

# Spherical Roller Bearings

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## Design and configurations

Spherical Roller Bearings are particularly suitable for applications where misalignment can arise from error in mounting or from shaft deflection.

NACHI Spherical Roller Bearings are manufactured in a number of design and material configurations depending on the type of application and size of the bearing.

See the [Table 1](#) for the roller, guide ring and cage design for NACHI Spherical Roller Bearings.

They can sustain radial and axial loads.

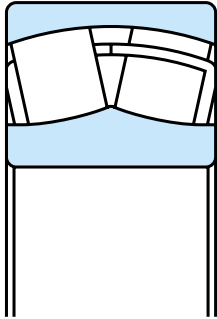
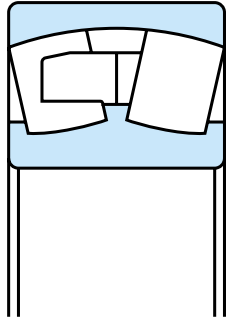
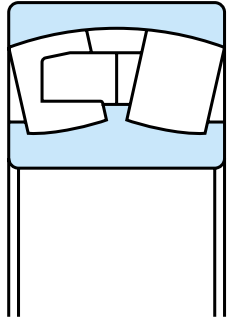
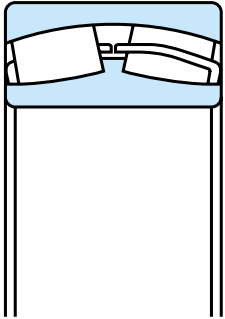
## Attention

- (1) For high axial load applications, the axial load  $F_a$  must not exceed 0.6 of the radial load  $F_r$ . If the axial load exceeds 0.6  $F_r$ , please contact NACHI engineers for design assistance.
- (2) For applications where oscillating loads (such as shaker screen applications) or high speed is involved, please contact NACHI for design assistance.
- (3) In very lightly loaded or no load conditions, sliding motion can occur which could damage the bearing.  
To prevent this damage, bearings must be subjected to a load greater than 0.02  $C_r$  (basic dynamic load rating).

## [Table 1. Design and configurations](#)



Table 1. Design and configurations

Suffix Series	EX	EX1	E	E2	E	AEX	AX	A2X	AX
239					20,26, 44~/1060		28~40		
230			20~36		38~/1000		20~36	38~48	
240		24~36			38~/800				24~36
231		22~34	20		36~/800		20~34	36~48	
241		22~32			36~/500				22~34
222	05~30		32	32	34~68	5~30		32	
232		18,20~30	16,17,19		32~/600		20~30	32~40	
213		11~22	04~10,24				6~22		
223	08~26				28~60	7~26		28,30	
Cross Section									
Roller	Symmetric			Symmetric		Asymmetric			Asymmetric
Center Guide	Floating Ring			Inner Ring Rib		Inner Ring Rib			Inner Ring Rib
Retainer	Pressed Steel			Machined Brass Mild Steel		Machined Brass			Pressed Brass



## Lubrication Holes and Groove

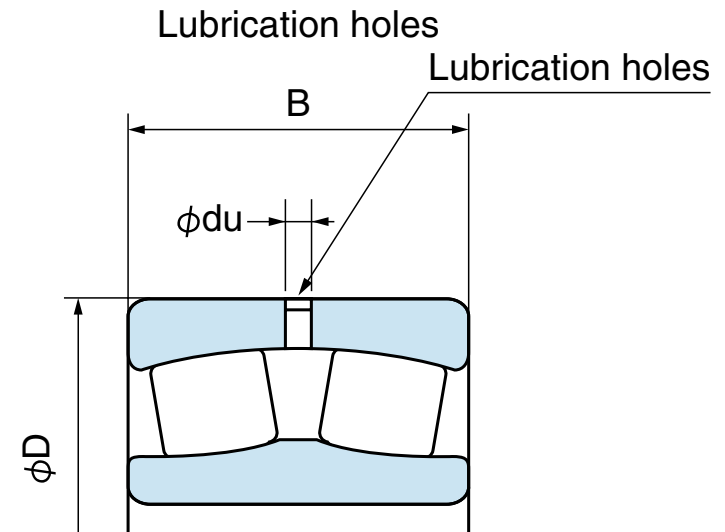
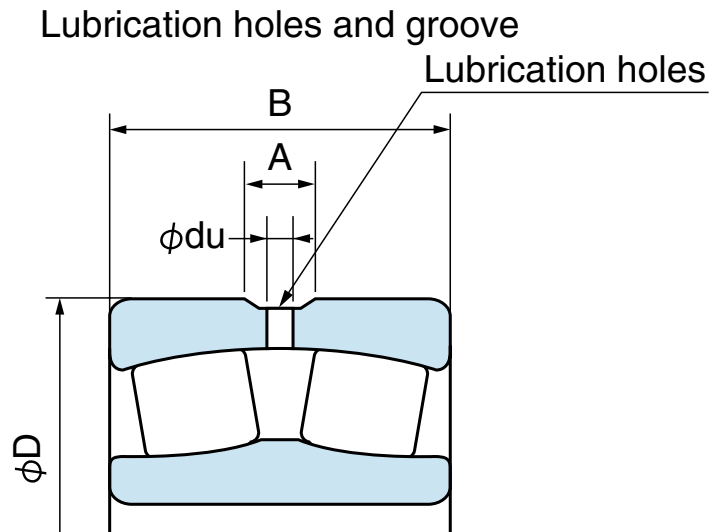
The outer ring of Spherical Roller Bearings are often made with lubrication holes and a groove for feeding lubricant. The outer ring may also be configured with oil holes only depending on fitting, mounting or service conditions.

## Heat-stabilized Bearings

NACHI Spherical Roller Bearings are subjected to a heat-stabilization treatment as standard. They can be used at operating temperature of up to 200°C with minimal dimensional changes occurring.

**Table 2. Lubrication holes and groove**

Modification to outer ring	Suffix	Part No. Example
Lubrication holes and groove	W33	22210E W33
Lubrication holes	W20	22210E W20





**Table 3. Lubrication holes and groove dimensions**

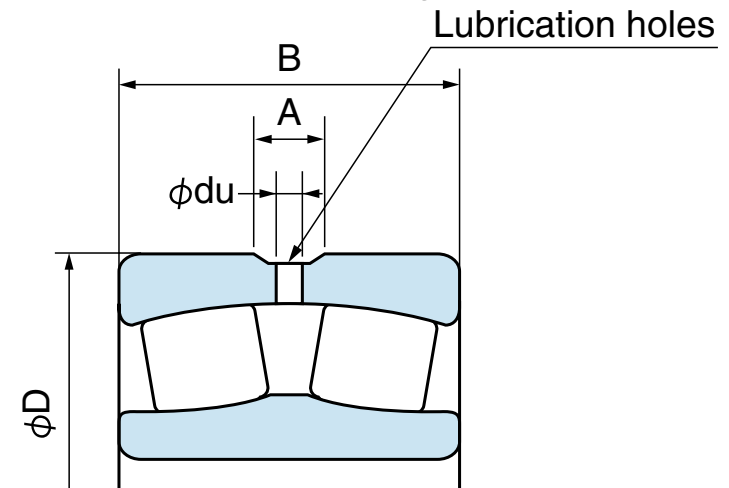
Outer ring width B (mm)		Series	23900		Others	
Over	Incl.		A	du	A	du
18	30		7	3	6	3
30	35		8	4	8	3 #1
35	40		8	4	8	4 #2
40	50		11	5	10	4 #3
50	65		12	6	11	5 #4
65	80		14	8	14	6 #5
80	100		18	10	18	8
100	120		24	12	20	10
120	160		28	15	26	12
160	200		35	20	32	15
200	250		40	20	40	20
250	315		45	25	45	20
315	400		50	25	50	25

Exceptions ; #1 : 22308 = 4, #2 : 21315 = 3,  
 #3 : 22219, 22220, 23022, 23024 = 5  
 #4 : 22317, 22318 = 6, #5 : 23036 = 8

**Table 4. Standard Number of Lubrication holes**

Nominal outside dia D (mm)		Number of lubrication holes
Over	Incl.	
—	180	4
180	250	6
250	315	6
315	400	6
400	500	6
500	—	8

Lubrication holes and groove





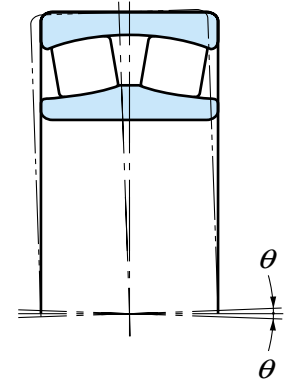
## Misalignment

Maximum permissible misalignment angle is about  $2^\circ$  under general service conditions.

But its angle will vary with the series, service condition and surrounding structure.

As rotational speed increases, misaligned bearings will tend to generate more noise.

Due to noise constraints, the practical maximum misalignment in a bearing may be considerably less than the maximum permissible misalignment.



## Mounting bearings with tapered bore

Mounting bearings with a tapered bore requires some experience and technique.

Bearings with tapered bore are always mounted with an interference fit on the shaft.

To measure the amount of interference fit on the shaft, the axial displacement of the inner ring or the reduction of radial internal clearance due to the interference fit can be used. Generally, the measurement of reduction in radial internal clearance is a more reliable method than measurement of the axial displacement of the inner ring.

### [Table 5 Mounting Bearings with Tapered Bore](#)

Table 5 Mounting Bearings with Tapered Bore

(1/2)

Nominal bore diameter d		Radial clearance reduction		Axial displacement <sup>1)</sup>				Internal clearance after mounting <sup>2)</sup>		
				Taper				Min		
Over	Incl.	Max	Min	1 : 12	1 : 30	Min	Max	Normal	C3	C4
24	30	0.015	0.020	0.3	0.35	–	–	0.015	0.020	0.035
30	40	0.020	0.025	0.35	0.4	–	–	0.015	0.025	0.040
40	50	0.025	0.030	0.34	0.45	–	–	0.020	0.030	0.050
50	65	0.030	0.040	0.45	0.6	–	–	0.025	0.035	0.055
65	80	0.040	0.050	0.6	0.75	–	–	0.025	0.040	0.070
80	100	0.045	0.060	0.7	0.9	1.7	2.2	0.035	0.050	0.080
100	120	0.050	0.070	0.75	1.1	1.9	2.7	0.050	0.065	0.100
120	140	0.065	0.090	1.1	1.4	2.7	3.5	0.055	0.080	0.110
140	160	0.075	0.100	1.2	1.6	3.0	4.0	0.055	0.090	0.130
160	180	0.080	0.110	1.3	1.7	3.2	4.2	0.060	0.100	0.150
180	200	0.090	0.130	1.4	2.0	3.5	5.0	0.070	0.100	0.160
200	225	0.100	0.140	1.6	2.2	4.0	5.5	0.080	0.120	0.180
225	250	0.110	0.150	1.7	2.4	4.2	6.0	0.090	0.130	0.200
250	280	0.120	0.170	1.9	2.7	4.7	6.7	0.100	0.140	0.220
280	315	0.130	0.190	2.0	3.0	5.0	7.5	0.110	0.150	0.240

Note: 1) The values are applied for mounting on solid shaft. In case of hollow shaft, larger axial displacement should be applied.

2) In following cases, please make sure radial internal clearance after mounting.

- Initial radial clearance is less than (bore diameter deviation) × 0.5
- Temperature difference exists between inner ring and outer ring under operation.

Internal clearance after mounting must be over these values.





Table 5 Mounting Bearings with Tapered Bore

(2/2)

Nominal bore diameter d		Radial clearance reduction		Axial displacement <sup>1)</sup>				Internal clearance after mounting <sup>2)</sup>		
				Taper		1 : 30		Min		
Over	Incl.	Max	Min	1 : 12 Min	Max	Min	Max	Normal	C3	C4
315	355	0.150	0.210	2.4	3.3	6.0	8.2	0.120	0.170	0.260
355	400	0.170	0.230	2.6	3.6	6.5	9.0	0.130	0.190	0.290
400	450	0.200	0.260	3.1	4.0	7.7	10	0.130	0.200	0.310
450	500	0.210	0.280	3.3	4.4	8.2	11	0.160	0.230	0.350
500	560	0.240	0.320	3.7	5.0	9.2	12.5	0.170	0.250	0.360
560	630	0.260	0.350	4.0	5.4	10	13.5	0.200	0.290	0.410
630	710	0.300	0.400	4.6	6.2	11.5	15.5	0.210	0.310	0.450
710	800	0.340	0.450	5.3	7.0	13.3	17.5	0.230	0.350	0.510
800	900	0.370	0.500	5.7	7.8	14.3	19.5	0.270	0.390	0.570
900	1000	0.410	0.550	6.3	8.5	15.8	21	0.300	0.430	0.640
1000	1120	0.450	0.600	6.8	9.0	17	23	0.320	0.480	0.700
1120	1250	0.490	0.650	7.4	9.8	18.5	25	0.340	0.540	0.770

Note: 1) The values are applied for mounting on solid shaft. In case of hollow shaft, larger axial displacement should be applied.

2) In following cases, please make sure radial internal clearance after mounting.

- Initial radial clearance is less than (bore diameter deviation)  $\times$  0.5
- Temperature difference exists between inner ring and outer ring under operation.

Internal clearance after mounting must be over these values.