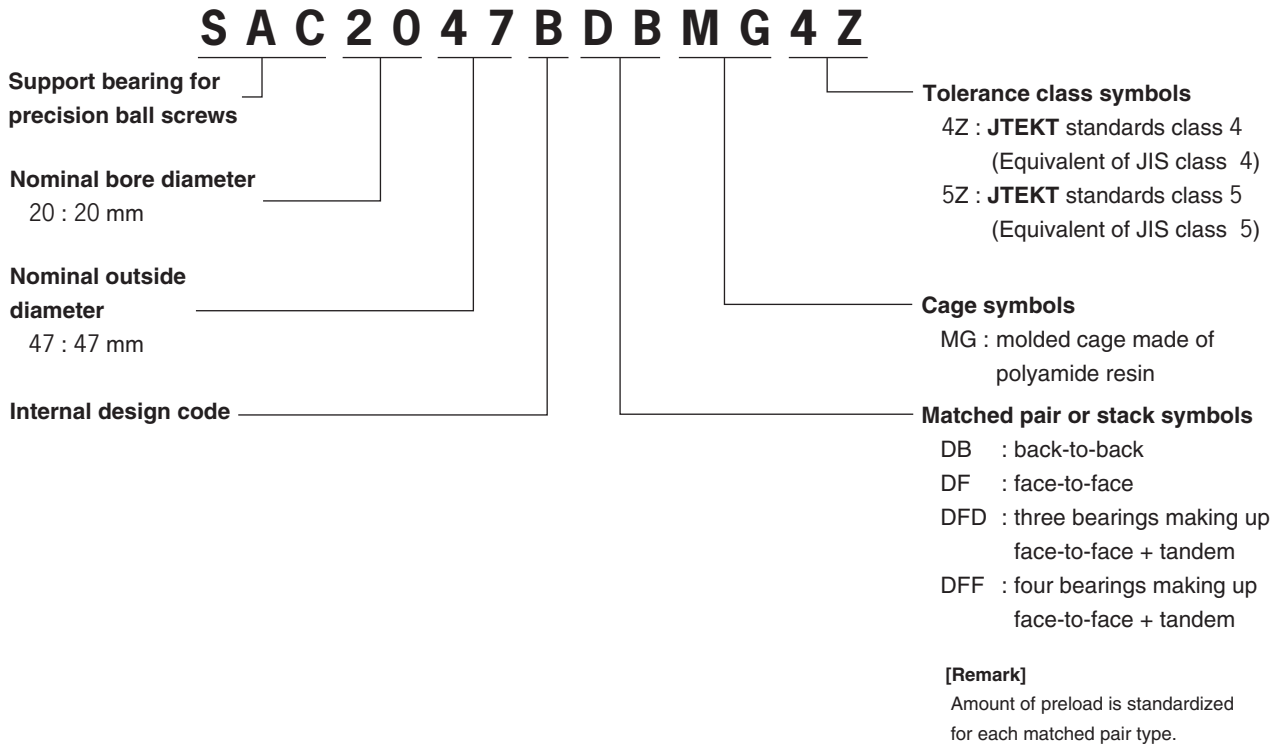
Type and symbol	
Combination of two bearings	<p>(Suffix : DF)</p>
Combination of three bearings	<p>(Suffix : DFD)</p>
Combination of four bearings	<p>(Suffix : DFF)</p>

2) Features of support bearing units for precision ball screws

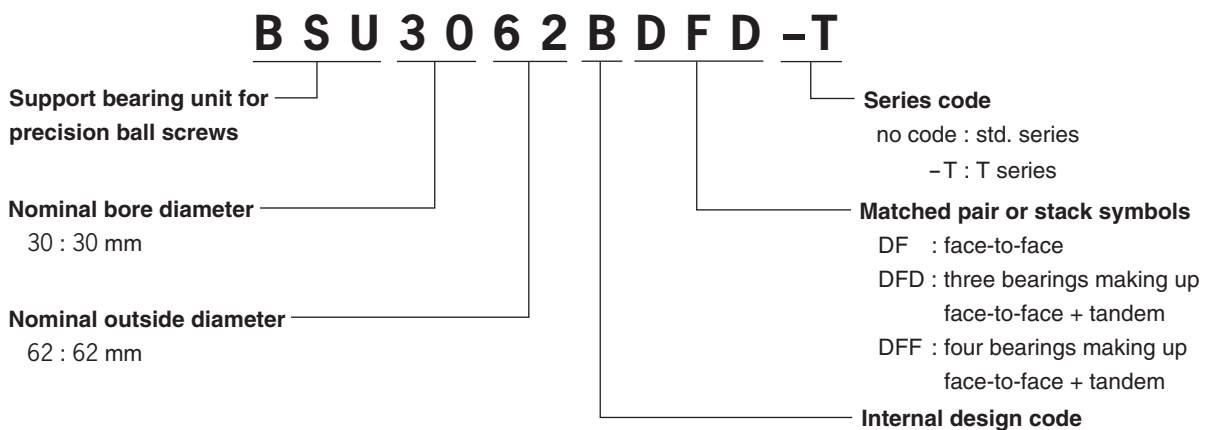
- Simple mounting work
This is a unit product consisting of a bearing where the preload is adjusted and an adequate quantity of grease is sealed within the bearing, and is mounted in a compact housing.
Thus the support bearing unit can be easily mounted on a machine.
- Excellent dust-proof performance
Having a high-performance built in oil seal the support bearing unit, with low torque operation, is excellent in dust-proof performance.
- Capability of coping with any desired design
In addition to the standard products listed in the dimension tables, **JTEKT** manufactures support bearing units to meet the support structures of various ball screws.
Consult **JTEKT** for more information.

**5.2 Composition of identification numbers
(support bearings and support bearing units for precision ball screws)**

Support bearings for precision ball screws



Support bearing units for precision ball screws



5.3 Tolerance of support bearings for precision ball screws

The support bearings for precision ball screws are manufactured to specific **JTEKT** standards suitable for

the requirements of precision ball screws (see **Table 5.3**).

Table 5.3 Permissible dimensional deviations and limits of support bearings for precision ball screws

(1) Inner ring

Unit : μm

Nominal bore diameter d (mm)		Single plane mean bore diameter deviation Δ_{dmp}				Single bore diameter deviation Δ_{ds}				Single inner ring width deviation Δ_{Bs}		Inner ring width variation V_{Bs}		K_{ia}		Perpendicularity of inner ring face with respect to the bore S_d		S_{ia}	
		Class 5Z		Class 4Z		Class 5Z		Class 4Z		Classes 5Z, 4Z		Class 5Z	Class 4Z	Class 5Z	Class 4Z	Class 5Z	Class 4Z	Class 5Z	Class 4Z
over	up to	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	max.		max.		max.		max.	
10	18	0	-5	0	-4	0	-5	0	-4	0	-80	5	2.5	4	2.5	7	3	5	3
18	30	0	-6	0	-5	0	-6	0	-5	0	-120	5	2.5	4	3	8	4	5	3
30	50	0	-8	0	-6	0	-8	0	-6	0	-120	5	3	5	4	8	4	6	3
50	80	0	-9	0	-7	0	-9	0	-7	0	-150	6	4	5	4	8	5	7	4

K_{ia} : Radial runout of assembled bearing inner ring

S_{ia} : Axial runout of assembled bearing inner ring

(2) Outer ring

Unit : μm

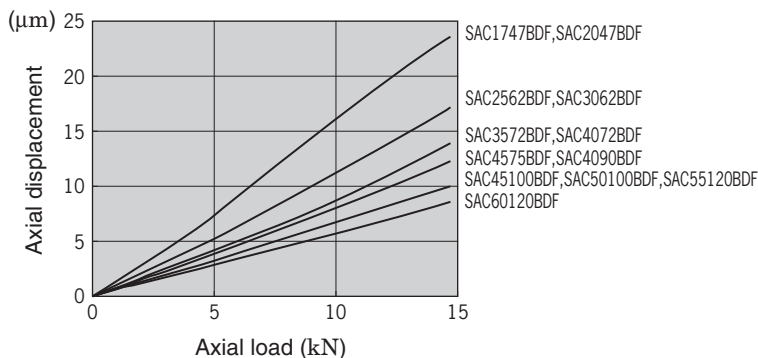
Nominal outside diameter D (mm)		Single plane mean outside diameter deviation Δ_{Dmp}				Single outside diameter deviation Δ_{Ds}				Deviation of a single outer ring width Δ_{Cs}		Ring width variation V_{Cs}		K_{ea}		S_D		S_{ea}	
		Class 5Z		Class 4Z		Class 5Z		Class 4Z		Classes 5Z, 4Z		Class 5Z	Class 4Z	Class 5Z	Class 4Z	Class 5Z	Class 4Z	Class 5Z	Class 4Z
over	up to	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	max.		max.		max.		max.	
30	50	0	-7	0	-6	0	-7	0	-6	Same as tolerance Δ_{Bs} , d being that of the same bearing.		5	2.5	7	5	8	4	Same as tolerance S_{ia} , d being that of the same bearing.	
50	80	0	-9	0	-7	0	-9	0	-7			6	3	8	5	8	4		
80	120	0	-10	0	-8	0	-10	0	-8			8	4	10	6	9	5		

K_{ea} : Radial runout of assembled bearing outer ring

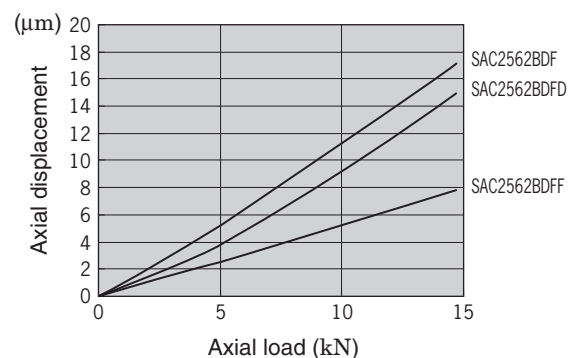
S_D : Perpendicularity of outer ring surface with respect to the face

S_{ea} : Axial runout of assembled bearing outer ring

5.4 Axial load and displacement (support bearings for precision ball screws)



(Matched pair, standard preload)



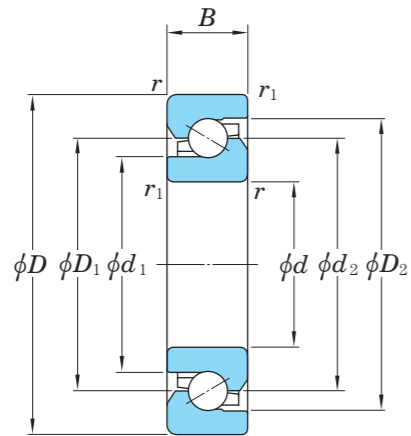
(Comparison of number of bearing rows)

Fig. 5.4 Relationship between axial load and displacement (support bearings for precision ball screws)

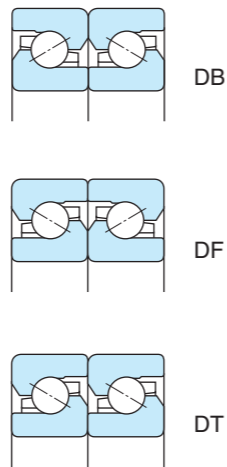
5. Support bearings and support bearing units for precision ball screws

SAC0000B, SAC00000B series

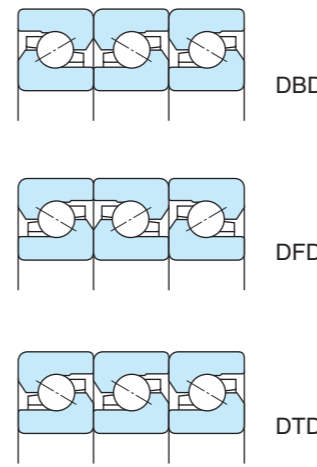
Contact angle 60°



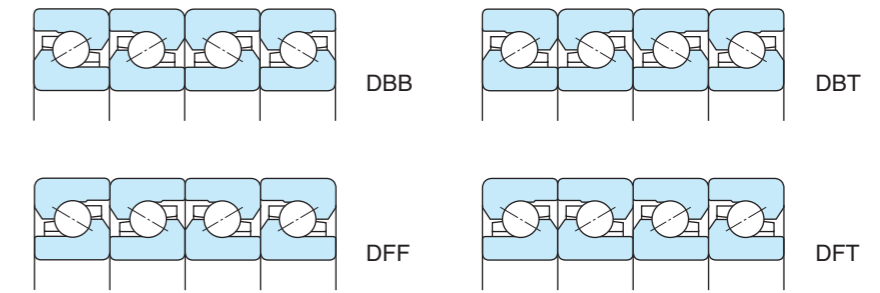
Two-bearing combination



Three-bearing combination



Four-bearing combination



d	Boundary dimensions (mm)				Basic dynamic load rating ¹⁾ (kN) C _a	Max. axial loads (kN)			Limiting speeds (min ⁻¹)		Bearing ²⁾ No.	Interspace volume (cm ³ /row)	Dimensions (mm)				Standard preloads (kN)			Starting torques (mN·m)			Axial spring constants (N/μm)			(Refer.) Mass (kg/row)	
	D	B	r min.	r ₁ min.		Single row	Double row	Triple row	Grease lub.	Oil lub.			d ₁	d ₂	D ₁	D ₂	Two bearings	Three bearings	Four bearings	Two bearings	Three bearings	Four bearings	Two bearings	Three bearings	Four bearings		
17	47	15	1	0.6	32.5	34.3	68.6	103	6 300	8 000	SAC1747B	3.7		25.5	33.7	33.5	41	2.15	2.92	4.3	140	180	280	695	1 030	1 390	0.130
20	47	15	1	0.6	32.5	34.3	68.6	103	6 300	8 000	SAC2047B	3.7		26.8	33.7	33.5	41	2.15	2.92	4.3	140	180	280	695	1 030	1 390	0.120
25	62	15	1	0.6	37.8	48.1	96.2	144	4 600	6 000	SAC2562B	4.9		38	46.2	46	53.5	3.04	4.13	6.08	200	260	400	970	1 440	1 940	0.240
30	62	15	1	0.6	37.8	48.1	96.2	144	4 600	6 000	SAC3062B	4.9		38	46.2	46	53.5	3.04	4.13	6.08	200	260	400	970	1 440	1 940	0.210
35	72	15	1	0.6	41.0	58.8	118	176	3 700	5 000	SAC3572B	6.2		48	56.3	55.9	63.5	3.73	5.07	7.46	240	320	480	1 180	1 760	2 360	0.290
40	72	15	1	0.6	41.0	58.8	118	176	3 700	4 800	SAC4072B	6.2		48	56.3	55.9	63.5	3.73	5.07	7.46	240	320	480	1 180	1 760	2 360	0.260
	90	20	1	0.6	81.8	122	244	366	3 100	4 000	SAC4090B	15		54.5	67.5	66.8	78.5	5	6.8	10	440	610	880	1 270	1 890	2 540	0.620
45	75	15	1	0.6	42.5	64.4	129	193	3 400	4 300	SAC4575B	6.9		54	61.7	61.5	69	3.89	5.29	7.78	250	330	500	1 270	1 890	2 540	0.250
	100	20	1	0.6	86.0	137	274	411	2 800	3 600	SAC45100B	16		61.5	74.2	74	85.5	5.95	8.09	11.9	540	730	1 080	1 450	2 150	2 900	0.790
50	100	20	1	0.6	87.9	144	288	432	2 700	3 400	SAC50100B	17		65.8	78.2	78	89.5	6	8.15	12	540	730	1 080	1 500	2 230	3 000	0.650
55	100	20	1	0.6	87.9	144	288	432	2 700	3 400	SAC55100B	17		65.8	78.2	78	89.5	6	8.15	12	540	730	1 080	1 500	2 230	3 000	0.650
	120	20	1	0.6	92.4	166	332	498	2 300	3 000	SAC55120B	20		79.5	92.2	92	103.6	7.08	9.62	14.2	640	860	1 280	1 740	2 590	3 480	1.15
60	120	20	1	0.6	92.4	166	332	498	2 300	3 000	SAC60120B	20		78.3	92.2	92	103.6	7.08	9.62	14.2	640	860	1 280	1 740	2 590	3 480	1.15

[Notes] 1) The value of the basic dynamic load rating of a single bearing is shown. For those of matched pair and stack bearings, see table below.
2) The identification of a matched bearing is composed of the bearing number of a single row bearing followed by the suffix (DB, DF, etc.).

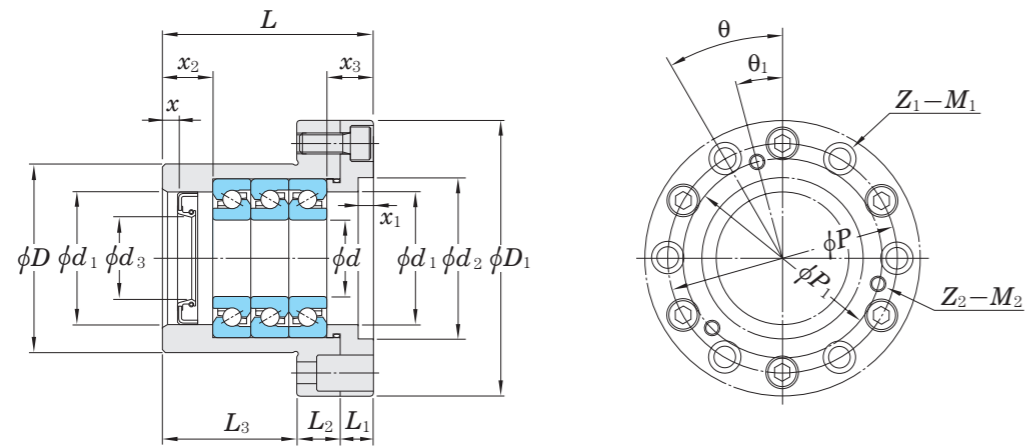
[Remarks] 1. We recommend a nut axial tension of two to three times the bearing preload.
2. We recommend a retaining plate holding allowance of 0.01 to 0.03 mm.

Number of rows to receive axial load	Basic dynamic load rating	Sample combination (arrow indicates direction of load.)
Single row	C _a	
Double row	C _a × 1.625	
Triple row	C _a × 2.16	

Dynamic equivalent load $P_a = XF_r + YF_a$

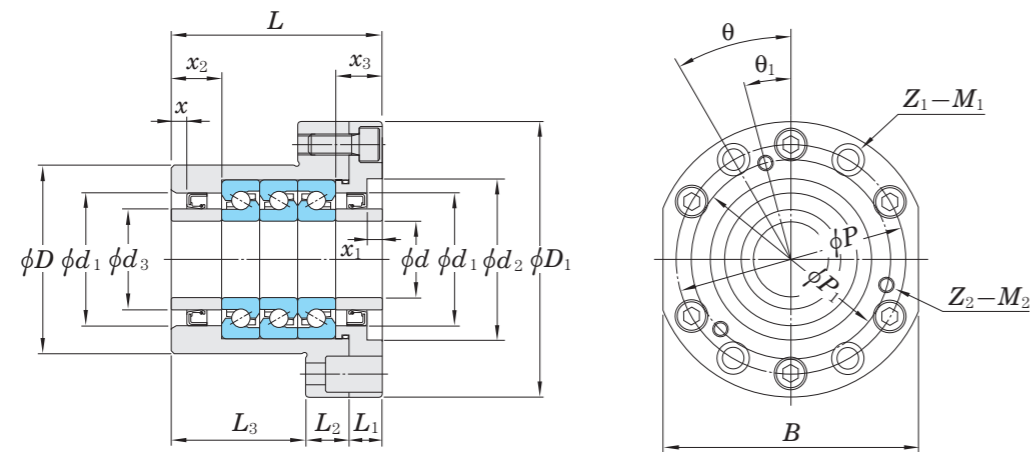
Sample combination	Two bearings		Three bearings			Four bearings		
	DB DF	DT	DBD DFD	DTD	DBT DFT	DBB DFF	DBT DFT	
Number of rows to receive axial load	Single row	Double row	Single row	Double row	Triple row	Single row	Double row	Triple row
$\frac{F_a}{F_r} \leq 2.17$	X	1.9	—	1.43	2.33	—	1.17	2.33
	Y	0.54	—	0.77	0.35	—	0.89	0.35
$\frac{F_a}{F_r} > 2.17$	X	0.92						
	Y	1						

BSU0000BDF(DFD, DFF) series



d	Dimensions (mm)												Applicable shaft dia. d ₃ (mm)	Unit identification number	Quantity of bearing	Mounting hole of housing			Tapped hole for Dust-proof cover/Damper			Standard preload (kN)	Starting torque (mN·m)	(Refer.) Mass (kg)
	D	D ₁	L	L ₁	L ₂	L ₃	d ₁	d ₂	x	x ₁	x ₂	x ₃				P (mm)	θ (°)	Z ₁ -M ₁ (No. of holes-threads)	P ₁ (mm)	θ ₁ (°)	Z ₂ -M ₂ (No. of holes-threads)			
17	60	90	65	15	15	35	38	47	6	6	15	20	28	BSU1747BDF	2	75	45	4-M6	75	22.5	4-M6	2.15	140	1.72
20	60	90	65	15	15	35	38	47	6	6	15	20	28	BSU2047BDF	2	75	45	4-M6	75	22.5	4-M6	2.15	140	1.70
25	74	108	68	13	17	38	52	63	6	6	20	18	32	BSU2562BDF	2	90	30	6-M8	78	15	3-M6	3.04	200	2.45
	74	108	83	13	17	53	52	63	6	6	20	18	32	BSU2562BDFD	3	90	30	6-M8	78	15	3-M6	4.13	260	2.85
30	74	108	68	13	17	38	52	63	6	6	20	18	40	BSU3062BDF	2	90	30	6-M8	78	15	3-M6	3.04	200	2.38
	74	108	83	13	17	53	52	63	6	6	20	18	40	BSU3062BDFD	3	90	30	6-M8	78	15	3-M6	4.13	260	2.74
35	84	118	68	13	17	38	60	73	6	6	20	18	45	BSU3572BDF	2	100	30	6-M8	88	15	3-M6	3.73	240	2.81
	84	118	83	13	17	53	60	73	6	6	20	18	45	BSU3572BDFD	3	100	30	6-M8	88	15	3-M6	5.07	320	3.28
	84	118	98	13	17	68	60	73	6	6	20	18	45	BSU3572BDFD	4	100	30	6-M8	88	15	3-M6	7.46	480	3.74
40	84	118	68	13	17	38	60	73	6	6	20	18	50	BSU4072BDF	2	100	30	6-M8	88	15	3-M6	3.73	240	2.77
	84	118	83	13	17	53	60	73	6	6	20	18	50	BSU4072BDFD	3	100	30	6-M8	88	15	3-M6	5.07	320	3.20
	84	118	98	13	17	68	60	73	6	6	20	18	50	BSU4072BDFD	4	100	30	6-M8	88	15	3-M6	7.46	480	3.64

BSU0000BDF(DFD, DFF) - T series



d	D	D ₁	B	L	Dimensions (mm)					Unit identification number	Quantity of bearing	Mounting hole of housing			Tapped hole for Dust-proof cover/Damper			Standard preload (kN)	Starting torque (mN·m)	(Refer.) Mass (kg)					
					L ₁	L ₂	L ₃	d ₁	d ₂			d ₃	x	x ₁	x ₂	x ₃	P (mm)				θ (°)	Z ₁ -M ₁ (No. of holes-threads)	P ₁ (mm)	θ ₁ (°)	Z ₂ -M ₂ (No. of holes-threads)
17	60	90	80	65	15	15	35	38	47	28	6	6	15	20	BSU1747BDF - T	2	75	22.5	6-M6	57	10	4-M6	2.15	140	1.36
20	60	90	80	65	15	15	35	38	47	28	6	6	15	20	BSU2047BDF - T	2	75	22.5	6-M6	57	10	4-M6	2.15	140	1.32
25	74	108	100	68	13	17	38	52	63	32	6	6	20	18	BSU2562BDF - T	2	90	30	4-M8	78	15	3-M6	3.04	200	1.46
	74	108	100	83	13	17	53	52	63	32	6	6	20	18	BSU2562BDFD - T	3	90	30	4-M8	78	15	3-M6	4.13	260	2.44
30	74	108	100	68	13	17	38	52	63	40	6	6	20	18	BSU3062BDF - T	2	90	30	4-M8	78	15	3-M6	3.04	200	1.40
	74	108	100	83	13	17	53	52	63	40	6	6	20	18	BSU3062BDFD - T	3	90	30	4-M8	78	15	3-M6	4.13	260	2.47
35	84	118	105	68	13	17	38	60	73	45	6	6	20	18	BSU3572BDF - T	2	100	30	4-M8	88	15	3-M6	3.73	240	1.29
	84	118	105	83	13	17	53	60	73	45	6	6	20	18	BSU3572BDFD - T	3	100	30	4-M8	88	15	3-M6	5.07	320	2.68
	84	118	105	98	13	17	68	60	73	45	6	6	20	18	BSU3572BDFD - T	4	100	30	4-M8	88	15	3-M6	7.46	480	3.62
40	84	118	105	68	13	17	38	60	73	50	6	6	20	18	BSU4072BDF - T	2	100	30	4-M8	88	15	3-M6	3.73	240	1.24
	84	118	105	83	13	17	53	60	73	50	6	6	20	18	BSU4072BDFD - T	3	100	30	4-M8	88	15	3-M6	5.07	320	2.72
	84	118	105	98	13	17	68	60	73	50	6	6	20	18	BSU4072BDFD - T	4	100	30	4-M8	88	15	3-M6	7.46	480	3.64

Ball screw related products

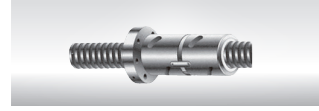
Ball screw

The following chart lists ball screws for support bearings.

● External ball circulation (standard)



○ Internal ball circulation (compact)



▲ Return-block type (compact/high load/high lead)



SAC2562B For $\phi 25$ shaft diameter

Ball screw shaft dia.	Lead						
	5	6	8	10	12	16	20
28	●○	●○	●○	●	●	●	
32	●○	●○	●○	●○	●	●	●
36	●○	●○	●○▲	●○▲	●▲	●	

SAC3062B For $\phi 30$ shaft diameter

Ball screw shaft dia.	Lead							
	5	6	8	10	12	16	20	25
32	●○	●○	●○	●○	●	●	●	
36	●○	●○	●○▲	●○▲	●▲	●		
40	●○	●○	●○	●○▲	●	●	●▲	●

SAC3572B For $\phi 35$ shaft diameter

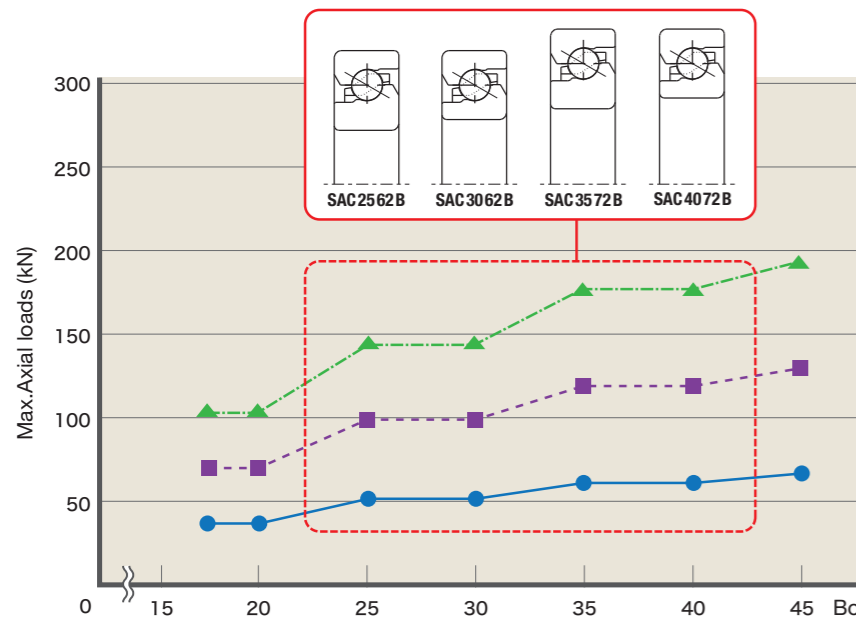
Ball screw shaft dia.	Lead							
	5	6	8	10	12	16	20	25
40	●○	●○	●○	●○▲	●	●	●▲	●
45	●○	●○	●○	●○	●	●	●▲	
50	●○	●○	●○	●○▲	●○	●○▲	●▲	●

SAC4072B For $\phi 40$ shaft diameter

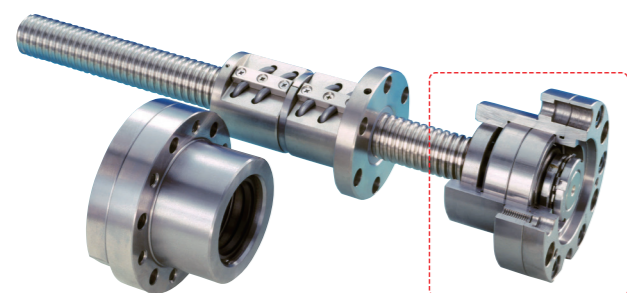
Ball screw shaft dia.	Lead							
	5	6	8	10	12	16	20	25
45	●○	●○	●○	●○	●	●	●▲	
50	●○	●○	●○	●○▲	●○	●○▲	●▲	●

Ball screw support bearings (SAC series) / Ball screw support unit (BSU series)

Ball screw support bearing selection chart



Number of rows to receive axial load	Sample combination (arrow indicates direction of load.)
Triple row	
Double row	
Single row	



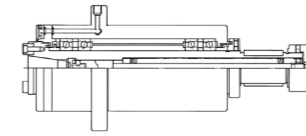
Bearing type	Cross-section	Bearing series	Contact angle
Precision ball screw support bearings	 	SAC	60°
Precision ball screw support bearing unit		BSU	(60°)

Spindle unit products

For machining centers

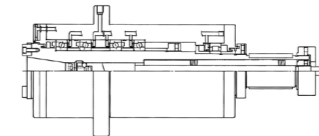


NT30
standard/high-speed type



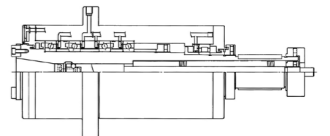
Limiting speed : 16,000 min⁻¹
Lubrication method : Grease
Drive method : Belt

NT40
standard/high-speed type



Limiting speed : 10,000~16,000 min⁻¹
Lubrication method : Grease or oil-air
Drive method : Belt or built-in

NT50
standard/high-speed type



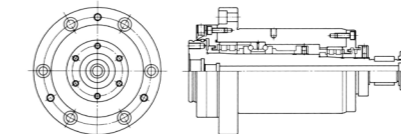
Limiting speed : 6,000~11,000 min⁻¹
Lubrication method : Grease or oil-air
Drive method : Belt or built-in

Please contact JTEKT for details regarding the machining center spindle unit.

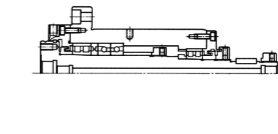
For lathes



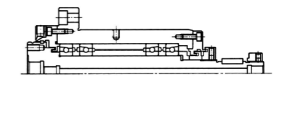
SPM 100CA



SPM 100CB



SPM 100CE



	SPM 100CA			SPM 100CB			SPM 100CE		
Shaft diameter: mm	45	70	100	45	70	100	45	70	100
Limiting speed: min ⁻¹	6000	4000	2800	9000	5500	4100	12000	7500	5500
Lubrication method	Grease								
Drive method	Belt								

Example of rotational speed/rigidity range and spindle unit selection

