1. OVERVIEW

Thin section bearings are precision bearings designed with a reduced and constant cross-section relative to bore diameter. This geometry allows designers to minimize radial envelope, weight, and inertia while maintaining load capacity and rotational accuracy.

Thin section bearings are widely used in robotics, aerospace assemblies, medical imaging systems, and satellite mechanisms where space and weight constraints are critical.

2. CONSTANT CROSS-SECTION CONCEPT

Unlike standard radial bearings, thin section bearings maintain the same cross-section across multiple bore sizes within a series. Engineering benefits include:

- Reduced system weight
- Lower rotational inertia
- Compact radial envelope
- Improved packaging flexibility
- Larger shaft diameter within constrained housings

3. TYPICAL DIMENSIONAL RANGE (REFERENCE GUIDE)

Parameter	Typical Range
Bore (ID)	10 mm – 400 mm
Cross-Section	Constant per series (e.g., 4 mm, 6 mm, 8 mm, etc.)
Outer Diameter (OD)	Bore + 2 × cross-section
Configuration	Radial Contact / Angular Contact
Internal Clearance	Standard or controlled preload

Final dimensional validation should consider shaft stiffness and housing rigidity.

4. TYPES & CONFIGURATIONS

Radial Contact (Type C) — Primarily supports radial loads with moderate axial capability in both directions.

Angular Contact (Type A) — Supports combined radial and axial loads in one direction; suitable for higher stiffness applications.

Thin section bearings may also be supplied as matched sets for preload-controlled systems.

5. LOAD CAPACITY & STRUCTURAL CONSIDERATIONS

Because of reduced cross-section, load capacity is lower than standard deep groove bearings of similar bore. Shaft and housing rigidity significantly influence performance. Mounting distortion can directly affect bearing life.

Designers must evaluate system deflection and ensure adequate support structure.

6. PRECISION GRADES & PERFORMANCE

Precision Class	Standard	Applications
ABEC 3 / ISO P6	ANSI / ISO	Automation
ABEC 5 / ISO P5	ANSI / ISO	Robotics
ABEC 7 / ISO P4	ANSI / ISO	Aerospace

Thin section bearings are frequently specified at ABEC 5 or higher in precision motion systems.

7. MATERIALS & CAGE OPTIONS

Component	Options	Engineering Notes
Rings	Chrome Steel / Stainless Steel	Strength or corrosion resistance
Rolling Elements	Steel / Hybrid Ceramic	Hybrid reduces inertia and vibration
Cage	Steel	Structural stability
Cage	Polymer	Reduced friction and noise

Hybrid ceramic configurations can reduce centrifugal loading at higher speeds.

8. SPEED & INERTIA CONSIDERATIONS

Thin section bearings provide reduced rotational inertia, lower torque requirements, and improved response in servo-driven systems.

However, speed capability depends on bearing size, lubrication method, preload, and cage design.

9. ENVIRONMENTAL & LUBRICATION CONSIDERATIONS

Factor	Engineering Notes
Temperature	Influences lubricant viscosity
Corrosion	Stainless materials recommended for humid environments
Lubrication	Grease, oil, or specialized low-outgassing formulations

In aerospace or satellite systems, lubricant outgassing and vacuum compatibility must be evaluated.

10. STRUCTURAL & MOUNTING CONSIDERATIONS

Due to reduced cross-section geometry:

- Housing distortion can impact raceway geometry
- Excessive press fit can reduce internal clearance
- Proper shaft/housing tolerance selection is critical
- Thin section bearings are more sensitive to mounting conditions than standard bearings

11. AEROSPACE & HIGH-RELIABILITY APPLICATION NOTE

For aerospace, robotics, or satellite systems:

- Weight optimization is often a primary driver
- Controlled preload may be required
- Vibration performance should be evaluated
- Material traceability may be required
- Lubrication must consider temperature extremes and vacuum exposure
- Thermal expansion of lightweight structures must be evaluated to prevent over-preload

12. TYPICAL APPLICATIONS

- Aerospace assemblies
- Satellite systems
- Robotics joints
- Medical imaging equipment
- Lightweight positioning systems

13. SELECTION GUIDELINES

Consideration	Key Question
Space	What is allowable radial envelope?
Accuracy	What runout tolerance is required?
Load	Radial or combined loading?
Structure	Is housing rigidity sufficient?
Environment	Vacuum or temperature extremes?