Spherical Roller Bearings

Spherical roller bearing

Spherical roller bearings consist of an outer ring having a continuous spherical raceway centered within two rows of barrel-shaped rollers operating in separate raceways ground into the inner ring with a center rib to guide the rollers (refer to Fig. 1). This type of bearing has a self-aligning nature, so, it can be used in cases where misalignment between the inner and outer ring occur from shaft mounting errors or shaft deflections.

The allowable misalignment for these bearings, being varied due to the dimensional series and loading conditions, is about 0.009 radian (0.5°) for ordinary loads (equivalent to 0.09 C_r). For light loads, this angle can be up to 0.035 radians (2°).

These bearings have a large capacity for radial loads, axial loads in either direction, and combinations of these loads. They are also suited for applications where vibration and/or impact forces are encountered.

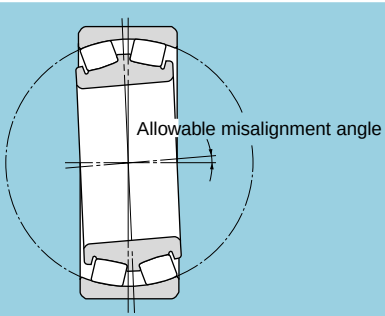
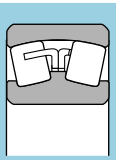


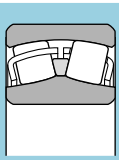
Fig. 1

The design of spherical roller bearings are standardized so that the center roller guide rib comes standard with the inner ring as one united inner ring (please refer to Fig. 2). Smaller bearing (bore diameter of 50 mm or less) of bearing series 222, 213, and 223 come in the design shown in Fig. 3. This design uses a separable guide ring between the two rows of roller and is specified by attaching the suffix “C” at the end of the basic number. For the bearing of series 213 (bore diameter of 55 mm or more) the guide ring between the rollers is located on the raceway of the outer ring (please refer to Fig. 4).



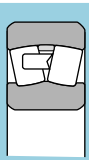
Standard Type

Fig. 2



C-Type

Fig. 3



213-Type

Fig. 4

There are other types of bearings having cylindrical or tapered bore diameters. Bearings with tapered bore diameters are specified by attaching the suffix “K” at the end of the basic number. The taper is generally 1/12, however, a taper of 1/30 is made for bearings of series 240 and 241 which are specified by attaching the suffix “K-30” at the end of the basic number. In most cases, bearings with tapered bore diameters are mounted on the shaft by means of an adapter or withdrawal sleeve.

The standard cages for spherical roller bearings are given in Table 1.

When the outer diameter of spherical roller bearings is used 320 mm or more, an oil hole and oil groove, shown in Table 2 and 3, are provided in the outer ring to supply lubricant.

Table 1 Standard cages of spherical roller bearings

Bearing series	Pressed cage	Machined cage
239	—	23932~239/1400
230	23022B~23040B	23044B~230/1120B
240	—	24024B~240/1120B
231	23120B~23134B	23136B~231/900B
241	—	24122B~241/710B
222	22208C~22236B	22238B~22264B
232	—	23218B~232/750B
213	21308C~21310C	21311~21322
223	22308C~22328B	22330B~22360B

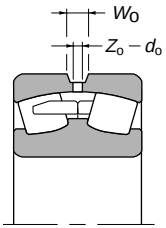


Table 2 Dimension of oil holes Unit: mm

Nominal bearing width		Oil groove width W_o	Diameters of oil holes d_o
over	incl.		
60	80	11	6
80	100	14	8
100	120	16	10
120	160	20	12
160	200	27	16
200	315	33	20
315	—	42	25

Table 3 Number of oil holes

Outside diameter D		Number of oil holes Z_o
over	incl.	
180	1000	8
1000	—	12

Adapters and withdrawal sleeves

The adapter is used for mounting the bearings with tapered bore diameters on cylindrical shafts. The bearing is secured to the shaft by utilizing the threads and nuts of the adapter sleeve and by drawing the sleeve into the bearing.

The withdrawal sleeve is also used to mount bearings with tapered bores onto cylindrical shafts. When mounting the bearings, after pressing the end face of the inner ring to the shoulder of the shaft, the bearing is pushed to the bore diameter using the threads located on the shaft end of the withdrawal sleeve to secure the bearing. During dismounting the bearings, after pushing the nut to have end face of the inner ring of the bearing using the threads located on the shaft end of the withdrawal sleeve, the sleeve is drawn out from the bore diameter face of the bearing.

Among the withdrawal sleeves to be used for bearing series 240 and 241, hydraulic withdrawal type sleeves are standardized for bearings with a bore diameter of 220 mm or more. These sleeves are classified by attaching the suffix “H” at the end of the basic sleeve’s part number.

For the hydraulic type sleeves, oil is pumped into both clearances between the shaft and sleeve, and between the sleeve and the bore diameter surface of the bearing by means of a pressure fitting. This process allows for easy mounting and dismounting of the bearing due to the decrease of friction.

Please refer to NTN for the hydraulic type sleeves to be used for bearings of other series.

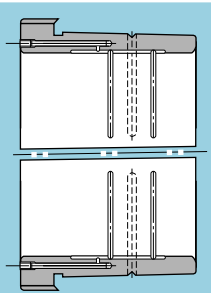


Fig. 5