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American Association State
Highway and Transportation Officials
Standard AASHTO No.: M 161

Standard Specification for High-Strength Low-Alloy Structural Steel[1]

This standard is issued under the fixed designation A 242/A 242M; 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.

ϵ[1] NOTE—The numbering for Tables 1 and 2 was corrected editorially in October 2005.

1. Scope*

1.1 This specification covers high-strength low-alloy structural steel shapes, plates, and bars for welded, riveted, or bolted construction intended primarily for use as structural members where savings in weight [mass] or added durability are important. The atmospheric corrosion resistance of the steel in most environments is substantially better than that of carbon structural steels with or without copper addition. When properly exposed to the atmosphere, this steel can be used bare (unpainted) for many applications (see Note 1). This specification is limited to material up to 4 in. [100 mm], inclusive, in thickness.

NOTE 1—For methods of estimating the atmospheric corrosion resistance of low-alloy steels, see Guide G 101.

1.2 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 A 6/A 6M for information on weldability.

1.3 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. Combining values from the two systems may result in nonconformance with the specification.

1.4 For structural products produced from coil and furnished without heat treatment or with stress relieving only, the additional requirements, including additional testing requirements and the reporting of additional test results, of Specification A 6/A 6M apply.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 6/A 6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

G 101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

3. General Requirements for Delivery

3.1 Structural products furnished under this specification shall conform to the requirements of the current edition of Specification A 6/A 6M, for the specific structural product ordered, unless a conflict exists, in which case this specification shall prevail.

3.2 Coils are excluded from qualification to this specification until they are processed into a finished structural product. Structural products produced from coil means structural products that have been cut to individual lengths from a coil. The processor directly controls, or is responsible for, the operations involved in the processing of a coil into a finished structural product. Such operations include decoiling, leveling or straightening, hot-forming or cold-forming (if applicable), cutting to length, testing, inspection, conditioning, heat treatment (if applicable), packaging, marking, loading for shipment, and certification.

NOTE 2—For structural products produced from coil and furnished without heat treatment or with stress relieving only, two test results are to be reported for each qualifying coil. Additional requirements regarding structural products produced from coil are described in Specification A 6/A 6M.

4. Materials and Manufacture

4.1 The steel shall be semi-killed or killed.

[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.**

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TABLE 1 Tensile Requirements

	Plates and Bars[A]			Structural Shapes		
	For thicknesses ¾ in. [20 mm], and under	For thicknesses over ¾ to 1½ in. [20 to 40 mm], incl	For thicknesses over 1½ to 4 in. [40 to 100 mm], incl	For flange or leg thicknesses 1.5 in. [40 mm] and under	For flange thicknesses over 1.5 in. [40 mm] to 2 in. [50 mm], incl	For flange thicknesses over 2 in. [50 mm]
Tensile strength, min, ksi [MPa]	70 [480]	67 [460]	63 [435]	70 [485]	67 [460]	63 [435]
Yield point, min, ksi [MPa]	50 [345]	46 [315]	42 [290]	50 [345]	46 [315]	42 [290]
Elongation in 8 in. [200 mm], min, %	18[B,C]	18[B,C]	18[B,C]	18[C]	18	18
Elongation in 2 in. [50 mm], min, %	21[C]	21[C]	21[C]	21	21	21[D]

[A]See the Orientation subsection in the Tension Tests section of Specification A 6/A 6M.
[B]Elongation not required to be determined for floor plate.
[C]For plates wider than 24 in. [600 mm] the elongation requirement is reduced two percentage points. See the Elongation Requirement Adjustments subsection in the Tension Tests section of Specification A 6/A 6M.
[D]For wide flange shapes over 426 lb/ft [634 kg/m], elongation in 2 in. [50 mm] of 18 % minimum applies.

5. Chemical Composition

5.1 The heat analysis shall conform to the requirements prescribed in Table 2.

5.2 The steel shall conform on product analysis to the requirements prescribed in Table 2, subject to the product analysis tolerances in Specification A 6/A 6M.

5.3 Choice and use of alloying elements, combined with carbon, manganese, phosphorus, sulfur, and copper within the limits prescribed in 5.1 to give the mechanical properties prescribed in Section 6 and to provide the atmospheric corrosion resistance of 1.1, shall be made by the manufacturer and included and reported in the heat analysis to identify the type of steel applied. Elements commonly added include: chromium, nickel, silicon, vanadium, titanium, and zirconium.

TABLE 2 Chemical Requirements (Heat Analysis)

Element	Composition, %
	Type 1
Carbon, max	0.15
Manganese, max	1.00
Phosphorus, max	0.15
Sulfur, max	0.05
Copper, min	0.20

5.4 The atmospheric corrosion-resistance index, calculated on the basis of the heat analysis of the steel, as described in Guide G 101–Predictive Method Based on the Data of Larabee and Coburn, shall be 6.0 or higher.

NOTE 3—The user is cautioned that the Guide G 101 predictive equation (Predictive Method Based on the Data of Larabee and Coburn) for calculation of an atmospheric corrosion-resistance index has only been verified for the composition limits stated in the guide.

5.5 When required, the manufacturer shall supply evidence of corrosion resistance satisfactory to the purchaser.

6. Tension Test

6.1 The material as represented by the test specimens shall conform to the requirements as to tensile properties prescribed in Table 1.

7. Keywords

7.1 atmospheric corrosion resistance; bars; bolted construction; durability; high-strength; low-alloy; plates; riveted construction; shapes; steel; structural steel; weight; welded construction

SUPPLEMENTARY REQUIREMENTS

Standardized supplementary requirements for use at the option of the purchaser are listed in Specification A 6/A 6M. Those that are considered suitable for use with this specification are listed by title:

S2. Product Analysis,
S3. Simulated Post-Weld Heat Treatment of Mechanical Test Coupons,
S5. Charpy V-Notch Impact Test,
S6. Drop Weight Test (for Material 0.625 in. [16 mm] and over in Thickness),
S8. Ultrasonic Examination, and
S15. Reduction of Area Measurement.
S32. Single Heat Bundles.

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SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 242/A 242M – 03a) that may impact the use of this standard (approved April 1, 2004).

(1) Added Supplementary Requirement S32.

Committee A01 has identified the location of selected changes to this standard since the last issue (A 242/A 242M-03) that may impact the use of this standard (approved May 10, 2003).

(1) Table 2 was revised.

Committee A01 has identified the location of selected changes to this standard since the last issue (A 242/A 242M-01) that may impact the use of this standard (approved April 10, 2003).

(1) 1.4, 3.1, 3.1.1 (renumbered as 3.2), and Note 2 have been revised to be consistent with the terminology and requirements of A 6/A 6M.

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