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Used in USDOE-NE Standards

Standard Specification for Pressure Vessel Plates, Alloy Steel, Quenched and Tempered, Manganese-Molybdenum and Manganese-Molybdenum-Nickel[1]

This standard is issued under the fixed designation A533/A533M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification[2] covers one type of manganese-molybdenum and four types of manganese-molybdenum-nickel alloy steel plates for use in the quenched and tempered condition for the construction of welded pressure vessels.

1.2 Material under this specification is available in five types, designated ~~"A", "B", "C", "D", and "E".~~"A," "B," "C," "D," and "E." The material is also available in three classes having the following strength levels.

Class	Tensile Strength, ksi [MPa]
~~1~~	~~80–100 [550 to 690]~~
1	80 to 100 [550 to 690]
~~2~~	~~90–115 [620 to 795]~~
2	90 to 115 [620 to 795]
~~3~~	~~100–125 [690 to 860]~~
3	100 to 125 [690 to 860]

1.3 The maximum thickness of Class 1 and Class 2 plates is limited only by the capacity of the composition to meet the specified mechanical property requirements; however, current practice normally limits the maximum thickness to 12 in. ~~[300 mm]~~ [300 mm] for Types A through D and to 7 in. [180 mm] for Type E.

1.4 The maximum thickness of Class 3 plates is 2½ in. ~~[65 mm]~~ [65 mm] for Types A through D and 2 in. [50 mm] for Type E.

1.5 The minimum nominal thickness of plates of all classes is 0.25 in. [6.5 mm].

1.6 These alloy steel plates in the as-rolled condition are sensitive to cracking during transit and handling, particularly in thicknesses over ~~about 1 or 2 in. [25 or 50 mm].~~ 1 in. [25 mm]. They should be shipped in the as-rolled conditions only by mutual agreement of manufacturer and the purchaser.

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[1] 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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[2] For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-533/SA-533M in Section II of that Code.

***A Summary of Changes section appears at the end of this standard**

1.7 Plates covered by this specification are often used in the beltline region of nuclear reactor vessels where the material properties may be affected by high levels of radiation. Appendix X1 provides some information pertinent to this usage.

1.8 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.

1.9 *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:*[3]

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.

TABLE 1 Chemical Requirements

NOTE 1—Where "..." appears there is no requirement.

	Composition, %				
	Type A	Type B	Type C	Type D	Type E
Carbon, max[A]	0.25	0.25	0.25	0.25	0.20
Manganese:[B]					
Heat analysis	1.15–1.50	1.15–1.50	1.15–1.50	1.15–1.50	1.15–1.70
Product analysis	1.07–1.62	1.07–1.62	1.07–1.62	1.07–1.62	1.04–1.84
Phosphorus, max[A]	0.025	0.025	0.025	0.025	0.020
Sulfur, max[A]	0.025	0.025	0.025	0.025	0.015
Silicon:					
Heat analysis	0.15–0.40	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	0.13–0.45
Molybdenum:					
Heat analysis	0.45–0.60	0.45–0.60	0.45–0.60	0.45–0.60	0.25–0.60
Product analysis	0.41–0.64	0.41–0.64	0.41–0.64	0.41–0.64	0.21–0.64
Nickel:					
Heat analysis	...	0.40–0.70	0.70–1.00	0.20–0.40	0.60–1.00
Product analysis	...	0.37–0.73	0.67–1.03	0.17–0.43	0.57–1.03
Chromium, max:					
Heat analysis	...	...	...	...	0.60
Product analysis	...	...	...	...	0.64

[A] Applies to both heat and product analyses.
[B] For Types A, B, C, and D, the maximum manganese content may be increased to 1.60 % on heat analysis and 1.65 % on product analysis when Class 2 or Class 3 properties are specified and when Supplementary Requirement S3 (see Specification A20/A20M) is specified with a total holding time of more than 1 h/in. [2.4 min/mm] of thickness.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.