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HSLA
For structural shapes

American Association of State
Highway and Transportation Officials Standard
AASHTO No.: M 222

Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4-in. [100-mm] Thick¹

This standard is issued under the fixed designation A 588/A 588M; 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 high-strength low-alloy structural steel shapes, plates, and bars for welded, riveted, or bolted construction but intended primarily for use in welded bridges and buildings where savings in weight or added durability are important. The atmospheric corrosion resistance of this steel in most environments is substantially better than that of carbon structural steels with or without copper addition (see Note 1). When properly exposed to the atmosphere, this steel is suitable for many applications in the bare (unpainted) condition. This specification is limited to material up to 8 in. [200 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, a welding procedure suitable for the grade of steel and intended use or service is to 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 separately 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 is to be used independently of the other, without combining values in any way.

1.4 The text of this specification contains notes, footnotes, or both, that provide explanatory material. Such notes and footnotes, excluding those in tables and figures, do not contain any mandatory requirements.

1.5 For structural products cut from coiled product, 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:

A 6/A 6M Specification for General Requirements for

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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Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling²

G 101 Guide for Estimating Atmospheric Corrosion Resistance of Low-Alloy Steels³

3. General Requirements for Delivery

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

3.1.1 Coiled product is excluded from qualification to this specification until leveled and cut to length. Structural products produced from coil means structural products that have been cut to individual lengths from a coiled product and are furnished without heat treatment. The processor decoils, levels, cuts to length, and marks the product. The processor is responsible for performing and certifying all tests, inspections, and operations not intended to affect the properties of the material. For structural products produced from coils, two tests shall be reported for each qualifying coil. See Note 2.

NOTE 2—Additional requirements regarding structural products from coil are described in Specification A 6/A 6M.

4. Materials and Manufacture

4.1 The steel shall be made to fine grain practice.

5. Chemical Composition

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

5.2 The steel shall conform on product analysis to the requirements prescribed in Table 1, subject to the product analysis tolerances in Specification A 6/A 6M.

5.3 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)

² Annual Book of ASTM Standards, Vol 01.04.

³ Annual Book of ASTM Standards, Vol 03.02.

for calculation of an atmospheric corrosion-resistance index has only been verified for the composition limits stated in the guide.

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

6. Tensile Requirements

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

7. Keywords

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

TABLE 1 Chemical Requirements (Heat Analysis)

NOTE 1—Where “. . .” appears in this table, there is no requirement.

Element	Composition, %			
	Grade A	Grade B	Grade C	Grade K
Carbon	0.19 max	0.20 max	0.15 max	0.17 max
Manganese	0.80–1.25	0.75–1.35	0.80–1.35	0.50–1.20
Phosphorus	0.04 max	0.04 max	0.04 max	0.04 max
Sulfur	0.05 max	0.05 max	0.05 max	0.05 max
Silicon	0.30–0.65	0.15–0.50	0.15–0.40	0.25–0.50
Nickel	0.40 max	0.50 max	0.25–0.50	0.40 max
Chromium	0.40–0.65	0.40–0.70	0.30–0.50	0.40–0.70
Molybdenum	...	...	...	0.10 max
Copper	0.25–0.40	0.20–0.40	0.20–0.50	0.30–0.50
Vanadium	0.02–0.10	0.01–0.10	0.01–0.10	...
Columbium	...	...	...	0.005–0.05 ^A

^AFor plates under 1/2 in. in thickness, the minimum columbium is waived.

TABLE 2 Tensile Requirements^A

NOTE 1—Where “. . .” appears in this table, there is no requirement.

	Plates and Bars			Structural Shapes
	For Thick- nesses 4 in. [100 mm] and Under	For Thick- nesses Over 4 in. [100 mm] to 5 in. [125 mm] incl	For Thick- nesses Over 5 in. [125 mm] to 8 in. [200 mm] incl	All Groups ^B
Tensile strength, min, ksi [MPa]	70 [485]	67 [460]	63 [435]	70 [485]
Yield point, min, ksi [MPa]	50 [345]	46 [315]	42 [290]	50 [345]
Elongation in 8 in. [200 mm], min, %	18 ^{C,D}	...	...	18 ^D
Elongation in 2 in. [50 mm], min, %	21 ^{C,D}	21 ^{C,D}	21 ^{C,D}	21 ^E

^ASee specimen orientation under the Tension Tests section of Specification A 6/A 6M.

^BSee Specification A 6/A 6M.

^CElongation not required to be determined for floor plate.

^DFor plates wider than 24 in. [600 mm], the elongation requirement is reduced two percentage points. See elongation requirement adjustments in the Tension Tests section of Specification A 6/A 6M.

^EFor wide flange shapes over 426 lb/ft [634 kg/m], elongation in 2 in. [50 mm] of 18 % minimum applies.

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall not apply unless specified in the order or contract. 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,

- S8. Ultrasonic Examination,
- S15. Reduction of Area Measurement, and
- S18. Maximum Tensile Strength.
- S30. Charpy V-Notch Impact Test for Structural Shapes: Alternate Core Location

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