

1. OVERVIEW

Precision radial ball bearings, commonly referred to as deep groove ball bearings, are rolling-element bearings designed primarily to support radial loads while accommodating moderate axial loads in both directions. Their optimized raceway geometry allows smooth operation, low noise, and consistent performance across a wide range of speeds and operating conditions.

These bearings are among the most widely used bearing types in industrial, automation, medical, and aerospace subsystems due to their versatility and efficiency.

2. TYPICAL DIMENSIONAL RANGE (REFERENCE GUIDE)

Parameter	Typical Range
Bore (ID)	3 mm – 200 mm
Outer Diameter (OD)	10 mm – 420 mm
Width	4 mm – 80 mm
Internal Clearance	C2, CN (Normal), C3, C4
Shield/Seal Options	Open, ZZ, 2RS / 2RS1

Exact dimensions vary by series (6000, 6200, 6300, etc.). Final selection should be validated against application requirements.

3. TYPES & CONFIGURATIONS

Open Bearings — Used where lubrication is externally managed and contamination risk is minimal. Lowest friction configuration and highest potential speed capability.

Shielded Bearings (ZZ) — Metal shields reduce debris ingress while maintaining relatively low torque. Suitable for clean industrial environments.

Sealed Bearings (2RS / 2RS1) — Elastomer seals provide lubrication retention and improved contamination protection. Preferred for maintenance-limited applications.

4. DESIGN & CONSTRUCTION FUNDAMENTALS

Deep raceway grooves provide stable rolling-element guidance and balanced load distribution. Key performance characteristics are influenced by:

- Internal radial clearance
- Raceway conformity
- Ball complement
- Cage material and geometry
- Lubrication type

5. LOAD RATINGS & LIFE CONSIDERATIONS

Dynamic Load Rating (C) — Indicates the constant radial load under which 90% of bearings are expected to achieve a rating life of 1 million revolutions.

Static Load Rating (C₀) — Defines the maximum load a bearing can withstand without excessive permanent deformation.

Basic Rating Life (L₁₀) — Calculated based on applied load, speed, and operating conditions.

- Misalignment
- Contamination
- Improper fit
- Inadequate lubrication

6. SPEED CAPABILITY

Maximum permissible speed depends on:

- Bearing size
- Cage material
- Lubrication type
- Seal/shield configuration
- Internal clearance

7. PRECISION GRADES & PERFORMANCE

Precision Class	Standard	Characteristics	Applications
ABEC 1 / ISO P0	ANSI / ISO	Standard tolerances	General machinery
ABEC 3 / ISO P6	ANSI / ISO	Improved dimensional consistency	Automation
ABEC 5 / ISO P5	ANSI / ISO	Low vibration performance	Robotics
ABEC 7 / ISO P4	ANSI / ISO	High accuracy, reduced runout	Aerospace
ABEC 9 / ISO P2	ANSI / ISO	Ultra-precision	Specialized systems

Higher ABEC ratings improve dimensional accuracy but do not inherently increase load capacity.

8. MATERIALS & CAGE OPTIONS

Component	Options	Characteristics	Use Considerations
Rings	Chrome Steel (AISI 52100)	High load capacity, fatigue resistance	Industrial applications
Rings	Stainless Steel (AISI 440C)	Corrosion resistance	Medical / humid environments
Rolling Elements	Steel Balls	Durable, standard performance	General use
Cage	Steel	High strength	Moderate to high loads
Cage	Brass	Improved stability at higher speeds	Larger bearings
Cage	Polymer	Lightweight, low friction	High-speed, low-noise systems

9. ENVIRONMENTAL & LUBRICATION CONSIDERATIONS

Factor	Typical Range	Engineering Notes
Operating Temperature	Low to elevated	Grease selection critical
Moisture Exposure	Dry to humid	Stainless materials recommended
Contamination Risk	Controlled to industrial	Seal configuration impacts service life

10. INTERNAL CLEARANCE & FIT CONSIDERATIONS

Proper shaft and housing fits must be evaluated to prevent:

- Excess preload
- Ring creep
- Distortion
- Reduced fatigue life

11. AEROSPACE & HIGH-RELIABILITY APPLICATION NOTE

For aerospace or mission-critical systems:

- Dimensional traceability may be required
- Vibration and noise testing may be specified
- Lubricant stability and material compatibility must be validated
- Preload and clearance must account for temperature variation
- Additional qualification testing may be necessary for regulated environments

12. TYPICAL APPLICATIONS

- Electric motors
- Automation systems
- Medical equipment
- Industrial machinery
- Aerospace subsystems

13. SELECTION GUIDELINES

Consideration	Key Question
Load	What radial and axial loads exist?
Precision	What vibration or runout limits apply?
Speed	What is maximum operating speed?
Environment	Is moisture, debris, or chemical exposure present?
Maintenance	Is relubrication possible?

TECHNICAL DISCLAIMER

This document is intended as a general technical reference only. It does not represent a product specification, guarantee of performance, or suitability for any specific application. Final bearing selection should be validated through detailed engineering analysis.