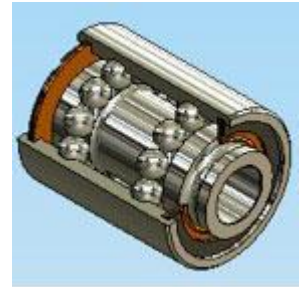


Airframe Control Ball Bearings

The following topics on Airframe Control Ball Bearings will be covered in this *Technical Information Sheet*:

- General
- Nomenclature
- Materials
- Closures
- Tolerances
- Radial Clearance
- Lubrication
- Mounting and Fitting
- Life and Loading



General

Originally designed for use in aircraft control systems, Airframe Control Ball Bearings have been utilized in many other industries due to their ability to withstand both slow rotational and primarily oscillatory motion. Being generally compact, corrosion resistant, sealed, and grease lubricated give these types of bearings the ability to be used in many different applications, including what could be considered harsh environments.

Standard operating temperatures for airframe control bearings range from -65°F to +250°F. Self-aligning airframe control bearings allow for the misalignment of shaft/housing up to 10° (8° for some KSP series), and also facilitate the mounting of the bearings. All bearings have extended inner rings which eliminated the need for misalignment spacers in the case of self-aligning bearings, and also facilitate mounting for all bearing series. AST airframe control bearings are also designed using a full complement of balls for maximum load capacity.

All AST Airframe Control Ball Bearings are manufactured in compliance with SAE-AS7949 standards.

Nomenclature

AST supplies a wide variety of Airframe Control Ball Bearings including the following series of products:

- KPx** Series Airframe Control Bearings - Single row, ball, heavy duty
- KPxA** Series Airframe Control Bearings - Single row, ball, deep groove
- KPxB** Series Airframe Control Bearings - Single row, ball, torque tube type
- DPPx** Series Airframe Control Bearings - Double row, ball
- DSPx** Series Airframe Control Bearings - Double row, ball, self-aligning
- KSPx** Series Airframe Control Bearings - Single row, ball, self-aligning
- DWx** Series Airframe Control Bearings - Double row, ball, extra-wide

The x in each series name denotes the bore diameter, in sixteenths of an inch. (e.g. KP4 bearing has a ¼" bore)

Suffix:

X – bearings with an X suffix have no plating and are not designed for use in aircraft.



TECHNICAL INFORMATION



Materials

AST Airframe control bearings are generally constructed from hardened 52100 chrome steel. This includes inner/outer rings, and balls. For corrosion resistance they are cadmium plating to AMS-QQ-P-416. For the ultimate in corrosion resistance, hardened 440c corrosion resistant steel can be utilized. Other types of coatings are available such as zinc-nickel plating, contact AST engineering for more information on materials/coatings.

Closures

All AST airframe control ball bearings come with PTFE seals. The PTFE seal is used for its highly inert material properties. Generally the PTFE seal is bonded to a metal shield and staked into place on the bearing outer ring. Multiple piece seals are available where the PTFE component is mounted behind a separate metallic washer/retainer. The metallic washer acts as a snap ring to retain the seal in place on the outer bearing ring.

Tolerances

Each of AST's Airframe control bearing series has its own respective military standard that they conform to. Each standard controls all tolerances for the specific bearing series. In general, OD and bore tolerances are +0" to -.0005", while width tolerances are +0" to -.005". Please contact AST engineering for more information regarding tolerance specifications for airframe control bearings.

Radial Clearance

For each bearing series, radial clearance is specified per each bearing standard. Below is a summary of standard radial clearance(s) per bearing series.

Bearing Series	Radial Clearance* (in)	
	min.	max.
KP	0.0004	0.001
KPxA	0.0002	0.0005
KPxB	0.0003	0.001
DPPx	0.0002	0.0005
DSPx	0.0002	0.0005
KSPx	0	0.001
DWx	0.001	0.003

**radial clearance is measured under a 5.5 lb. gage load*

Lubrication

Standard lubrication for all AST airframe control bearings is in accordance to MIL-PRF-81322. This standard has a minimum grease fill of 80%. Bearings can be lubricated to different standards or fill amounts upon special request, contact AST engineering for details.

Mounting and Fitting

It is advisable that when an airframe bearing is subjected to oscillating loads, that the bearing housing to bearing OD be a light interference fit. Retention within the housing is also recommended by mean of



staking. For heavy thrust loading, a housing shoulder is recommended.

In general, a .0005" nominal interference fit for steel housings, and a .0007" nominal interference fit for aluminum housings, should be used to ensure positive retention of the bearings without completely eliminating the radial clearance out of the bearings. When press fitting bearings into housing, only use force on the outer ring of the bearing. NEVER press on the inner ring of the bearing when there is an interference fit on the outer ring, the bearing will become unusable.

The mating shaft of each bearing should be sized by taking the nominal bearing bore size, then reducing this by .0005" - .001". For more information on correct mounting and fitting of airframe control bearings, please contact AST engineer.

Life and Loading

Unlike standard deep groove ball bearings, airframe control bearing load ratings are calculated in a completely different manner. The industry standard to calculating static radial limit load is by the equation:

$$\text{Limit Load Rating} = KnD^2$$

Where:

K = load rating constant*

n = number of balls in the bearing

D = diameter of the ball in the bearing

* load rating constant varies by bearing type,

K = 10,000 for standard single and double row airframe bearings

4800 for single row self-aligning bearings

3800 for double row self-aligning bearing

The limit load rating is equal to 2/3 of the bearings minimum static fracture strength.

Also, unlike standard deep groove ball bearings, the dynamic load ratings for airframe control bearings are based on the bearing's ability to withstand 10,000 complete oscillation cycles of 90°. Please contact AST engineering for any further life and loading information on airframe control bearings.