



Standard Specification for Pressure Vessel Plates, Alloy Steel, Higher Strength Chromium-Molybdenum-Tungsten¹

This standard is issued under the fixed designation A 1041/A 1041M; 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 chromium-tungsten-molybdenum-vanadium, with or without tantalum, alloy steel plates intended primarily for welded boilers and pressure vessels designed for elevated temperature service.

1.2 Plates are available under this specification in two grades having different alloy contents as follows:

Grade	Nominal Chromium Content, %	Nominal Tungsten Content, %	Nominal Molybdenum Content, %	Nominal Vanadium Content, %	Nominal Tantalum Content, %
315	3.00	1.50	0.75	0.25	
315T	3.00	1.50	0.75	0.25	0.10

1.3 The maximum thickness of plates is limited only by the capacity of the composition to meet the specified mechanical property requirements.

1.4 The specification is expressed in both inch-pound units and in SI units; however, unless the order specifies the applicable “M” specification designation (SI units), the plates are furnished to inch-pound units.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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. Referenced Documents

2.1 ASTM Standards:²

- A 20/A 20M Specification for General Requirements for Steel Plates for Pressure Vessels
- A 435/A 435M Specification for Straight-Beam Ultrasonic Examination of Steel Plates
- A 577/A 577M Specification for Ultrasonic Angle-Beam Examination of Steel Plates
- A 578/A 578M Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications

3. General Requirements

3.1 Product furnished to this specification shall conform to Specification A 20/A 20M, including any supplementary requirements indicated in the purchase order or contract. Failure to comply with the general requirements of Specification A 20/A 20M constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A 20/A 20M, the requirements of this specification shall prevail.

3.2 In addition to the basic requirements of this specification, certain supplementary requirements are available if additional control, testing, or examination is required to meet end use requirements. The purchaser is referred to the listed supplementary requirements in this specification and to the detailed requirements in Specification A 20/A 20M.

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.

TABLE 1 Chemical Requirements

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

Element	Composition, %	
	Grade 315	Grade 315T
Carbon:		
Heat Analysis	0.08–0.12	0.08–0.12
Product Analysis	0.07–0.13	0.07–0.13
Manganese:		
Heat Analysis	0.25–0.45	0.25–0.45
Product Analysis	0.20–0.50	0.20–0.50
Phosphorus, max:		
Heat Analysis	0.010	0.010
Product Analysis	0.015	0.015
Sulfur, max:		
Heat Analysis	0.010	0.010
Product Analysis	0.012	0.012
Silicon:		
Heat Analysis	0.15–0.40	0.15–0.40
Product Analysis	0.10–0.45	0.10–0.45
Nickel, max:		
Heat Analysis	0.25	0.25
Product Analysis	0.30	0.30
Chromium:		
Heat Analysis	2.8–3.2	2.8–3.2
Product Analysis	2.7–3.3	2.7–3.3
Molybdenum:		
Heat Analysis	0.65–0.85	0.65–0.85
Product Analysis	0.60–0.90	0.60–0.90
Vanadium:		
Heat Analysis	0.20–0.30	0.20–0.30
Product Analysis	0.18–0.33	0.18–0.33
Boron, max:		
Heat Analysis	0.0007	0.0007
Tantalum:		
Heat Analysis	. . .	0.07–0.13
Product Analysis	. . .	0.06–0.14
Tungsten:		
Heat Analysis	1.35–1.65	1.35–1.65
Product Analysis	1.30–1.70	1.30–1.70

TABLE 2 Tensile Requirements

	Grade 315 and 315T
Tensile Strength, ksi [MPa]	105 to 135 [725 to 930]
Yield Strength, Min, ksi [MPa]	85 [585]
Elongation in 2 in. [50 mm], %, Min	16

4. Materials and Manufacture

4.1 *Steelmaking Practice*—The steel shall be killed and shall conform to the fine austenitic grain size requirements of Specification **A 20/A 20M**.

5. Heat Treatment

5.1 Except as allowed by 5.2, all plates shall be normalized at 1950 to 2050°F [1065 to 1120°C] and then tempered at 1290 to 1400°F [700 to 760°C].

5.2 Plates ordered without the heat treatment required by 5.1 shall be furnished in either the stress-relieved or annealed condition, and the purchaser shall be responsible for the heat treatment of such plates to conform to 5.1.

6. Chemical Composition

6.1 The steel shall conform to the requirements for chemical composition given in **Table 1**.

7. Mechanical Properties

7.1 *Tension Test*—The plates, as represented by the tension test specimens, shall conform to the applicable requirements given in **Table 2**.

8. Keywords

8.1 alloy steel plates; chromium; creep resistance; elevated temperature service; high-strength; hydrogen service; molybdenum; pressure vessels; tantalum; tungsten; vanadium

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall not apply unless specified in the order. A list of standardized supplementary requirements for use at the option of the purchaser is included in Specification **A 20/A 20M**. Several of those considered suitable for use with this specification are listed below by title. Other tests may be performed by agreement between the supplier and the purchaser.

- S1. Vacuum Treatment
- S2. Product Analysis
- S3. Simulated Post-Weld Heat Treatment of Mechanical Test Coupons
- S4. Additional Tension Test
- S5. Charpy V-Notch Impact Test
- S6. Drop-Weight Test (for Plates 0.625 in. [16 mm] Over in Thickness]

- S7. High-Temperature Tension Tests
- S8. Ultrasonic Examination in Accordance with Specification **A 435/A 435M**
- S9. Magnetic Particle Examination
- S11. Ultrasonic Examination in Accordance with Specification **A 577/A 577M**
- S12. Ultrasonic Examination in Accordance with Specification **A 578/A 578M**

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