



Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding¹

This standard is issued under the fixed designation A 514/A514M; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

A 514/A514M

TABLE 1 Chemical Requirements (Heat Analysis)

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

	Grade A, %	Grade B, %	Grade C, %	Grade E, %	Grade F, %	Grade H, %	Grade J, %
Maximum Thickness, in. [mm]	1¼[32]	1¼[32]	1¼[32]	6 [150]	2½[65]	2 [50]	1¼[32]
Carbon	0.15–0.21	0.12–0.21	0.10–0.20	0.12–0.20	0.10–0.20	0.12–0.21	0.12–0.21
Manganese	0.80–1.10	0.70–1.00	1.10–1.50	0.40–0.70	0.60–1.00	0.95–1.30	0.45–0.70
Phosphorus, max	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Sulfur, max	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Silicon	0.40–0.80	0.20–0.35	0.15–0.30	0.20–0.40	0.15–0.35	0.20–0.35	0.20–0.35
Nickel	...	...	...	...	0.70–1.00	0.30–0.70	...
Chromium	0.50–0.80	0.40–0.65	...	1.40–2.00	0.40–0.65	0.40–0.65	...
Molybdenum	0.18–0.28	0.15–0.25	0.15–0.30	0.40–0.60	0.40–0.60	0.20–0.30	0.50–0.65
Vanadium	...	0.03–0.08	...	...	0.03–0.08	0.03–0.08	...
Titanium	...	0.01–0.03	...	0.01–0.10	...	...	...
Zirconium	0.05–0.15 ^B	...	...	...	...	...	...
Copper	...	...	...	...	0.15–0.50	...	...
Boron	0.0025 max	0.0005–0.005	0.001–0.005	0.001–0.005	0.0005–0.006	0.0005–0.005	0.001–0.005
Columbium, max	...	...	...	...	...	...	...

^AMay be substituted for part or all of titanium content on a one for one basis.

^BZirconium may be replaced by cerium. When cerium is added, the cerium/sulfur ratio should be approximately 1.5 to 1, based upon heat analysis.

	Grade K, %	Grade M, %	Grade P, %	Grade Q, %	Grade R, %	Grade S, %	Grade T, %
Maximum Thickness, in. [mm]	2 [50]	2 [50]	6 [150]	6 [150]	2½ [65]	2½ [65]	2 [50]
Carbon	0.10–0.20	0.12–0.21	0.12–0.21	0.14–0.21	0.15–0.20	0.11–0.21	0.08–0.14
Manganese	1.10–1.50	0.45–0.70	0.45–0.70	0.95–1.30	0.85–1.15	1.10–1.50	1.20–1.50
Phosphorus, max	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Sulfur, max	0.035	0.035	0.035	0.035	0.035	0.020	0.010
Silicon	0.15–0.30	0.20–0.35	0.20–0.35	0.15–0.35	0.20–0.35	0.15–0.45	0.40–0.60
Nickel	...	1.20–1.50	1.20–1.50	1.20–1.50	0.90–1.10	...	...
Chromium	...	...	0.85–1.20	1.00–1.50	0.35–0.65	...	...
Molybdenum	0.45–0.55	0.45–0.60	0.45–0.60	0.40–0.60	0.15–0.25	0.10–0.60	0.45–0.60
Vanadium, max	...	...	...	0.03–0.08	0.03–0.08	0.06	0.03–0.08
Titanium	...	...	...	...	...	^A	...
Zirconium	...	...	...	...	...	...	...
Copper	...	...	...	...	...	...	...
Boron	0.001–0.005	0.001–0.005	0.001–0.005	...	...	0.001–0.005	0.001–0.005
Columbium, max	...	...	...	...	...	0.06	...

^ATitanium may be present in levels up to 0.06% to protect the boron additions.

TABLE 2 Tensile and Hardness Requirements

NOTE 1— See the Orientation and Preparation subsections in the Tension Tests section of Specification A 6/A 6M.

NOTE 2—Where “...” appears in this table there is no requirement.

Thickness, in. [mm]	Ultimate Tensile Strength, ksi [MPa]	Yield Strength ^A min, ksi [MPa]	Elongation in 2 in. [50 mm], ^{B,C,D} min, %	Reduction of Area ^{B,C} , min, %	Brinell Hardness ^E Number
To ¾ [20], incl	110 to 130 [760 to 895]	100 [690]	18	40 ^F	235 to 293
Over ¾ to 2½ [20 to 65], incl	110 to 130 [760 to 895]	100 [690]	18	40 ^F , 50 ^G	...
Over 2½ to 6 [65 to 150], incl	100 to 130 [690 to 895]	90 [620]	16	50 ^G	...

^AMeasured at 0.2% offset or 0.5% extension under load as described in the Determination of Tensile Properties section of Test Methods and Definitions A 370.

^BElongation and reduction of area not required to be determined for floor plates.

^CFor plates tested in the transverse direction, the elongation requirement is reduced by two percentage points and the reduction of area minimum requirement is reduced by five percentage points. See elongation requirement adjustments in the Tension Tests section of Specification A 6/A 6M.

^DWhen measured on the Fig. 3 (Test Methods and Definitions A 370) 1½-in. [40-mm] wide specimen, the elongation is determined in a 2-in. [50-mm] gage length that includes the fracture and shows the greatest elongation.

^ESee Section 8 of this specification.

^FWhen measured on the Fig. 3 (Test Methods and Definitions A 370) 1½-in. [40-mm] wide specimen.

^GWhen measured on the Fig. 4 (Test Methods and Definitions A 370) ½-in. [12.5-mm] round specimen.