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Standard Specification for High-Strength Low-Alloy Structural Steel Plate With Atmospheric Corrosion Resistance[1]

This standard is issued under the fixed designation A 871/A 871M; 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.

1. Scope

1.1 This specification covers high-strength low-alloy steel plate intended for use in tubular structures and poles or in other suitable applications. Two grades, 60 and 65, may be provided as-rolled, normalized or quenched and tempered as required to meet the specified mechanical requirements.

1.2 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 can be used bare (unpainted) for many applications.

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

1.3 When the steel is to be welded, it is presupposed that welding procedures 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.

1.4 Supplementary requirements in accordance with Specification A 6/A 6M are available, but shall apply only when specified by the purchaser at time of ordering.

1.5 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.

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

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 673/A 673M Specification for Sampling Procedure for Impact Testing of Structural Steel

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

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.

4. Materials and Manufacture

4.1 The steel shall be made to fine grain practice.

5. Heat Treatment

5.1 Grade 65 in thicknesses of 3⁄16 to 3⁄4 in. [5 to 20 mm] and Grade 60 in thicknesses of 3⁄16 to 1 3⁄8 in. [5 to 35 mm] are normally furnished in the as-rolled condition. The manufacturer has the option to heat treat this material to meet the mechanical requirements of Section 7. Quenched and tempered material shall be heat treated by heating to not less than 1650°F [900°C], holding a sufficient time to attain uniform heat throughout the material, quenching in a suitable medium, and tempering at not less than 1100°F [595°C]. Heat treating temperatures shall be reported on the test certificates.

5.2 The maximum thickness of plates is limited only by the capacity of the composition to meet the specified mechanical requirements. The individual manufacturer shall be contacted to determine the actual maximum thickness for each grade and heat treatment method.

6. Chemical Requirements

6.1 The heat analysis shall conform to the chemical requirements of Table 1.

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

[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.

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TABLE 1 Chemical Requirements (Heat Analysis)

Element	Composition, %			
	Type I	Type II	Type III	Type IV
Carbon[A]	0.19 max	0.20 max	0.15 max	0.17 max
Manganese[A]	0.80–1.35	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	0.40–0.70	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[B]

[A] For each reduction of 0.01 percentage point below the specified maximum for carbon, an increase of 0.06 percentage point above the specified maximum for manganese is permitted, up to a maximum of 1.50 %.

[B] For plates under ½ in. [13 mm] in thickness, the minimum columbium is waived.

6.3 The atmospheric corrosion-resistance index, calculated on the basis of the heat analysis for 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 2—The user is cautioned that the Guide G 101 (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 that guide.

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

7. Mechanical Requirements

7.1 *Tension Tests*:

7.1.1 The steel as represented by the tension test specimens shall conform to the tensile requirements of Table 2.

7.1.2 For adjustments in Table 2 percentage elongation requirements for material thickness under 0.312 in. [8 mm] and over 3.5 in. [90 mm], see Specification A 6/A 6M.

7.2 *Charpy V-Notch Impact Tests*:

TABLE 2 Tensile Requirements[A]

Grade	Yield Strength[B] min. ksi [MPa]	Tensile Strength min. ksi [MPa]	Minimum Elongation, %[C]	
			In 8 in. [200 mm]	In 2 in. [50 mm]
60	60 [415]	75 [520]	16	18
65	65 [450]	80 [550]	15	17

[A] For plates wider than 24 in. [600 mm], the test specimen is taken in the transverse direction. See 11.2 of Specification A 6/A 6M.

[B] Measured at 0.2 % offset or 0.5 % extension under load as described in Section 13 on yield strength of Test Methods A 370.

[C] For plates wider than 24 in. [600 mm], the elongation requirement is reduced three percentage points.

7.2.1 The steel, as represented by the Charpy V-Notch test, shall conform to the impact test requirements of Table 3.

7.2.2 If more stringent impact requirements are required, they shall be negotiated between the purchaser and the manufacturer.

8. Test Specimens and Number of Tests

8.1 The purchaser shall indicate on the purchase order the frequency of Charpy V-Notch Impact Testing, as provided for in Specification A 673/A 673M. If the purchase order does not specify the frequency, "H" testing frequency shall be supplied.

9. Keywords

9.1 as-rolled; atmospheric corrosion resistance; high-strength; low-alloy; normalized; plate; poles; quenched; steel; structural steel; tempered; tubular structures

TABLE 3 Charpy V-Notch Impact Test Requirements

Plate Thickness in [mm]	Absorbed Energy ft-lb [J]	Temperature °F [°C]
Up to ½ [12] incl	15 [20]	0 [–18]
Over ½ [12]	15 [20]	– 20 [–29]

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall not apply unless specified in the purchase order or contract. Standardized supplementary requirements for use at the option of the purchaser are listed in Specification A 6/A 6 M.

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