



Designation: A 945/A 945M – 00

Standard Specification for High-Strength Low-Alloy Structural Steel Plate with Low Carbon and Restricted Sulfur for Improved Weldability, Formability, and Toughness¹

This standard is issued under the fixed designation A 945/A 945M; 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 structural steel plate intended for use in welded construction of naval ships where a savings in weight is important. Steels that conform to this specification offer improved weldability, formability, and toughness resulting from the specified alloying elements with limitations on carbon, sulfur, and residual element contents. Two grades, 50 and 65, may be provided as-rolled, control-rolled, thermo-mechanical control processed (including accelerated cooling), normalized, or quenched and tempered as required to meet the specified mechanical requirements.

1.2 The maximum thickness or weight [mass] of plates shall be as follows:

Grade	Plate thickness, max, in. [mm]	Plate weight [mass], max, lb/ft ² [kg/m ²]
50	2 [50]	81.7 [393]
65	1¼ [32]	51.0 [251]

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.

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 shall be used independently of the other. Combining values from the two systems may result in nonconformance with this specification.

2. Referenced Documents

2.1 ASTM Standards:

A 6/A6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling²

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys and is under the direct responsibility of Subcommittee A01.02 on Structural Steel for Bridges, Buildings, Rolling Stock, and Ships.

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² Annual Book of ASTM Standards, Vol 01.04.

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products³

A 673/A 673M Specification for Sampling Procedure for Impact Testing of Structural Steel²

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment⁴

E 208 Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels⁵

3. General Requirements for Delivery

3.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 6/A 6M.

3.2 When specified by the purchaser, materials ordered under this specification shall be prepared for shipment in accordance with the requirements of the current edition of Specification A 700.

4. Materials and Manufacture

4.1 The steel shall be made to fine grain practice.

4.2 The plates after finish-rolling shall be in one of the following conditions: as-rolled, control-rolled, or thermo-mechanical control processed (including accelerated cooling).

5. Heat Treatment

5.1 Grade 50 plates and Grade 65 plates are normally furnished without heat treatment. The manufacturer has the option to normalize or quench and temper this material to meet the mechanical requirements of Section 7 provided the heat treatment is reported on the test report.

6. Chemical Composition

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

³ Annual Book of ASTM Standards, Vol 01.03.

⁴ Annual Book of ASTM Standards, Vol 01.05.

⁵ Annual Book of ASTM Standards, Vol 03.01.

TABLE 1 Chemical Requirements

Element	Composition, %
Carbon	0.10 max
Manganese	1.10–1.65
Phosphorus	0.025 max
Sulfur	0.010 max
Silicon	0.10–0.50
Nickel	0.40 max
Chromium	0.20 max
Molybdenum	0.08 max
Copper	0.35 max
Vanadium	0.10 max
Columbium	0.05 max
Aluminum	0.08 max

6.2 If a product analysis is made, the material shall conform to the requirements of Table 1, subject to the product analysis tolerances in Specification A 6/A 6M.

7. Mechanical Properties

7.1 Tensile Properties:

7.1.1 The material as represented by the test specimens shall conform to the tensile properties specified for the applicable grade as listed in Table 2.

7.1.2 For quenched and tempered plates, one tension test shall be taken from a corner of each plate as heat treated.

TABLE 2 Tensile Requirements^A

Grade	Yield Point or Yield Strength ^B min, ksi [MPa]	Tensile Strength ksi [MPa]	Minimum Elongation, % ^C	
			In 8 in. [200 mm]	In 2 in. [50 mm]
50	50 [345]	70 [485]–90 [620]	21	24
65	65 [450]	78 [540]–100 [690]	18	22

^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 and Definitions A 370.

^C For plates wider than 24 in. [600 mm], the elongation requirement is reduced two percentage points. See elongation requirement adjustment in the tension tests section of Specification A 6/A 6M.

7.1.3 When measured on a 1½ in. [40-mm] wide specimen (see Fig. 3 of Test Methods and Definitions A 370), the elongation may be determined in a 2 in. [50-mm] gage length which includes the fracture and shows the greatest elongation.

7.2 Charpy V-Notch Impact Properties:

7.2.1 The Charpy V-Notch impact tests shall be conducted in accordance with Specification A 673/A 673M. All plates shall be tested in accordance with frequency (*P*) Piece Testing.

7.2.2 The material as represented by the test specimens shall conform to the impact properties for the applicable grade as listed in Table 3. The longitudinal axis of the specimens may be parallel or transverse to the final direction of rolling of the material at the option of the steel manufacturer, unless the test direction is specified by the purchaser.

7.2.3 If more stringent impact requirements are required. Supplementary Requirement S5 should be specified in the order.

8. Report

8.1 The manufacturer or processor shall report the results of all tests required by this specification as identified in Section 18 of Specification A 6/A 6M.

8.2 The manufacturer shall furnish a certification that the material has been manufactured and tested in accordance with the requirements of the material specification.

9. Keywords

9.1 as-rolled; high-strength; low-alloy; low-carbon; normalized; plate; quenched; restricted sulfur; ship applications; steel; structural applications; tempered; thermo-mechanical control processed (TMCP); weight; welded construction

TABLE 3 Charpy V-Notch Impact Test Requirements

Grade	Temperature °F [°C]	Longitudinal Specimens, min avg		Transverse Specimens, min avg	
		ft-lbf	[J]	ft-lbf	[J]
50	–40 [–40]	30	[41]	20	[27]
65	–40 [–40]	30	[41]	20	[27]

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 6M. Those that are considered suitable for use with this specification are listed by title:

S5. Charpy V-Notch Impact Test.