



Designation: A230/A230M – 19

Standard Specification for Steel Wire, Carbon Valve Spring Quality¹

This standard is issued under the fixed designation A230/A230M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification covers the highest quality of round and shaped carbon steel spring wire, uniform in quality and temper, intended especially for the manufacture of valve springs and other springs requiring high-fatigue properties. It is similar to the grade VD (referenced in EN 10270-2) intended for high fatigue levels. This wire shall be either in the annealed and cold-drawn or quenched and tempered condition as specified by purchaser.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A510/A510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel](#)

[A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment](#)

[A751 Test Methods and Practices for Chemical Analysis of Steel Products](#)

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.03 on Steel Rod and Wire.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys](#)

[E8/E8M Test Methods for Tension Testing of Metallic Materials](#)

[E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)

[E45 Test Methods for Determining the Inclusion Content of Steel](#)

2.2 *Federal Standard:*³

[Fed. Std. No. 123 Marking for Shipment \(Civil Agencies\)](#)

2.3 *European Standard:*⁴

[EN 10270-2 Steel Wire for Mechanical Springs Part 2: Oil-Hardened and Tempered Spring Steel Wire of Unalloyed and Alloyed Steels](#)

3. Terminology

3.1 Definitions:

3.1.1 Refer to Terminology [A941](#) for additional definitions of terms used in this standard.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *billet, n*—an as-cast or forged section, typically available for transport, inspection, and conditioning, that is used as raw material for wire rod manufacture.

3.2.2 *bloom, n*—an as-cast or forged section used as raw material for billet manufacture.

3.2.3 *equivalent round diameter, n*—diameter of a round wire having equivalent cross sectional area to a given shaped wire.

3.2.4 *round wire, n*—wire having a circular cross section.

3.2.5 *shape factor, n*—a value used to obtain cross sectional area for shaped wires when multiplied by measured width and measured thickness

3.2.6 *shaped wire, n*—wire having a non-circular cross section.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

⁴ Available from European Committee for Standardization, CEN-CENELEC Management Centre Avenue Marnix 17-B-1000 Brussels, Belgium.

*A Summary of Changes section appears at the end of this standard

4. Ordering Information

4.1 Orders for material under this specification should include the following information for each ordered item:

- 4.1.1 Quantity (mass or weight),
- 4.1.2 Name of material (carbon steel valve spring quality wire),
- 4.1.3 Dimensions (Section 9),
- 4.1.4 Chemical composition (Table 1), if required,
- 4.1.5 Condition (Section 5), and
- 4.1.6 ASTM designation and year of issue.

4.2 The purchaser shall have the option to specify additional requirements, including but not limited to:

- 4.2.1 Requirements for certifications, heat analysis or test reports (6.2 and Section 14)
- 4.2.2 Special packing, marking, and loading requirements (Section 15), and
- 4.2.3 Other special requirements, if any.

NOTE 1—A typical ordering description is as follows: 20 000 kg quenched and tempered carbon steel valve spring quality wire, 6.00 mm diameter in 125-kg coils to ASTM A230M dated _____. For inch-pound units, 40 000 lb quenched and tempered carbon steel valve spring quality wire, 0.250 in. diameter in 350-lb coils to ASTM A230 dated _____.

5. Materials and Manufacture

5.1 The steel shall be made by a steel making process combined with secondary ladle refining that is capable of satisfying the inclusion content requirements of this specification.

5.2 The steel shall be continuously cast into blooms and rolled into billets.

5.3 Billet conditioning shall precede wire rod manufacture. The resulting wire rods shall be of sufficient surface quality that when combined with a surface removal operation performed prior to or during the wire manufacturing operation the resulting wire shall satisfy the surface condition and decarburization requirements of this specification.

5.4 The finished wire shall be free of detrimental pipe and undue segregation.

5.5 Unless ordered in the annealed and cold-drawn condition, the wire shall be quenched and tempered to produce the desired mechanical properties.

5.6 Alternate manufacturing processes may be used upon agreement between purchaser and supplier.

6. Chemical Composition

6.1 The steel shall conform to the requirements for chemical composition prescribed in Table 1.

TABLE 1 Chemical Requirements

Element	Composition, %
Carbon	0.60–0.75 ^A
Manganese	0.60–0.90 ^A
Phosphorus, max	0.025
Sulfur, max	0.030
Silicon	0.15–0.35

^A For quenched and tempered wires, carbon and manganese may be varied by the manufacturer at his discretion, provided the mechanical properties specified are maintained and provided the purchaser does not specifically stipulate otherwise.

6.2 *Heat Analysis*—Each heat of steel shall be analyzed to determine the percentage of elements prescribed in Table 1. This analysis shall be made from a test specimen preferably taken during the pouring of the heat. When requested, this shall be reported to the purchaser and shall conform to the requirements of Table 1.

6.3 *Product Analysis*—An analysis may be made by the purchaser from finished wire representing each cast or heat of steel. The chemical composition thus determined, as to elements required or restricted, shall conform to the product analysis requirements specified in Table 3 of Specification A510/A510M.

6.4 For referee purposes, Test Methods, Practices, and Terminology A751 shall be used.

7. Mechanical Properties

7.1 Tension Test:

7.1.1 *Requirements for Annealed and Cold-Drawn Wires*—Tension test requirements, if any, shall be stated in the purchase order.

7.1.2 *Requirements for Quenched and Tempered Wires*—The material as represented by tension test specimens shall conform to the requirements in Table 2. Variation in tensile strength within a coil shall not exceed 70 Mpa [10.15 ksi]. Tensile strength of shaped wires shall conform to Table 2 based on the conversion to equivalent round diameter.

7.1.3 *Number of Tests*—For quenched and tempered wires, each coil in a lot shall be tested. When specified for annealed and cold-drawn wires, one test specimen shall be taken for each five coils, or fraction thereof, in a lot. Each heat in a given lot shall be tested.

7.1.4 *Location of Tests*—For quenched and tempered wires, test specimens shall be taken from both ends of the coil. For annealed and cold-drawn wires, it shall be permissible for test specimens to be taken from either end of the coil.

TABLE 2 Tensile and % Reduction of Area Requirements

Diameter, mm	SI Units		Reduction of Area, min, % ^A
	Tensile Strength, MPa		
	min	max	
Less than 1.50	1700	1850	...
1.50 to 2.35, incl	1650	1800	...
Over 2.35 to 3.25, incl	1620	1770	40
Over 3.25 to 4.00, incl	1580	1720	40
Over 4.00 to 4.90, incl	1550	1700	40
Over 4.90 to 5.70, incl	1520	1680	40
Over 5.70 to 6.35, incl	1480	1630	40
Over 6.35	1450	1600	40
Diameter, in.	Inch-Pound Units		Reduction of Area, min, % ^A
	Tensile Strength, ksi		
	min	max	
Less than 0.062	245	265	...
0.062 to 0.092, incl	240	260	... ^B
Over 0.092 to 0.128, incl	235	255	40
Over 0.128 to 0.157, incl	230	250	40
Over 0.157 to 0.192, incl	225	245	40
Over 0.192 to 0.225, incl	220	240	40
Over 0.225 to 0.250, incl	215	235	40
Over 0.250	210	230	40

^A The reduction of area test is not applicable to wire diameters under 2.34 mm [0.092 in.].

^B The minimum reduction of area requirement for a 0.092 in. wire is 40 %.

“...” Indicates that there is no requirement.