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Standard Specification for Pressure Vessel Plates, Alloy Steel, Quenched-and-Tempered, Chromium-Molybdenum, and Chromium-Molybdenum-Vanadium¹

This standard is issued under the fixed designation A542/A542M; 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 two types of 2¹/₄ Cr-1 Mo and three types of Cr-Mo-V alloy steel plates for use in the quenched-and-tempered condition, intended for the fabrication of welded pressure vessels and components.

1.2 Material under this specification is available in five types, designated "A," "B," "C," "D," and "E." Type B is identical to Type A except for restrictive limits for carbon, phosphorus, sulfur, and nickel. The material is also available in five classes having the following strength levels. Type E is available only as Class 4 and 4a.

Class	Minimum Tensile Strength, ksi [MPa]
1	105 [725]
2	115 [795]
3	95 [655]
4 and 4a	85 [585]

1.3 The maximum thickness of plates is limited only by the capacity of the chemical composition to meet the specified mechanical property requirements.

1.4 The minimum thickness of plates is limited to $\frac{3}{16}$ in. [5 mm].

1.5 The material is intended to be suitable for fusion welding. Welding technique is of fundamental importance and it is presupposed that welding procedures will be in accordance with approved methods.

1.6 These alloy steel plates in the as-rolled condition are sensitive to cracking during flame cutting, transit, and handling. They should be shipped in the as-rolled condition only with the mutual agreement of the manufacturer and the purchaser or fabricator.

1.7 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 this specification.

2. Referenced Documents

2.1 ASTM Standards:³

A20/A20M Specification for General Requirements for Steel Plates for Pressure Vessels A370 Test Methods and Definitions for Mechanical Testing of Steel Products A387/A387M Specification for Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum 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.

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-542 in Section II of that Code.

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.

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TABLE 1 Chemical Requirements

Note 1-Where "..." appears there is no requirement. Values are maximum unless minimum or a range is indicated.

Floment	Composition, %					
	Туре А	Туре В	Туре С	Type D	Type E	
Carbon:						
 Heat analysis 	0.15 max	0.11_0.15	0.10-0.15	0.11_0.15	0.10-0.15	
Heat analysis	0.15	0.11–0.15	0.10-0.15	0.11–0.15	0.10-0.15	
Product analysis	0.18 max	0.09-0.18	0.08-0.18	0.09-0.18	0.08-0.18	
Product analysis	0.18	0.09-0.18	0.08-0.18	0.09-0.18	0.08-0.18	
Manganese:						
Heat analysis	0.30-0.60	0.30-0.60	0.30-0.60	0.30-0.60	0.30-0.60	
Product analysis	0.25–0.66	0.25–0.66	0.25–0.66	0.25–0.66	0.25–0.66	
Phosphorus, max	0.025	0.015	0.025			
Phosphorus:						
Heat analysis	0.025	0.015	0.025	0.015	0.025	
Product analysis	0.025	0.015	0.025	0.020	0.025	
Sulfur, max	0.025	0.015	0.025			
Sulfur:						
Heat analysis	0.025	0.015	0.025	0.010	0.010	
Product analysis	0.025	0.015	0.025	0.015	0.010	
Silicon, max Silicon:	0.50	0.50	0.13			
Heat analysis	0.50	0.50	0.13	0.10	0.15	
Product analysis	0.50	0.50	0.13	0.13	0.15	
Chromium:						
Heat analysis	2.00-2.50	2.00-2.50	2.75-3.25	2.00-2.50	2.75-3.25	
Product analysis	1.88-2.62	1.88-2.62	2.63-3.37	1.88-2.62	2.63-3.37	
Molvbdenum:						
Heat analysis	0.90-1.10	0.90-1.10	0.90-1.10	0.90-1.10	0.90-1.10	
Product analysis	0.85-1.15	0.85-1.15	0.85-1.15	0.85-1.15	0.85-1.15	
Copper. max:						
Copper:						
Heat analysis	0.40	0.25	0.25	0.20	0.25	
Product analysis	0.43	0.28	0.28	0.23	0.28	
Nickel. max:						
Nickel:						
Heat analysis	0.40	0.25	0.25	0.25	0.25	
Product analysis	0.43	0.28	0.28	0.28	0.28	
Vanadium:						
-Heat analysis	0.03 max	0.02 max	0.20-0.30	0.25-0.35	0.20-0.30	
Heat analysis	0.03	0.02	0.20-0.30	0.25-0.35	0.20-0.30	
Product analysis	0.04 max	0.03 max	0.18-0.33	0.23-0.37	0.18-0.33	
Product analysis	0.04	$0.03 \Delta STM \Delta 54'$	0.18-0.33	0.23-0.37	0.18-0.33	
Titanium:		<u>ASIMAJA</u>	2.779.772111-15			
-Heat analysis /catalog	e /st andards/astm/d7	7 1 ea78-a915-403	0.015-0.035 38cd9af5	0.030 max 1-a542-a5	4 .2. m-13	
Heat analysis			0.015-0.035	0.030		
Product analysis	<u>—</u>	<u>—</u>	0.005-0.045	0.035 max	<u> </u>	
Product analysis			0.005-0.045	0.035		
Boron:	—	—				
- Heat analysis			0.001-0.003	0.0020 max		
Heat analysis			0.001-0.003	0.0020		
Product analysis	<u> </u>	<u> </u>		<u>_</u>	<u> </u>	
Columbium:						
- Heat analysis				0.07 max	0.015-0.070	
Heat analysis	<u></u>	<u></u>	<u></u>	0.07	0.015-0.070	
- Product analysis				0.08 max	0.010-0.075	
Product analysis	<u></u>	<u></u>	<u></u>	<u>0.08</u>	0.010-0.075	

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.

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.

4. Manufacture

4.1 *Steelmaking Practice*—The steel shall be killed and shall conform to the fine austenitic grain size requirement of Specification A20/A20M.