

# SPECIFICATION FOR PRESSURE VESSEL PLATES, CARBON STEEL, FOR INTERMEDIATE- AND HIGHER-TEMPERATURE SERVICE



SA-515/SA-515M



(Identical with ASTM Specification A515/A515M-17.)

# Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

## 1. Scope

1.1 This specification covers carbon-silicon steel plates primarily for intermediate- and higher-temperature service in welded boilers and other pressure vessels.

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

Grade U.S. [SI]	Tensile Strength, ksi [MPa]
60 [415]	60–80 [415–550]
65 [450]	65–85 [450–585]
70 [485]	70–90 [485–620]

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 For plates produced from coil and furnished without heat treatment or with stress relieving only, the additional requirements, including additional testing requirements and the reporting of additional test results, of Specification A20/A20M apply.

1.5 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.

1.6 *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 Plates supplied to this product specification shall conform to Specification A20/A20M. These requirements outline the testing and retesting methods and procedures, permissible 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 where 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.

3.4 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

Elements	Composition, %		
	Grade 60 [Grade 415]	Grade 65 [Grade 450]	Grade 70 [Grade 485]
Carbon, max: <sup>A, B</sup>			
1 in. [25 mm] and under	0.24	0.28	0.31
Over 1 to 2 in. [25 to 50 mm], incl	0.27	0.31	0.33
Over 2 to 4 in. [50 to 100 mm], incl	0.29	0.33	0.35
Over 4 to 8 in. [100 to 200 mm], incl	0.31	0.33	0.35
Over 8 in. [200 mm]	0.31	0.33	0.35
Manganese, <sup>B</sup> max:			
Heat analysis	0.90	0.90	1.20
Product analysis	0.98	0.98	1.30
Phosphorus, max <sup>A</sup>	0.025	0.025	0.025
Sulfur, max <sup>A</sup>	0.025	0.025	0.025
Silicon:			
Heat analysis	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

<sup>A</sup> Applies to both heat and product analyses.

<sup>B</sup> For each reduction of 0.01 percentage point below the specified maximum for carbon, an increase of 0.06 percentage point above the specified maximum for manganese is permitted, up to a maximum of 1.50 % by heat analysis and 1.60 % by product analysis.

TABLE 2 Tensile Requirements

	Grade		
	60 [415]	65 [450]	70 [485]
Tensile strength, ksi [MPa]	60–80 [415–550]	65–85 [450–585]	70–90 [485–620]
Yield strength, min, ksi [MPa]	32 [220]	35 [240]	38 [260]
Elongation in 8 in. [200 mm], min, % <sup>A</sup>	21	19	17
Elongation in 2 in. [50 mm], min, % <sup>A</sup>	25	23	21

<sup>A</sup> 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 plate produced from coil are described in Specification A20/A20M.

#### 4. Materials and Manufacture

4.1 *Steelmaking Practice*—The steel shall be killed and made to a coarse austenitic grain size practice.

#### 5. Heat Treatment

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

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

#### 6. Chemical Composition

6.1 The steel shall conform to the chemical requirements given 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*—The plates, as represented by the tension test specimens, shall conform to the requirements given in Table 2.

#### 8. Keywords

8.1 carbon steel; carbon steel plate; pressure containing parts; pressure vessel steels; steel plates for pressure vessels

**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.

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

**ADDITIONAL SUPPLEMENTARY REQUIREMENTS**

Also listed below is an additional optional supplementary requirement suitable for this specification:

**S61. Austenitic Grain Size**

S61.1 The material shall have a carburized austenitic grain size of 1 to 5.