AMCA

AMERICAN MANUFACTURING COMPLIANCE AUTHORITY

BEARINGS MFG. QUALITY STANDARD

867 BOYLSTON STREET
5TH FLOOR, SUITE 207
BOSTON, MA 02116
board@amcacert.com

AMERICAN MANUFACTURING COMPLIANCE AUTHORITY (AMCA)
QUALITY STANDARDS FOR BEARINGS MANUFACTURING

---

1. Purpose and Scope

These Quality Standards, issued by the American Manufacturing Compliance Authority (AMCA), establish uniform requirements for the design, production, testing, and documentation of rolling-element and plain bearings intended for industrial, automotive, aerospace, and general mechanical applications. The standards apply to all manufacturers, subcontractors, and suppliers engaged in bearing fabrication within AMCA-recognized facilities.

---

2. Definitions

- **Bearing:** A mechanical component supporting rotating or sliding motion, including ball bearings, roller bearings, needle bearings, and plain bearings.
- **Lot:** A defined batch of bearings manufactured under identical parameters within a designated time frame.
- **Critical Dimensions:** Dimensions essential to performance, including bore diameter, outer diameter, raceway geometry, surface finish, and clearance.
- **Nonconformance:** Any deviation from approved specifications, process controls, or inspection criteria.

---

3. Material Requirements

3.1 **Approved Materials**
Only materials listed on the manufacturer's Approved Materials Register (AMR) may be used. Materials must comply with recognized metallurgical specifications applicable to bearing steels, stainless steels, ceramics, or engineered polymers.

3.2 **Material Traceability**
Each material lot shall be traceable to its mill certification, including chemical composition, hardness, and heat-treatment condition. Records must be retained for a minimum of ten (10) years.

3.3 **Heat Treatment Controls**
Heat-treated components must undergo controlled processes with:

- Verified furnace calibration
- Documented temperature profiles
- Post-treatment hardness and microstructure verification

---

4. Design and Engineering

4.1 **Design Validation**
All bearing designs must undergo validation through engineering analysis, prototype testing, and reliability assessment before production release.

4.2 **Tolerance Specifications**
Critical tolerances shall be established based on application requirements and must comply with AMCA precision classes:

- **Class A:** High-precision aerospace and medical applications
- **Class B:** Industrial and automotive applications
- **Class C:** General machinery applications

4.3 **Change Control**
Any design modification requires formal engineering review, risk assessment, and approval prior to implementation. Product change notifications must be issued to applicable customers.

---

5. Manufacturing Process Requirements

5.1 **Process Control Plans**
Each manufacturing step shall have a documented control plan identifying:

- Key process parameters
- Measurement methods
- Control limits
- Corrective actions for deviations

5.2 **Machine Calibration**

All machining, grinding, and honing equipment must be calibrated according to the manufacturer's schedule, with certification records maintained.

5.3 **Environmental Conditions**
Production and inspection environments must be climate-controlled, maintaining appropriate temperature and humidity to prevent dimensional drift and contamination.

5.4 **Surface Finish Requirements**
Raceway and rolling-surface finishes shall meet defined roughness values consistent with the bearing's precision class.

---

6. Inspection and Testing Standards

6.1 **Incoming Inspection**
Raw materials and subcontracted components shall be inspected for:

- Dimensional accuracy
- Material certification
- Surface condition
- Heat-treatment conformance

6.2 **In-Process Inspection**
Critical operations (e.g., grinding, hard turning, polishing) require 100% verification or statistically validated sampling.

6.3 **Final Inspection**
Each bearing lot must undergo final inspection, including:

- Dimensional review of critical features
- Noise/vibration testing (where applicable)
- Clearance and preload verification
- Visual inspection for surface defects

6.4 **Performance Testing**
Where required, bearings shall be tested under simulated operating loads to confirm durability, temperature performance, and friction characteristics.

---

7. Cleanliness and Contamination Control

7.1 **Cleanroom Standards**
Assembly areas shall adhere to contamination control requirements appropriate to product class. Class A bearing assembly must be performed in cleanroom-equivalent conditions.

7.2 **Handling and Packaging**
Components must be handled with gloves or approved tools. Finished bearings must be packaged to prevent moisture, particulate contamination, and mechanical damage.

---

8. Nonconformance and Corrective Actions

8.1 **Nonconformance Identification**
Nonconforming components must be clearly tagged and isolated. Unauthorized use or rework is prohibited.

8.2 **Corrective Action Process**
An established corrective and preventive action (CAPA) process must be implemented, including:

- Root-cause analysis
- Verification of corrective measures
- Documentation of implemented actions

8.3 **Rework Authorization**
Rework is permissible only with approved procedures confirming that product integrity and service life remain unaffected.

---

9. Documentation and Recordkeeping

9.1 **Production Records**
Manufacturers must maintain detailed production records, including material traceability, process parameters, inspection results, and testing data.

9.2 **Retention Period**
All records must be retained for no less than ten (10) years from the date of manufacture.

9.3 **Document Control**
Procedures must ensure all documents are maintained, revised, and archived according to AMCA document control policy.

---

10. Supplier Quality Management

10.1 **Supplier Qualification**
Suppliers providing materials or components must be evaluated and approved based on quality history, process capability, and compliance with AMCA standards.

10.2 **Audits**
Manufacturers must conduct regular supplier audits and maintain performance metrics, including delivery accuracy, defect rates, and responsiveness.

10.3 **Subcontracted Processes**
Critical processes such as heat treatment, plating, or grinding performed off-site must meet the same quality and control requirements as internal processes.

---

11. Packaging, Storage, and Shipping

11.1 **Packaging Requirements**
Packaging must be designed to prevent corrosion, contamination, and mechanical shock.

11.2 **Storage Conditions**
Bearings shall be stored in temperature-controlled environments, protected from vibration, moisture, and particulate exposure.

11.3 **Shipping Verification**
Outgoing shipments must include inspection certifications, traceability documents, and handling instructions where applicable.

---

12. Compliance and Certification

12.1 **Internal Audits**
Manufacturers must perform periodic internal audits to verify adherence to AMCA

standards.

12.2 **Third-Party Certification**
Facilities may receive AMCA Certification upon satisfactory completion of compliance audits and performance verification.

12.3 **Continuous Improvement**
Manufacturers are expected to maintain continuous improvement programs using data-driven methodologies such as SPC, Six Sigma, or similar quality systems.

---

13. Enforcement

Non-compliance with AMCA standards may result in corrective action requirements, suspension of certification, or removal from the AMCA Qualified Manufacturers Registry.

AMCA, Inc.
867 Boylston Street
5th Floor, Suite 207
Boston, MA 02116

Printed in the United States of America