



Designation: **A633/A633M—18 A633/A633M – 24**

## Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates<sup>1</sup>

This standard is issued under the fixed designation A633/A633M; 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 ( $\epsilon$ ) 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 normalized high-strength low-alloy structural steel plates for welded, riveted, or bolted construction.
- 1.2 This material is particularly suited for service at low ambient temperatures of  $-50^{\circ}\text{F}$  [ $-45^{\circ}\text{C}$ ] $-50^{\circ}\text{F}$  [ $-45^{\circ}\text{C}$ ] and higher where notch toughness better than that expected in as-rolled material of a comparable strength level is desired.
- 1.3 Four grades, designated Grades A, C, D, and E are covered by this specification. Grade A provides a minimum yield point of 42 ksi [290 MPa]. Grades C and D provide a minimum yield point of 50 ksi [345 MPa] in thicknesses up to 2.50 in. [65 mm], inclusive and 46 ksi [315 MPa] in thicknesses over 2.50 in. [65 mm]. Grade E provides a minimum yield point of 60 ksi [415 MPa] in thicknesses up to 4.0 in. [100 mm], inclusive and 55 ksi [380 MPa] in thicknesses over 4 in. [100 mm].
- 1.4 Current practice normally limits plates furnished under this specification to maximum thickness of 4 in. [100 mm] for Grades A, C, and D, and to a maximum thickness of 6 in. [~~150 mm~~][150 mm] for Grade E. However, the maximum thickness of the plates is limited only by the capacity of the composition to meet the specified mechanical property requirements.
- 1.5 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.
- 1.6 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 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.

1.7 *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:<sup>2</sup>

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

<sup>1</sup> 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.

Current edition approved ~~June 1, 2018~~ March 1, 2024. Published ~~June 2018~~ April 2024. Originally approved in 1970. Last previous edition approved in ~~2013~~ 2018 as ~~A633/A633M—13~~ A633/A633M – 18. DOI: ~~10.1520/A0633-A0633M-18~~ 10.1520/A0633\_A0633M-24.

<sup>2</sup> 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



### 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 requirements for fine austenitic grain size in Specification A6/A6M shall be met.

### 5. Heat Treatment

5.1 The material shall be normalized by heating to a suitable temperature which produces an austenitic structure, but not exceeding 1700°F [925°C], 1700 °F [925 °C], holding a sufficient time to attain uniform heat throughout the material and cooling in air.

5.1.1 Grade E material over 3 in. [75 mm] in thickness shall be double normalized.

5.2 If the purchaser elects to perform the required heat treatment, the material shall be accepted on the basis of mill tests made from test coupons heat treated in accordance with the purchase order requirements. If the test coupon heat treatment requirements are not indicated on the purchase order, the manufacturer shall heat treat the test coupons under conditions considered appropriate. The manufacturer shall inform the purchaser of the heat-treatment procedure followed in heat treating the test coupons at the mill.

### 6. Chemical Composition

6.1 The heat analysis shall conform to the chemical composition requirements listed in Table 1.

6.2 The steel shall conform on product analysis. When a purchaser specifies a product analysis in accordance with Supplementary Requirement S2, the product analysis shall conform to the requirements prescribed given in Table 1, subject to the product analysis tolerances in Specification A6/A6M.

### 7. Tension Test

7.1 The material as represented by the test specimens shall conform to the requirements listed in Table 2.

TABLE 1 Chemical Requirements

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

Element	Grade A, %	Grade C, %	Grade D, %	Grade E, % <sup>A</sup>
Carbon, max	0.18	0.20	0.20	0.22
Manganese:				
1 ½ in. [40 mm] and under in thickness	1.00–1.35	1.15–1.50 <sup>B</sup>	0.70–1.35	1.15–1.50
1 ½ in. [40 mm] and under in thickness	1.00 to 1.35	1.15 to 1.50 <sup>B</sup>	0.70 to 1.35	1.15 to 1.50
Over 1 ½ in. to 4 in. [40 to 100 mm], incl	1.00–1.35	1.15–1.50 <sup>B</sup>	1.00–1.60	1.15–1.50
Over 1 ½ in. to 4 in. [40 mm to 100 mm], incl	1.00 to 1.35	1.15 to 1.50 <sup>B</sup>	1.00 to 1.60	1.15 to 1.50
Over 4 in. to 6 in. [100 to 150 mm], incl	<sup>C</sup>	<sup>C</sup>	<sup>C</sup>	1.15–1.50
Over 4 in. to 6 in. [100 mm to 150 mm], incl	<i>c</i>	<i>c</i>	<i>c</i>	1.15 to 1.50
Phosphorus, max	0.030	0.030	0.030	0.030
Sulfur, max	0.030	0.030	0.030	0.030
Silicon	0.15–0.50	0.15–0.50	0.15–0.50	0.15–0.50
Silicon	0.15 to 0.50	0.15 to 0.50	0.15 to 0.50	0.15 to 0.50
Vanadium	...	...	...	0.04–0.11
Vanadium	...	...	...	0.04 to 0.11
Columbium (niobium) <sup>D</sup>	0.05 max	0.01–0.05	...	<sup>E</sup>
Columbium (niobium) <sup>D</sup>	0.05 max	0.01 to 0.05	...	<sup>E</sup>
Nitrogen, max	...	...	...	0.03
Copper, max	...	...	0.35	...
Nickel, max	...	...	0.25	...
Chromium, max	...	...	0.25	...
Molybdenum, max	...	...	0.08	...

<sup>A</sup> For Grade E the minimum total aluminum content shall be 0.018 %, or the vanadium-to-nitrogen ratio shall be 4:1 minimum.

<sup>B</sup> For Grade C manganese content may be increased to 1.60 % maximum provided the carbon content does not exceed 0.18 %.

<sup>C</sup> The size and grade is not described in this specification.

<sup>D</sup> Columbium and niobium are interchangeable names for the same element.

<sup>E</sup> Columbium (niobium) may be present in the amount of 0.01 % to 0.05 %.