



Standard Specification for Pressure-Vessel Plates, Quenched-and-Tempered, Manganese-Chromium-Molybdenum-Silicon Zirconium Alloy Steel¹

This standard is issued under the fixed designation A 782/A 782M; 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 specification covers high-strength quenched and tempered alloy steel plates intended for use in fusion welded pressure vessels.

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

Class	Yield Strength, min,	Tensile Strength, min,
	ksi [MPa]	ksi [MPa]
1	80 [550]	97 [670]
2	90 [620]	107 [740]
3	100 [690]	115 [795]

1.3 The thickness of plates under this specification is limited to a maximum of 2 in. [50 mm].

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.

2. Referenced Documents

2.1 ASTM Standards:

A 20/A 20M Specification for General Requirements for Steel Plates for Pressure Vessels²

A 435/A 435M Specification for Straight-Beam Ultrasonic Examination of Steel Plates²

A 577/A 577M Specification for Ultrasonic Angle-Beam Examination of Steel Plates²

A 578/A 578M Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications²

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.

Current edition approved Dec. 28, 1990. Published May 1991. Originally published as A 782 – 81. Last previous edition A 782/A 782M – 87.

² Annual Book of ASTM Standards, Vol 01.04.

3. General Requirements and Ordering Information

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

3.2 Specification A 20/A 20M also establishes the rules for the ordering information that should be complied with when purchasing material to this specification.

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 end use requirements. The purchaser is referred to the listed supplementary requirements in this specification and to the detailed requirements in Specification A 20/A 20M.

3.4 If the requirements of this specification are in conflict with the requirements of Specification A 20/A 20M, the requirements of this specification shall prevail.

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 All plates shall be heat treated by the material manufacturer by heating to not less than 1650°F [900°C], quenching in water or oil and tempering at not less than 1150°F [620°C] for not less than ½ h.

6. Chemical Requirements

6.1 The steel shall conform to the chemical requirements shown in Table 1.

7. Mechanical Requirements

7.1 Tension Tests:

7.1.1 *Requirements*—The material as represented by the tension-test specimens shall conform to the requirements shown in Table 2.

TABLE 1 Chemical Requirements

Element	Composition, %
Carbon, max:	
Heat analysis	0.20
Product analysis	0.22
Manganese:	
Heat analysis	0.70–1.20
Product analysis	0.62–1.30
Phosphorus, max ^A	0.035
Sulfur, max ^A	0.035
Silicon:	
Heat analysis	0.40–0.80
Product analysis	0.34–0.86
Chromium:	
Heat analysis	0.50–1.00
Product analysis	0.46–1.06
Molybdenum:	
Heat analysis	0.20–0.60
Product analysis	0.17–0.64
Zirconium:	
Heat analysis	0.04–0.12
Product analysis	0.03–0.16

^AApplies to both heat and product analyses.

7.1.2 Test Methods:

7.1.2.1 For material $\frac{3}{4}$ in. [20 mm] and under in thickness, the test specimen shall be the $1\frac{1}{2}$ -in. [40-mm] wide rectangular test specimen.

TABLE 2 Tensile Requirements

	Class 1	Class 2	Class 3
Tensile strength, ksi	97–119	107–129	115–136
[MPa]	[670–820]	[740–890]	[795–940]
Yield strength, min, ksi	80	90	100
[MPa]	[550]	[620]	[690]
Elongation in 2 in. [50 mm], min, % ^A	18	17	16

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

7.1.2.2 For material over $\frac{3}{4}$ in. either the full thickness rectangular test specimen or the $\frac{1}{2}$ -in. [12.5-mm] round test specimen may be used.

7.1.2.3 When the $1\frac{1}{2}$ -in. [40-mm] wide rectangular test specimen is used, the elongation is measured in a 2-in. or [50-mm] gage length which includes the fracture.

7.2 Impact Properties Requirements:

7.2.1 Transverse Charpy V-notch impact test specimens shall have a lateral expansion opposite the notch of not less than 0.015 in. [0.38 mm].

7.2.2 The test temperature shall be agreed upon between the manufacturer and the purchaser, but shall not be higher than 32°F [0°C].

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall not apply unless specified in the order.

A list of standardized supplementary requirements for use at the option of the purchaser are included in Specification A 20/A 20M. Several of those considered suitable for use with this specification are listed below by title. Other tests may be performed by agreement between the supplier and the purchaser.

- S1. Vacuum Treatment,
- S2. Product Analysis,
- S3. Simulated Post-Weld Heat Treatment of Mechanical Test Coupons,
- S5. Charpy V-Notch Impact Test,
- S6. Drop Weight Test,
- S7. High-Temperature Tension Test,

- S8. Ultrasonic Examination in accordance with Specification A 435/A 435M,
- S9. Magnetic Particle Examination,
- S11. Ultrasonic Examination in accordance with Specification A 577/A 577M,
- S12. Ultrasonic Examination in accordance with Specification A 578/A 578M, and
- S14. Bend Test.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).