Designation: A 678/A 678M – 05

Standard Specification for Quenched-and-Tempered Carbon and High-Strength Low-Alloy Structural Steel Plates[1]

This standard is issued under the fixed designation A 678/A 678M; 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 quenched-and-tempered carbon steel and high-strength low-alloy steel plates of structural quality for welded, riveted, or bolted construction.

1.2 If 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 used.

1.3 Plates under this specification are available in four grades as follows:

Grade	Yield Strength, min, ksi [MPa]	Tensile Strength, ksi [MPa]	Maximum Thickness, in. [mm]
A	50 [345]	70–90 [485–620]	1½ [40]
B	60 [415]	80–100 [550–690]	2½ [65]
C	[A]	[A]	2 [50]
D	75 [515]	90–110 [620–760]	3 [75]

[A]Varies with thickness. See Table 1.

1.4 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.

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

3. General Requirements for Delivery—

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

5. Heat Treatment

5.1 The plates shall be heat treated by heating to a temperature that produces an austenitic structure, but not exceeding 1700°F [925°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 [593°C]. The heat-treatment temperatures shall be reported in the test report.

6. Chemical Composition

6.1 The heat analysis shall conform to the requirements given in Table 2 for the applicable grade.

6.2 The product analysis shall conform to the requirements given in Table 2, subject to the product analysis tolerances in Specification A 6/A 6M.

7. Tension Test

7.1 The plates as represented by the test specimens shall conform to the requirements given in Table 1 specified for the applicable grade.

7.2 *Number of Tests*—One tension test shall be taken from a corner of each plate as heat treated.

8. Keywords

8.1 carbon; bolted construction; high-strength; low-alloy; plates; quenched; steel; structural steel; tempered; welded construction

[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 Mechanical Requirements[A]

	Grade A	Grade B	Grade C	Grade D
Yield strength[B], min. ksi [MPa]				
To ¾ in. [20 mm], incl	50 [345]	60 [415]	75 [515]	75 [515]
Over ¾ to 1½ in. [20 to 40 mm], incl	50 [345]	60 [415]	70 [485]	75 [515]
Over 1½ to 2 in. [40 to 50 mm], incl	[C]	60 [415]	65 [450]	75 [515]
Over 2 to 2½ in. [50 to 65 mm], incl	[C]	60 [415]	[C]	75 [515]
Over 2½ to 3 in. [65 to 75 mm], incl	[C]	[C]	[C]	75 [515]
Tensile strength, ksi [MPa]				
To ¾ in. [20 mm], incl	70–90 [485–620]	80–100 [550–690]	95–115 [655–790]	90–110 [620–760]
Over ¾ to 1½ in. [20 to 40 mm], incl	70–90 [485–620]	80–100 [550–690]	90–110 [620–760]	90–110 [620–760]
Over 1½ to 2 in. [40 to 50 mm], incl	[C]	80–100 [550–690]	85–105 [585–720]	90–110 [620–760]
Over 2 to 2½ in. [50 to 65 mm], incl	[C]	80–100 [550–690]	[C]	90–110 [620–760]
Over 2½ to 3 in. [65 to 75 mm], incl	[C]	[C]	[C]	90–110 [620–760]
Elongation in 2 in. [50 mm], min, %[DE]	22	22	19	18

[A] See Specimen Orientation under the Tension Tests section of Specification A 6/A 6M.
[B] Measured at 0.2 % offset or 0.5 % extension under load.
[C] The size and grade is not described in this specification.
[D] For thickness of ¾ in. [20 mm] and under, measured on 1½-in. [40-mm] wide full thickness rectangular specimen as shown in Fig. 3 of Test Methods and Definitions A 370. The elongation is measured in a 2-in. [50-mm] gage length that includes the fracture and which shows the greatest elongation.
[E] For 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.

TABLE 2 Chemical Requirements

NOTE 1— Small amounts of alloying elements may be present, but shall not exceed the following amounts: Cu-0.35; Ni-0.25; Cr-0.25; Mo-0.08.
NOTE 2—Where ". . ." appears in this table there is no requirement.

Element	Composition, %			
	Grade A[A]	Grade B[A]	Grade C[A]	Grade D[A]
Carbon, max	0.16	0.20	0.22	0.22
Manganese				
1½ in. [40 mm] and under in thickness	0.90–1.50	0.70–1.35	1.00–1.60	1.15–1.50
Over 1½ to 2½ in. [40 to 65 mm], incl	[B]	1.00–1.60	1.00–1.60	1.15–1.50
Over 2½ to 3 in. [65 to 75 mm], incl	[B]	[B]	[B]	1.15–1.50
Phosphorus, max	0.035	0.035	0.035	0.035
Sulfur, max	0.04	0.04	0.04	0.04
Silicon	0.15–0.50	0.15–0.50	0.20–0.50	0.15–0.50
Vanadium	...	...	...	0.04–0.11
Columbium	...	...	...	[C]
Nitrogen, max	...	...	...	0.03
Copper, min, if specified	0.20	0.20	0.20	0.20

[A] Boron may be added only by agreement between the manufacturer and the purchaser.
[B] This size and grade is not described in this specification.
[C] Columbium may be present in the amount of 0.01 to 0.05 %.

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 in this section by title.

S5. Charpy V-Notch Impact Test

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SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 678/A 678M – 00a) that may impact the use of this standard.

(1) References to riveted construction have been removed. removed.
(2) In Table 2, the lower limit for nitrogen for Grade D was

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