



Designation: A 738/A738M – 05

## Standard Specification for Pressure Vessel Plates, Heat-Treated, Carbon-Manganese- Silicon Steel, for Moderate and Lower Temperature Service<sup>1</sup>

This standard is issued under the fixed designation A 738/A738M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This specification<sup>2</sup> covers heat-treated carbon-manganese-silicon steel plates intended for use in welded pressure vessels at moderate and lower temperature service.

1.2 Material under this specification is available in four strength levels, 75 ksi [515 MPa], 85 ksi [585 MPa], 80 ksi [550 MPa], and 90 ksi [620 MPa] minimum ultimate tensile strengths.

1.3 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 of plates furnished under this specification to 6 in. [150 mm] for Grade A, 4 in. [100 mm] for Grade B, and 6 in. [150 mm] for Grade C. For Grades D and E, the maximum permitted nominal thickness is 1.5 in. [40 mm].

1.4 Grade A is the material that, prior to 1984, was covered by Specification A 738 without a grade designation.

1.5 The values stated in either inch-pound units or SI units are to be regarded separately as standards. 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.

### 2. Referenced Documents

2.1 *ASTM Standards*:<sup>3</sup>

A 20/A20M Specification for General Requirements for Steel Plates for Pressure Vessels

### 3. General Requirements and Ordering Information

3.1 Plates supplied to this product specification shall conform to the requirements of Specification A 20/A 20M, which outlines the testing and retesting methods and procedures, permissible variations in dimensions and mass, quality, repair of defects, marking, loading, etc.

3.2 Specification A 20/A 20M also establishes the rules for compliance to the ordering information when purchasing material to this specification.

<sup>1</sup> 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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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Specification SA-738/SA-738M in Section II of that Code.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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

Element	Composition, %				
	Grade A	Grade B	Grade C	Grade D	Grade E
Carbon, max <sup>A</sup>	0.24	0.20	0.20	0.10	0.12 <sup>B</sup>
Manganese:					
Heat analysis					
1.5 in. [40 mm] and under	1.50 max	0.90–1.50	1.50 max	1.00 — 1.60	1.10 — 1.60 <sup>B</sup>
Over 1.5 in. [40 mm] to 2.5 in. [65 mm] incl	1.50 max	0.90–1.50	1.50 max	<i>c</i>	<i>c</i>
Over 2.5 in. [65 mm]	1.60 max	0.90–1.60	1.60 max	<i>c</i>	<i>c</i>
Product analysis					
1.5 in. [40 mm] and under	1.62 max	0.84–1.62	1.62 max	0.92–1.72	1.02–1.72 <sup>B</sup>
Over 1.5 in. [40 mm] to 2.5 in. [65 mm] incl	1.62 max	0.84–1.62	1.62 max	<i>c</i>	<i>c</i>
Over 2.5 in. [65 mm]	1.72 max	0.84–1.72	1.72 max	<i>c</i>	<i>c</i>
Phosphorus, max <sup>A</sup>	0.035	0.030	0.025	0.015	0.015
Sulfur, max <sup>A</sup>	0.035	0.030	0.025	0.006	0.006
Silicon:					
Heat analysis	0.15–0.50	0.15–0.55	0.15–0.50	0.15–0.50	0.15–0.50
Product analysis	0.13–0.55	0.13–0.60	0.13–0.55	0.13–0.55	0.13–0.55
Copper, max:					
Heat analysis	0.35	0.35	0.35	0.35	0.35
Product analysis	0.38	0.38	0.38	0.38	0.38
Nickel, max:					
Heat analysis	0.50	0.60	0.50	0.60	0.70
Product analysis	0.53	0.63	0.53	0.63	0.73
Chromium, max:					
Heat analysis	0.25	0.30	0.25	0.25	0.30
Product analysis	0.29	0.34	0.29	0.29	0.34
Molybdenum, max:					
Heat analysis					
1.5 in. [40 mm] and under	0.08	0.20	0.08	0.30	0.35
Over 1.5 in. [40 mm]	0.08	0.30	0.08	<i>c</i>	<i>c</i>
Product analysis					
1.5 in. [40 mm] and under	0.09	0.21	0.09	0.33	0.38
Over 1.5 in. [40 mm]	0.09	0.33	0.09	<i>c</i>	<i>c</i>
Vanadium, max:					
Heat analysis	0.07 <sup>D</sup>	0.07	0.05	0.08	0.09
Product analysis	0.08 <sup>D</sup>	0.08	0.05	0.09	0.10
Columbium, max:					
Heat analysis	0.04 <sup>D</sup>	0.04	<i>E</i>	0.05	0.05
Product analysis	0.05 <sup>D</sup>	0.05	<i>E</i>	0.06	0.06
Columbium plus Vanadium, max:					
Heat analysis	0.08 <sup>D</sup>	0.08	<i>E</i>	0.11	0.12
Product analysis	0.10 <sup>D</sup>	0.10	<i>E</i>	0.12	0.13
Titanium, max <sup>A</sup>	...	...	...	<i>F</i>	<i>G</i>
Boron, max <sup>A</sup>	...	...	...	0.0007	0.0007
Aluminum, min <sup>A</sup>	...	...	...	0.020 total or 0.015 acid soluble <sup>F</sup>	0.020 total or 0.015 acid soluble <sup>G</sup>

<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 1.85 % by heat analysis, and 1.99 % by product analysis.

<sup>C</sup>Not applicable.

<sup>D</sup>Vanadium and columbium may be added only by agreement between the manufacturer and the purchaser.

<sup>E</sup>For Grade C, columbium is an unspecified element.

<sup>F</sup>By agreement between the manufacturer and the purchaser, the steel may be produced with titanium, in which case the minimum aluminum content shall not apply. If this option is exercised, the titanium content, by heat analysis, shall be 0.006 % to 0.03 %, and the titanium content for the heat and product analyses shall be reported on the test report.

<sup>G</sup>By agreement between the manufacturer and the purchaser, the steel may be produced with titanium, in which case the minimum aluminum content shall not apply. If this option is exercised, the titanium content, by heat analysis, shall be 0.006 % to 0.03 % inclusive and the titanium content for the heat and product analyses shall be reported on the test report.

3.3 In addition to the basic requirements of this specification, certain supplementary requirements are available when

additional control, testing, or examination is required to meet the end use requirements.