



SPRINGS & WIREFORM QUALITY STANDARD



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

American Manufacturing Compliance Authority (AMCA)

Quality Standards for Springs and Wire Forming

1. Introduction

The American Manufacturing Compliance Authority (AMCA) has established a set of quality standards to ensure that all springs and wire forms produced meet the highest levels of performance, durability, and safety. These standards provide manufacturers with guidelines for design, materials, production, testing, and post-production inspection. Adherence to these standards ensures the reliability and functionality of springs and wire forms across various industries, including automotive, aerospace, electronics, and industrial machinery.

2. Scope

These quality standards apply to the manufacturing of all types of springs (compression, tension, torsion) and wire forms used in a range of mechanical applications. The standards are applicable to materials, dimensions, tolerances, testing, and handling during production, as well as packaging and shipping.

3. Definitions

- **Spring:** A mechanical device designed to store and release energy, typically made from wire or rod.
- **Wire Form:** A custom-shaped part formed from wire used for various mechanical or structural purposes.
- **Tensile Strength:** The maximum stress that a material can withstand while being stretched or pulled before breaking.
- **Yield Strength:** The stress at which a material begins to deform plastically.

4. Material Requirements

4.1 Material Composition

- All materials used for springs and wire forms must conform to industry-recognized standards such as ASTM, SAE, or equivalent international standards.
- Common materials include carbon steel, stainless steel, alloy steel, and non-ferrous metals such as copper alloys.
- Materials must be free from defects such as cracks, voids, and excessive rust

or oxidation.

4.2 Material Properties

- The tensile strength, yield strength, and hardness of the material must meet or exceed the specifications provided in the product's design requirements.
- Materials must demonstrate consistent performance across all production batches, ensuring uniformity in mechanical properties.

5. Design and Engineering Requirements

5.1 Design Parameters

- The design of springs and wire forms must account for the intended load, deflection, fatigue resistance, and environmental factors (e.g., temperature, corrosion).
- Springs should be designed to operate within the specified range of motion or deformation without permanent distortion or failure.
- Wire forms must be designed to provide adequate strength and stability for their intended use, considering factors like stress concentration and load-bearing capacity.

5.2 Tolerance and Dimensional Control

- All dimensions (e.g., wire diameter, spring length, coil diameter) must adhere to the tolerances specified in the product's design or drawing.
- Standard dimensional tolerances for springs may vary by type and size but generally should not exceed $\pm 0.2\%$ of the nominal dimension.
- Wire forms must be manufactured to the specific shape and dimensions as outlined in the design specification, with tight control over bend radii and angles.

6. Manufacturing Process Requirements

6.1 Wire Preparation

- The wire should be cleaned and conditioned before forming to remove any contaminants, oils, or oxidation.
- Any defects in the wire (such as bends, twists, or inconsistent diameters) must be corrected prior to use.

6.2 Forming and Coiling

- Springs must be coiled using equipment capable of producing precise,

uniform coils with controlled pitch and spacing.

- Wire forms must be bent or shaped with minimal deformation and distortion. The use of automated or CNC-controlled equipment is recommended for consistency and precision.
- Special attention should be given to the spring's end conditions, whether they are ground or unground ends, to ensure they meet the design specifications.

6.3 Heat Treatment

- Heat treatment, including hardening and tempering, must be performed according to the material specifications to achieve the required mechanical properties, such as increased strength and fatigue resistance.
- Springs must be uniformly heated and cooled to avoid uneven stresses or deformation.
- Any coatings or finishes (e.g., zinc plating, phosphate coating) applied after heat treatment should not negatively affect the material's performance.

7. Testing and Inspection

7.1 Visual Inspection

- All springs and wire forms must undergo a visual inspection to check for defects such as cracks, corrosion, or dimensional irregularities.
- Any part that exhibits visible defects must be rejected or reworked as per established guidelines.

7.2 Dimensional Inspection

- Measurement tools such as calipers, micrometers, and specialized spring testers should be used to verify the dimensions of each spring or wire form.
- The following dimensions must be inspected: wire diameter, spring free length, spring diameter (outer and inner), coil pitch, and total number of coils.
- Tolerance checks should be carried out in accordance with the product's design specifications.

7.3 Load Testing

- Springs must be subjected to load testing to verify their performance under both compression and tension (as applicable).

- The spring's force-deflection characteristics must be measured to ensure they fall within the specified load range.
- For wire forms, load-bearing tests should confirm that the part can withstand the maximum expected operational stress without permanent deformation.

7.4 Fatigue Testing

- Springs must undergo fatigue testing to determine their ability to withstand cyclic loading without failure. The testing should replicate the expected usage conditions.
- Wire forms should also be tested for fatigue resistance if subjected to repetitive motion or cyclic loading.

7.5 Corrosion Resistance Testing

- For springs and wire forms intended for use in harsh environments (e.g., outdoors, high humidity, or chemicals), corrosion resistance must be verified through salt-spray or other corrosion testing methods.
- The final product must demonstrate adequate resistance to corrosion, or it must be treated with an appropriate protective coating.

8. Packaging and Shipping Requirements

8.1 Packaging

- Springs and wire forms must be carefully packaged to prevent damage during handling, transport, and storage.
- Springs should be individually or batch-packed to avoid tangling or deformation. Packaging materials should be corrosion-resistant and durable.
- Wire forms must be packaged in such a way that they retain their shape and integrity.

8.2 Shipping

- Shipping containers should be labeled with handling instructions and any special considerations for storage, such as temperature or humidity restrictions.
- Parts must be shipped in a manner that ensures no damage occurs during transit.

9. Documentation and Traceability

9.1 Manufacturing Records

- Manufacturers must maintain detailed records for each production batch, including material certificates, process documentation, and test results.
- Each batch of springs or wire forms should have traceability to the raw material source, processing parameters, and final inspection results.

9.2 Certification and Compliance

- Products must be certified as meeting all relevant AMCA standards and industry-specific requirements.
- Manufacturers should provide certificates of compliance upon request, verifying that their products meet the specifications outlined in this document.

10. Conclusion

The adherence to AMCA quality standards for springs and wire forming ensures that these critical components meet safety, performance, and reliability requirements. Manufacturers are responsible for complying with these standards throughout the entire production process, from material selection to final inspection. Continuous improvement, employee training, and technological upgrades are essential to maintaining the highest levels of quality in spring and wire form production.

NOTE: This set of quality standards for springs and wire forming developed by AMCA is designed to ensure consistency, reliability, and safety in the manufacturing process. Adhering to these guidelines will help manufacturers produce high-quality products that meet or exceed customer expectations.

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

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