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Designation: A356/A356M – 11 (Reapproved 2016)

Standard Specification for Steel Castings, Carbon, Low Alloy, and Stainless Steel, Heavy-Walled for Steam Turbines[1]

This standard is issued under the fixed designation A356/A356M; 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 one grade of martensitic stainless steel and several grades of ferritic steel castings for cylinders (shells), valve chests, throttle valves, and other heavy-walled castings for steam turbine applications.

1.2 Optional supplementary requirements (S1 through S5) shall apply as selected by and specified by the purchaser.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3.1 Within the text, the SI units are shown in brackets.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A488/A488M Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel

E94 Guide for Radiographic Examination

E125 Reference Photographs for Magnetic Particle Indications on Ferrous Castings

E165 Practice for Liquid Penetrant Examination for General Industry

E186 Reference Radiographs for Heavy-Walled (2 to 4½ in. (50.8 to 114 mm)) Steel Castings

E280 Reference Radiographs for Heavy-Walled (4½ to 12 in. (114 to 305 mm)) Steel Castings

E446 Reference Radiographs for Steel Castings Up to 2 in. (50.8 mm) in Thickness

E709 Guide for Magnetic Particle Testing

2.2 *Manufacturers' Standardization Society of the Valve and Fittings Industry Standard:*[3]

SP-55 Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components (Visual Method)

3. Classification

3.1 The castings are furnished in the grades shown in Table 1.

4. Ordering Information

4.1 Orders for material to this specification should include the following information:

4.1.1 A description of the casting by pattern number or drawing (dimensional tolerances shall be included on the casting drawing),

4.1.2 Grade of steel,

4.1.3 Options in the specification, and

4.1.4 The supplementary requirements desired, including the standards of acceptance.

5. Melting Process

5.1 The steel shall be made by the open-hearth or electric-furnace process.

5.2 *Deoxidation Practice:*

5.2.1 Deoxidation of the carbon and low-alloy steel grades shall be by manganese and silicon. Furnace or ladle deoxidation with other agents is permissible with the approval of the purchaser.

5.2.2 The purchaser may specify that no aluminum be added.

5.2.3 Vacuum deoxidation is acceptable. The specific method shall be subject to approval by the purchaser.

6. Heat Treatment

6.1 *Preliminary Heat Treatment*—The castings may receive such preliminary heat treatment as the founder may elect to employ.

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloysand is the direct responsibility of Subcommittee A01.18 on Castings.

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[2] 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.

[3] Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, http://www.mss-hq.org.

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

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TABLE 1 Chemical Requirements[A]

Grade/ UNS Number	Material	Composition, %												
		Carbon	Manganese	Silicon	Phosphorus, max	Sulfur, max	Molybdenum	Chromium	Nickel	Vanadium	Columbium	Nitrogen	Aluminum	Other
1 J03502	carbon steel	0.35[B] max	0.70[B] max	0.60 max	0.035	0.030	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
2 J12523	½ % molybdenum	0.25[B] max	0.70[B] max	0.60 max	0.035	0.030	0.45-0.65	. . .	. . .	. . .	. . .	. . .	. . .	. . .
5 J12540	½ % chromium, ½ % molybdenum	0.25[B] max	0.70[B] max	0.60 max	0.035	0.030	0.40-0.60	0.40-0.70	. . .	. . .	. . .	. . .	. . .	. . .
6 J12073	1¼ % chromium, ½ % molybdenum	0.20 max	0.50-0.80	0.60 max	0.035	0.030	0.45-0.65	1.00-1.50	. . .	. . .	. . .	. . .	. . .	. . .
8 J11697	1 % chromium, 1 % molybdenum, vanadium	0.20 max	0.50-0.90	0.20-0.60	0.035	0.030	0.90-1.20	1.00-1.50	. . .	0.05-0.15	. . .	. . .	. . .	. . .
9 J21610	1 % chromium, 1 % molybdenum, vanadium	0.20 max	0.50-0.90	0.20-0.60	0.035	0.030	0.90-1.20	1.00-1.50	. . .	0.20-0.35	. . .	. . .	. . .	. . .
10 J22090	2¼ % chromium, 1 % molybdenum	0.20 max	0.50-0.80	0.60 max	0.035	0.030	0.90-1.20	2.00-2.75	. . .	. . .	. . .	. . .	. . .	. . .
CA6NM J91540	martensic chromium nickel	0.06 max	1.00 max	1.00 max	0.040	0.030	0.4-1.0	11.5-14.0	3.5-4.5	. . .	. . .	. . .	. . .	. . .

[A] Where ellipses appear in this table, there is no requirement and the element need not be analyzed for or reported.
[B] For each 0.01 % reduction in carbon below the maximum specified, an increase of 0.04 percentage points of manganese over the maximum specified for that element will be permitted up to 1.00.

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