

SPECIFICATION FOR PRESSURE VESSEL PLATES, ALLOY STEEL, MANGANESE-MOLYBDENUM AND MANGANESE-MOLYBDENUM-NICKEL



SA-302/SA-302M



(Identical with ASTM Specification A302/A302M-17.)

Standard Specification for Pressure Vessel Plates, Alloy Steel, Manganese- Molybdenum and Manganese-Molybdenum-Nickel

1. Scope

1.1 This specification covers manganese-molybdenum and manganese-molybdenum-nickel alloy steel plates intended particularly for welded boilers and other pressure vessels.

1.2 Plates under this specification are available in four grades having different strength levels as follows:

Grade	Tensile Strength, ksi [MPa]	Type
A	75–95 [515–655]	manganese-molybdenum
B	80–100 [550–690]	manganese-molybdenum
C	80–100 [550–690]	manganese-molybdenum-nickel
D	80–100 [550–690]	manganese-molybdenum-nickel

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

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

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:

- 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 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. The purchaser is referred to the listed supplementary requirements in this specification and to the detailed requirements in Specification A20/A20M.

3.3 Coils are excluded from qualification to this specification until they are processed into finished plates. Plates produced from coil means plates that have been cut to individual lengths from coil. The processor directly controls, or is responsible for, the operations involved in the processing of coils into finished plates. Such operations include decoiling, leveling, cutting to length, testing, inspection, conditioning, heat treatment (if applicable), packaging, marking, loading for shipment, and certification.

TABLE 1 Chemical Requirements

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

Elements	Composition, %			
	Grade A	Grade B	Grade C	Grade D
Carbon, max: ^A				
Up to 1 in. [25 mm], incl, in thickness	0.20	0.20	0.20	0.20
Over 1 to 2 in. [50 mm], incl	0.23	0.23	0.23	0.23
Over 2 in. [50 mm] in thickness	0.25	0.25	0.25	0.25
Manganese:				
Heat analysis	0.95–1.30	1.15–1.50	1.15–1.50	1.15–1.50
Product analysis	0.87–1.41	1.07–1.62	1.07–1.62	1.07–1.62
Phosphorus, max ^A	0.025	0.025	0.025	0.025
Sulfur, max ^A	0.025	0.025	0.025	0.025
Silicon:				
Heat analysis	0.15–0.40	0.15–0.40	0.15–0.40	0.15–0.40
Product analysis	0.13–0.45	0.13–0.45	0.13–0.45	0.13–0.45
Molybdenum:				
Heat analysis	0.45–0.60	0.45–0.60	0.45–0.60	0.45–0.60
Product analysis	0.41–0.64	0.41–0.64	0.41–0.64	0.41–0.64
Nickel:				
Heat analysis	0.40–0.70	0.70–1.00
Product analysis	0.37–0.73	0.67–1.03

^A Applies to both heat and product analyses.

TABLE 2 Tensile Requirements

	Grade A	Grade B	Grade C	Grade D
Tensile strength, ksi [MPa]	75–95 [515–655]	80–100 [550–690]	80–100 [550–690]	80–100 [550–690]
Yield strength, min, ksi [MPa]	45 [310]	50 [345]	50 [345]	50 [345]
Elongation in 8 in. [200 mm], min, % ^A	15	15	17	17
Elongation in 2 in. [50 mm], min, % ^A	19	18	20	20

^A See Specification A20/A20M for elongation adjustment.

NOTE 1—For plates produced from coil and furnished without heat treatment or with stress relieving only, three test results are reported for each qualifying coil. Additional requirements regarding plates from coil are described in Specification A20/A20M.

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

4. Materials and Manufacture

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

5. Heat Treatment

5.1 Plates 2 in. [50 mm] and under in thickness are normally supplied in the as-rolled condition. Plates may be ordered normalized, normalized and tempered, or stress relieved.

5.2 Plates over 2 in. [50 mm] in thickness shall be normalized or normalized and tempered.

5.3 When normalizing plates 4 in. [100 mm] or over in thickness, the cooling rate may be accelerated by air blasting or liquid quenching followed by tempering in the temperature range from 1100 to 1300°F [595 to 705°C] to obtain mechanical properties comparable to those developed by normalizing plates in the lesser thicknesses.

5.4 If approved by the purchaser, for plates less than 4 in. [100 mm] in thickness, cooling rates faster than those obtained by cooling in air are permissible for improvement of toughness, provided the plates are subsequently tempered in the temperature range from 1100 to 1300°F [595 to 705°C].

6. Chemical Composition

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

7. Mechanical Properties

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

7.1.1 For accelerated cooled plates with a nominal thickness of ¾ in. [20 mm] or less, 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.

8. Keywords

8.1 alloy steel plate; pressure containing parts; pressure vessel steels; steel plates; steel plates for pressure vessel applications

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. Those that are considered suitable for use with this specification are listed below by title.

- S1. Vacuum Treatment,
- S2. Product Analysis,
- S3. Simulated Post-Weld Heat Treatment of Mechanical Test Coupons,
 - S4.1 Additional Tension Test,
 - S5. Charpy V-Notch Impact Test,
 - S6. Drop Weight Test (for Material 0.625 in. [16 mm] and over in Thickness),
 - S7. High-Temperature Tension Test,
- S8. Ultrasonic Examination in accordance with Specification A435/A435M,
- S9. Magnetic Particle Examination,
- S11. Ultrasonic Examination in accordance with Specification A577/A577M,
- S12. Ultrasonic Examination in accordance with Specification A578/A578M, and
- S17. Vacuum Carbon-Deoxidized Steel.