



Designation: A 738/A738M – 00

Standard Specification for Pressure Vessel Plates, Heat-Treated, Carbon-Manganese- Silicon Steel, for Moderate and Lower Temperature Service¹

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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification² 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 three strength levels, 75 ksi [515 MPa], 85 ksi [585 MPa], and 80 ksi [550 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.

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:

A 20/A20M Specification for General Requirements for Steel Plates for Pressure Vessels³

3. General Requirements and Ordering Information

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

¹ This specification is under the jurisdiction of ASTM Committee A-1 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 For ASME Boiler and Pressure Vessel Code applications see related Specification SA-738/SA-738M in Section II of that Code.

³ Annual Book of ASTM Standards, Vol 01.04.

TABLE 1 Chemical Requirements

Element	Composition, %		
	Grade A	Grade B	Grade C
Carbon, max ^A	0.24	0.20	0.20
Manganese:			
Heat analysis			
2.5 in. [65 mm] and under	1.50 max	0.90–1.50	1.50 max
Over 2.5 in. [65 mm]	1.60 max	0.90–1.60	1.60 max
Product analysis			
2.5 in. [65 mm] and under	1.62 max	0.84–1.62	1.62 max
Over 2.5 in. [65 mm]	1.72 max	0.84–1.72	1.72 max
Phosphorus, max ^A	0.035	0.030	0.025
Sulfur, max ^A	0.035	0.030	0.025
Silicon:			
Heat analysis	0.15–0.50	0.15–0.55	0.15–0.50
Product analysis	0.13–0.55	0.13–0.60	0.13–0.55
Copper, max:			
Heat analysis	0.35	0.35	0.35
Product analysis	0.38	0.38	0.38
Nickel, max:			
Heat analysis	0.50	0.60	0.50
Product analysis	0.53	0.63	0.53
Chromium, max:			
Heat analysis	0.25	0.30	0.25
Product analysis	0.29	0.34	0.29
Molybdenum, max:			
Heat analysis			
1.5 in. [40 mm] and under	0.08	0.20	0.08
Over 1.5 in. [40 mm]	0.08	0.30	0.08
Product analysis			
1.5 in. [40 mm] and under	0.09	0.21	0.09
Over 1.5 in. [40 mm]	0.09	0.33	0.09
Vanadium, max:			
Heat analysis	0.07 ^B	0.07	0.05
Product analysis	0.08 ^B	0.08	0.05
Columbium, max:			
Heat analysis	0.04 ^B	0.04	C
Product analysis	0.05 ^B	0.05	C
Columbium plus Vanadium, max:			
Heat analysis	0.08 ^B	0.08	C
Product analysis	0.10 ^B	0.10	C

^AApplies to both heat and product analyses.

^BVanadium and columbium may be added only by agreement between the producer and the purchaser.

^CFor Grade C, columbium is an unspecified element.

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



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TABLE 2 Tensile Requirements

NOTE 1— t = plate nominal thickness.

	Grade A		Grade B		Grade C	
	ksi	[MPa]	ksi	[MPa]	ksi	[MPa]
Tensile strength						
t = 2.5 in. & under	75–95		85–102		80–100	
[t = 65 mm & under]		[515–655]		[585–705]		[550–690]
t = Over 2.5 in. to 4 in. incl	75–95		85–102		75–95	
[t = Over 65 mm to 100 mm incl]		[515–655]		[585–705]		[515–655]
t = Over 4 in.	75–95		85–102		70–90	
[t = Over 100 mm]		[515–655]		[585–705]		[485–620]
Yield strength, min						
t = 2.5 in. & under	45		60		60	
[t = 65 mm & under]		[310]		[415]		[415]
t = Over 2.5 in. to 4 in. incl	45		60		55	
[t = Over 65 mm to 100 mm incl]		[310]		[415]		[380]
t = Over 4 in. to 6 in. incl	45		60		46	
[t = Over 100 mm]		[310]		[415]		[315]
Elongation in 2 in. [50 mm], min, % ^A						
t = 4 in. & under	20		20		22	
[t = 100 mm & under]	20		20		22	
t = Over 4 in.	20		20		20	
[t = Over 100 mm]	20		20		20	

^ASee Specification A 20/A 20M for elongation adjustment.

3.3 Certain supplementary requirements considered suitable for use with this specification are listed at the end of the specification. These include some of the standardized supplementary requirements listed in Specification A 20/A 20M as well as additional ones unique to this specification.

4. Manufacture

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

5. Heat Treatment

5.1 Grade A plates 2.5 in. [65 mm] and under in thickness shall be supplied in either the normalized or quenched and tempered condition.

5.2 Grade A plates over 2.5 in. [65 mm] in thickness and Grade B and Grade C plates in all thicknesses shall be quenched-and-tempered.

5.3 When plates are tempered, the minimum tempering temperature shall be 1100°F [595°C].

6. Chemical Requirements

6.1 The steel shall conform to the chemical requirements shown in Table 1 unless otherwise modified in accordance with Supplementary Requirement S 17, Vacuum Carbon-Deoxidized Steel in Specification A 20/A 20M.

7. Mechanical Requirements

7.1 *Tension Test Requirements*—The material as represented by the tension test specimens shall conform to the requirements of Table 2.

7.1.1 For nominal plate thicknesses of ¾ in. [20 mm] and under, the 1.5-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 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 A 20/A 20M. Several of those considered suitable for use with this specification are listed by title. Other tests may be performed by agreement between the supplier and the purchaser:

- 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.
- S17. Vacuum Carbon-Deoxidized Steel.
- S20. Maximum Carbon Equivalent for Weldability