Designation: A517/A517M – 17

Standard Specification for Pressure Vessel Plates, Alloy Steel, High-Strength, Quenched and Tempered[1]

This standard is issued under the fixed designation A517/A517M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification[2] covers high-strength quenched and tempered alloy steel plates intended for use in fusion welded boilers and other pressure vessels.

1.2 This specification includes a number of grades as manufactured by different producers, but all having the same mechanical properties and general characteristics.

1.3 The maximum thickness of plates furnished under this specification shall be as follows:

Grade	Thickness
A, B	1.25 in. [32 mm]
H, S	2 in. [50 mm]
P	4 in. [100 mm]
F	2.50 in. [65 mm]
E, Q	6 in. [150 mm]

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 without combining values in any way.

1.5 *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:*[3]

A20/A20M Specification for General Requirements for Steel Plates for Pressure Vessels

A435/A435M Specification for Straight-Beam Ultrasonic Examination of Steel Plates

A577/A577M Specification for Ultrasonic Angle-Beam Examination of Steel Plates

A578/A578M Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications

3. General Requirements and Ordering Information

3.1 Plates furnished to this material specification shall conform to Specification A20/A20M. These requirements outline the testing and retesting methods and procedures, permitted variations in dimensions, and mass, quality and repair of defects, marking, loading, and ordering information.

3.2 In addition to the basic requirements of this specification, certain supplementary requirements are available when additional control, testing, or examination is required to meet end use requirements.

3.3 If the requirements of this specification are in conflict with the requirements of Specification A20/A20M, the requirements of this specification shall prevail.

4. Manufacture

4.1 *Steelmaking Practice*—The steel shall be killed and shall conform to the fine austenitic grain size requirement of Specification A20/A20M.

5. Heat Treatment

5.1 Except as allowed by 5.2, the plates shall be heat treated by heating to not less than 1650°F [900°C], quenching in water or oil and tempering at not less than 1150°F [620°C].

5.2 Plates ordered without the heat treatment specified in 5.1 shall be stress relieved by the manufacturer, and subsequent heat treatment of the plates to conform to 5.1 shall be the responsibility of the purchaser.

6. Chemical Requirements

6.1 The steel shall conform to the chemical requirements shown in Table 1 unless otherwise modified in accordance with

[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 A01.11 on Steel Plates for Boilers and Pressure Vessels.

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[2] For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-517/SA-517M in Section II of that Code.

[3] 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**

TABLE 1 Chemical Requirements

NOTE 1—Where " … " appears there is no requirement.

Elements	Composition, %							
	Grade A	Grade B	Grade E	Grade F	Grade H	Grade P	Grade Q	Grade S
Carbon:								
Heat analysis	0.15–0.21	0.15–0.21	0.12–0.20	0.10–0.20	0.12–0.21	0.12–0.21	0.14–0.21	0.10–0.20
Product analysis	0.13–0.23	0.13–0.23	0.10–0.22	0.08–0.22	0.10–0.23	0.10–0.23	0.12–0.23	0.10–0.22
Manganese:								
Heat analysis	0.80–1.10	0.70–1.00	0.40–0.70	0.60–1.00	0.95–1.30	0.45–0.70	0.95–1.30	1.10–1.50
Product analysis	0.74–1.20	0.64–1.10	0.35–0.78	0.55–1.10	0.87–1.41	0.40–0.78	0.87–1.41	1.02–1.62
Phosphorus, max[A]	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Sulfur, max[A]	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Silicon:								
Heat analysis	0.40–0.80	0.15–0.35	0.10–0.40	0.15–0.35	0.15–0.35	0.20–0.35	0.15–0.35	0.15–0.40
Product analysis	0.34–0.86	0.13–0.37	0.08–0.45	0.13–0.37	0.13–0.37	0.18–0.37	0.13–0.37	0.13–0.45
Nickel:								
Heat analysis	. . .	. . .	. . .	0.70–1.00	0.30–0.70	1.20–1.50	1.20–1.50	. . .
Product analysis	. . .	. . .	. . .	0.67–1.03	0.27–0.73	1.15–1.55	1.15–1.55	. . .
Chromium:								
Heat analysis	0.50–0.80	0.40–0.65	1.40–2.00	0.40–0.65	0.40–0.65	0.85–1.20	1.00–1.50	. . .
Product analysis	0.46–0.84	0.36–0.69	1.34–2.06	0.36–0.69	0.36–0.69	0.79–1.26	0.94–1.56	. . .
Molybdenum:								
Heat analysis	0.18–0.28	0.15–0.25	0.40–0.60	0.40–0.60	0.20–0.30	0.45–0.60	0.40–0.60	0.10–0.35
Product analysis	0.15–0.31	0.12–0.28	0.36–0.64	0.36–0.64	0.17–0.33	0.41–0.64	0.36–0.64	0.10–0.38
Boron	0.0025 max	0.0005–0.005	0.001–0.005	0.0005–0.006	0.0005 min	0.001–0.005	. . .	. . .
Vanadium:								
Heat analysis	. . .	0.03–0.08	[B]	0.03–0.08	0.03–0.08	. . .	0.03–0.08	. . .
Product analysis	. . .	0.02–0.09	. . .	0.02–0.09	0.02–0.09	. . .	0.02–0.09	. . .
Titanium:								
Heat analysis	. . .	0.01–0.04	0.01–0.10	0.10 max	0.10 max	0.10 max	. . .	0.06 max
Product analysis	. . .	0.01–0.05	0.005–0.11	0.11 max	0.11 max	0.11 max	. . .	0.07 max
Zirconium:								
Heat analysis	0.05–0.15[C]	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Product analysis	0.04–0.16	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Copper:								
Heat analysis	. . .	. . .	. . .	0.15–0.50	. . .	. . .	. . .	. . .
Product analysis	. . .	. . .	. . .	0.12–0.53	. . .	. . .	. . .	. . .
Columbium (Niobium),[D] max								
Heat analysis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.06
Product analysis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.07

[A] Applied to both heat and product analyses.
[B] May be substituted for part or all of titanium content on a one for one basis.
[C] Zirconium may be replaced by cerium. When cerium is added, the cerium/sulfur ratio should be approximately 1.5 to 1, based on heat analysis.
[D] Columbium and niobium are interchangeable names for the same element and both names are acceptable for use in A01 specifications.