

Self-Aligning Double Row Ball Bearings

The following topics on Self-Aligning Double-Row Ball Bearings will be covered in this technical information sheet:

- General Overview
- Nomenclature
- Retainers
- Radial Clearance
- Life and Load Ratings



General Overview of Self-Aligning Double Row Ball Bearings

Self-Aligning Double Row Ball Bearings consist of two rows of balls and a spherical outer ring raceway. They are designed to work in applications where misalignment exists whether from mounting or shaft deflection during operation. The spherical outer raceway gives the bearings the ability to align themselves correctly with the shaft and housing without causing undue stress on the rest of the bearing assembly. The misalignment capability of the bearings gives ease of mounting without damage to the bearing. Slight misalignments creating during operation can be accommodated for by the use of a double row self-aligning bearing. Noteworthy is that the self-aligning ball bearing has the lowest friction of all rolling bearings, which gives it the ability to run at high speeds without excessive heat.

Standard Self-Aligning Double Row Ball Bearings are produced with straight, cylindrical bores; however, tapered bores, and sealed/shielded bearings are available upon request. Please contact AST engineering for more information on special bearings.

Nomenclature for Self-Aligning Double Row Ball Bearings

AST's Self-Aligning Double Row Ball Bearings come in four numeric series which represent the maximum specified degree of misalignment and loads:

- **12xx Series** – Can be misaligned 2.5°
- **13xx Series** – Can be misaligned 3.0°
- **22xx Series** – Can be misaligned 2.5° but has higher load ratings and is wider than the 1200 Series
- **23xx Series** – Can be misaligned 3° but has higher load ratings and is wider than the 1300 series

Each bearing part number consists of the first two numbers designating the bearing series, followed by the second group of numbers designating the bore diameter.

The bore size designations are as follows:

00=10mm, **01**=12mm, **02**=15mm, **03**=17mm, **>03**=BBx5 (example: 2208, 08x5=40mm bore)



Retainers for Self-Aligning Double Row Ball Bearings

Standard retainers for double row self-aligning bearings are all snap-type, and are made of either pressed steel, or molded polyamide. Each retainer is of crown design with the open ends towards each face of the bearing to allow for bearing assembly. Other retainer material types are available upon special request. Please contact AST engineering for information on other retainer materials.

Radial Clearance for Self-Aligning Double Row Ball Bearings

Similar to standard radial ball bearings, double row self-aligning ball bearing radial clearance is designated by C0 (normal), C2, C3, or C4. Below is a table which shows each radial clearance designation with respect to the bearing bore diameter.

| Nominal Bore Diameter d (mm) | | Radial Internal Clearance (μm) | | | | | | | |
|--------------------------------|-------|---|------|------------|------|-----|------|-----|------|
| | | C2 | | C0 Normal) | | C3 | | C4 | |
| Over | Incl. | Low | High | Low | High | Low | High | Low | High |
| 2.5 | 6 | 1 | 5 | 5 | 10 | 10 | 15 | 15 | 21 |
| 6 | 10 | 2 | 6 | 6 | 12 | 12 | 19 | 19 | 27 |
| 10 | 14 | 2 | 6 | 6 | 13 | 13 | 21 | 21 | 30 |
| 14 | 18 | 3 | 8 | 8 | 15 | 15 | 23 | 23 | 32 |
| 18 | 24 | 4 | 10 | 10 | 17 | 17 | 25 | 25 | 34 |
| 24 | 30 | 5 | 11 | 11 | 19 | 19 | 29 | 29 | 40 |
| 30 | 40 | 6 | 13 | 13 | 23 | 23 | 34 | 34 | 46 |
| 40 | 50 | 6 | 14 | 14 | 25 | 25 | 37 | 37 | 50 |
| 50 | 65 | 7 | 16 | 16 | 30 | 30 | 45 | 45 | 65 |

Life and Load Ratings for Self-Aligning Double Row Ball Bearings

This section will present the various calculations used to determine various life and load solutions for self-aligning double-row ball bearings:

Equivalent Dynamic Radial Loads

To calculate **equivalent dynamic radial loads** for double row self-aligning bearings, one of two calculations can be used. The calculations are shown below:

$$P = F_R + Y_1 F_A, \text{ where } F_A/F_R \leq e$$

or

$$P = 0.65F_R + Y_2 F_A, \text{ where } F_A/F_R > e$$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Axial load

Y_1 = Thrust load factor

Y_2 = Thrust load factor

e = limiting factor for F_A/F_R



Static Equivalent Radial

To calculate **static equivalent radial loads** for Double row self-aligning ball bearings, use the following equation:

$$P_0 = F_R + Y_0 F_A$$

P_0 = Static equivalent radial load

F_R = Radial Load

F_A = Thrust Load

Y_0 = Thrust load factor

Life Ratings

Life ratings for double row self-aligning bearings are calculated in either millions of revolutions, or in hours. Both calculations are shown below:

$$L_{10} = (C/P)^3 \text{ (millions of revs.)}$$

or

$$L_{10h} = (16667/n) \times (C/P)^3 \text{ (hours)}$$

C = Basic dynamic load rating

P = Dynamic equivalent radial load

n = Speed in RPM

Minimum Load

Similar to all styles of rolling bearings, to ensure that the double row self-aligning ball bearing will operate satisfactorily, a **minimum load** must be applied. The minimum load is applied in order to eliminate the possibility for ball sliding at high speeds or accelerations. The minimum load calculation is shown below:

$$P_{0m} = 0.01C_0$$

P_{0m} = minimum equivalent static bearing load

C_0 = basic static load rating

Normally, the weight of component(s) being supported by the bearing, in addition to external forces, is enough to meet the minimum load requirements. If this does not meet the minimum loading, radially preloading is recommended. For more information or suggestions on loading, please contact AST engineering.