



Standard Specification for Quenched-and-Tempered Carbon and High-Strength Low- Alloy Structural Steel Plates¹

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 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 used.

1.3 Material under this specification is 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]

^AVaries with thickness. See Table 1.

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

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

E 112 Test Methods for Determining the Average Grain Size⁴

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 Annual Book of ASTM Standards, Vol 01.04.

³ Annual Book of ASTM Standards, Vol 01.03.

⁴ Annual Book of ASTM Standards, Vol 03.01.

3. Materials and Manufacture

3.1 The requirements for fine austenitic grain size in Specification A 6/A 6M shall be met.

4. Heat Treatment

4.1 The material shall be treated by the manufacturer 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]. Heat-treating temperatures shall be reported on the mill certificates.

5. Chemical Composition

5.1 The heat analysis shall conform to the chemical composition requirements for the applicable grade as listed in Table 2.

5.2 The steel shall conform on product analysis to the requirements prescribed in Table 2, subject to the product analysis tolerances in Specification A 6/A 6M.

6. Tension Test

6.1 The material as represented by the test specimens shall conform to the requirements specified for the applicable grade in Table 1.

6.2 *Number of Tests*—One tension test shall be taken from a corner of each plate as heat treated. Plates wider than 24 in. [600 mm] shall be tested in the transverse direction and are subject to the modifications for elongation contained in Footnote D of Table 1.

7. General Requirements for Delivery

7.1 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.

8. Keywords

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



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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

^ASee Specimen Orientation under the Tension Tests section of Specification A 6/A 6M.

^BMeasured at 0.2 % offset or 0.5 % extension underload.

^CThe size and grade is not described in this specification.

^DFor thickness of ¾ in. [20 mm] and under, measured on 1½ -in. [40-mm] wide full thickness rectangular specimen as shown in Fig. 4 of Test Methods and Definitions A 370. The elongation is measured in a 2-in. [50-mm] gage length which includes the fracture and which shows the greatest elongation.

^EFor 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 will 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	...	...	...	0.01–0.03
Copper, min, when specified	0.20	0.20	0.20	0.20

^ABoron may be added only by agreement between the producer and the purchaser.

^BThis size and grade is not described in this specification.

^CColumbium 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. A requirement that is considered suitable for use with this specification is listed in this section by title:

S5. Charpy V-Notch Impact Test



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