SPECIFICATION FOR PRESSURE VESSEL PLATES, HIGH-STRENGTH LOW-ALLOY STEEL

SA-737/SA-737M

(Identical with ASTM Specification A737/A737M-17.)

Standard Specification for Pressure Vessel Plates, High-Strength, Low-Alloy Steel

1. Scope

1.1 This specification covers high-strength low-alloy steel plates for service in welded pressure vessels and piping components.

1.2 This material is particularly intended for piping and pressure vessel applications where high strength and improved toughness are required.

1.3 Two grades, designated B and C, are covered by this specification. Grade B provides a minimum yield strength of 50 ksi [345 MPa]. Grade C provides a minimum yield strength of 60 ksi [415 MPa].

1.4 The maximum thickness of plates is limited only by the capacity of the chemical composition and heat treatment to meet the specified mechanical property requirements; however, current practice normally limits the maximum thickness to 4 in. [100 mm] for each grade.

1.5 Grade C in the as-rolled condition is sensitive to cracking during flame cutting, transit, and handling, particularly in thicknesses over 2 in. [50 mm]. Plates should not be shipped in the as-rolled condition only except by mutual agreement between the manufacturer and the purchaser.

1.6 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 must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

1.7 *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:*

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 Material supplied to this specification shall conform to the requirements of Specification A20/A20M. These requirements outline the testing and retesting methods and procedures, permitted variations in dimensions and mass, quality, 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. The purchaser is referred to the listed supplementary requirements in this specification and to the detailed requirements in Specification A20/A20M.

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 The material shall be normalized by heating to a suitable temperature which produces an austenitic structure, but not exceeding 1700°F [925°C], holding a sufficient time to attain uniform heat throughout the material, and cooling in air.

TABLE 1 Chemical Requirements

NOTE 1—Where "…" appears in this table, there is no requirement.

Element	Composition, %			
	Grade B		Grade C	
	Heat	Product	Heat	Product
Carbon, max	0.20	0.22	0.22	0.24
Manganese	1.15–1.50[A]	1.07–1.62[A]	1.15–1.50	1.07–1.62
Phosphorus, max	0.025	0.025	0.025	0.025
Sulfur, max	0.025	0.025	0.025	0.025
Silicon	0.15–0.50	0.10–0.55	0.15–0.50	0.10–0.55
Vanadium	. . .	. . .	0.04–0.11	0.03–0.12
Columbium (Niobium),[B] max	0.05	0.05	0.05	0.05
Nitrogen, max	. . .	. . .	0.03	0.03

[A] The maximum manganese may be increased to 1.60 % on heat analysis and 1.72 % on product analysis, provided that the carbon content on heat analysis does not exceed 0.18 %.
[B] Columbium and niobium are interchangeable names for the same element and both names are acceptable for use in A01 specifications.

TABLE 2 Tensile Requirements

	Grade B	Grade C
Yield strength, min, ksi [MPa]	50 [345]	60 [415]
Tensile strength, ksi [MPa]	70–90 [485–620]	80–100 [550–690]
Elongation in 8 in. [200 mm], min, %[A]	18	18
Elongation in 2 in. [50 mm], min, %[A]	23	23

[A] See Specification A20/A20M for elongation adjustment.

5.2 If approved by the purchaser, cooling rates faster than air cooling are permitted for improvement of strength or toughness, provided the plates are subsequently tempered in the temperature range from 1100 to 1300°F [595 to 705°C].

5.3 When the fabricator elects to perform the heat treatment in 5.1 and 5.2, the manufacturer shall normalize plates conforming to Grade C within the range from 1650 to 1850oF [900 to 1010oC] prior to shipment for plates exceeding 2 in. [50 mm] in thickness unless otherwise agreed to.

6. Chemical Requirements

6.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 1 unless otherwise modified in accordance with Supplementary Requirement S17, Vacuum Carbon-Deoxidized Steel, in Specification A20/A20M.

7. Mechanical Requirements

7.1 *Tension Tests*—The material as represented by the tension test specimens shall conform to the requirements shown in Table 2.

7.1.1 For nominal plate thicknesses of ¾ in. [20 mm] and under, when requirements for elongation in 2 in. [50 mm] are to be determined, the 1½-in. [40-mm] wide rectangular specimen may be used for the tension test, and the elongation may be determined in a 2-in. [50-mm] gage length that includes the fracture and that shows the greatest elongation.

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall not apply unless specified in the purchase order.

A list of standardized supplementary requirements for use at the option of the purchaser is included in Specification A20/A20M. 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,
S5. Charpy V-Notch Impact Tests,
S8. Ultrasonic Examination in accordance with Specification A435/A435M,
S11. Ultrasonic Examination in accordance with Specification A577/A577M,
S12. Ultrasonic Examination in accordance with Specification A578/A578M, and
S17. Vacuum Carbon-Deoxidized Steel.

INTENTIONALLY LEFT BLANK