Designation: A529/A529M – 05

Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality[1]

This standard is issued under the fixed designation A529/A529M; 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 Department of Defense.

1. Scope*

1.1 This specification covers carbon-manganese steel shapes, plates, and bars of structural quality for use in riveted, bolted, or welded construction of buildings and for general structural purposes.

1.2 Material under this specification is available in two grades:

Grade	Yield Strength, ksi [MPa]	Thickness
50 [345]	50 [345]	Plates to 1 in. [25 mm] thick to 15 in. [380 mm] wide Bars to 3½ in. [90 mm] Shapes with flange or leg thickness to 1½ in. [40 mm] inclusive
55 [380]	55 [380]	Plates to 1 in. [25 mm] thick to 15 in. [380 mm] wide Bars to 3 in. [75 mm] Shapes with flange or leg thickness to 1½ in. [40 mm] inclusive

1.3 When the steel is to be welded, it is presupposed that a welding procedure suitable for the grade of steel and intended use or service will be utilized. See Appendix X3 of Specification A6/A6M for information on weldability.

1.4 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A6/A6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

3. General Requirements for Delivery

3.1 Material furnished under this specification shall conform to the requirements of the current edition of Specification A6/A6M, for the ordered material, unless a conflict exists in which case this specification shall prevail.

4. Materials and Manufacture

4.1 The steel shall be killed, and such shall be affirmed in the test report by the inclusion of a statement of *killed steel*, a value of 0.10 % or more for silicon content, or a value of 0.015 % or more for total aluminum content.

5. Chemical Composition

5.1 *Heat Analysis*:

5.1.1 The heat analysis shall conform to the requirements prescribed in Table 1.

5.1.2 In addition to the elements specified in Table 1, test reports shall include for information the chemical analysis for copper, columbium, chromium, nickel, molybdenum, and vanadium. When the amount of copper, chromium, nickel, molybdenum, or silicon is less than 0.02 %, the analysis may be reported as "<0.02 %." When the amount of columbium or vanadium is less than 0.008 %, the analysis may be reported as "<0.008 %."

5.2 *Product Analysis*:

5.2.1 The steel shall conform on product analysis to the requirements of Table 1, subject to the product analysis tolerances in Specification A6/A6M.

6. Tension Test

6.1 The material as represented by the test specimen shall conform to the requirements as to the tensile properties prescribed in Table 2.

7. Keywords

7.1 bars; bolted construction; carbon; frames; metal building systems; plates; riveted construction; shapes; steel; structural steel; trusses; welded construction

[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 A01.02 on Structural Steel for Bridges, Buildings, Rolling Stock, and Ships.

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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.

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

TABLE 1 Chemical Requirements (Heat Analysis)

NOTE—A maximum of 1.50 % manganese is permissible, with an associated reduction of the carbon maximum of 0.01 percentage point for each 0.05 percentage point increase in manganese.

Element	Composition, %
	Grades 50 [345] and 55 [380]
Carbon, max	0.27
Manganese, max	1.35
Phosphorus, max	0.04
Sulfur, max	0.05
Silicon, max	0.40
Copper, min, when copper is specified	0.20

TABLE 2 Tensile Requirements[A]

	Grade 50 [345]		Grade 55 [380]	
	ksi	[MPa]	ksi	[MPa]
Tensile strength, min	70[B]	[485]	70	[485]
Tensile strength, max	100	[690]	100	[690]
Yield strength, min	50	[345]	55	[380]
Elongation in 8 in. [200 mm], min, %	18		17	
Elongation in 2 in. [50 mm], min, %	21		20	

[A] See the Orientation subsection in the Tension Tests section of Specification A6/A6M.

[B] Minimum tensile strength for Grade 50 shapes with flange or leg thickness to 1 ½ in. [40 mm] inclusive, shall be 65 ksi [450 MPa].

SUPPLEMENTARY REQUIREMENTS

Standardized supplementary requirements for use at the option of the purchaser are listed in Specification A6/A6M. Those that are considered suitable for use with this specification are listed by title:

S5. Charpy V-Notch Impact Test.

In addition, the following optional supplementary requirements are also suitable for use with this specification.

S32. Single Heat Bundles.

S32.1 Bundles containing shapes or bars shall be from a single heat of steel.

S78. Maximum Carbon Equivalent.

S78.1 This material shall be supplied with a maximum carbon equivalent value of 0.55 % or to a lower value specified in the purchase documents. This value will be based on heat analysis. The required chemical analysis as well as the carbon equivalent shall be reported.

S78.2 The carbon equivalent shall be calculated using the following formula:

$$CE = C + (Mn + Si)/6 + (Cu + Ni)/15 + (Cr + Mo + V + Cb)/5$$

S79. Maximum Tensile Strength.

S79.1 The maximum tensile strength shall be 90 ksi [620 MPa].