



**Designation: A351/A351M – 12**

# Standard Specification for Castings, Austenitic, for Pressure-Containing Parts<sup>1</sup>

This standard is issued under the fixed designation A351/A351M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope\*

1.1 This specification<sup>2</sup> covers austenitic steel castings for valves, flanges, fittings, and other pressure-containing parts (Note 1).

NOTE 1—Carbon steel castings for pressure-containing parts are covered by Specification **A216/A216M**, low-alloy steel castings by Specification **A217/A217M**, and duplex stainless steel castings by Specification **A995/A995M**.

1.2 A number of grades of austenitic steel castings are included in this specification. Since these grades possess varying degrees of suitability for service at high temperatures or in corrosive environments, it is the responsibility of the purchaser to determine which grade shall be furnished. Selection will depend on design and service conditions, mechanical properties, and high-temperature or corrosion-resistant characteristics, or both.

1.2.1 Because of thermal instability, Grades CE20N, CF3A, CF3MA, and CF8A are not recommended for service at temperatures above 800°F [425°C].

1.2.2 Because of embrittlement phases, Grade CD4MCu is not recommended for service at temperatures above 600°F [316°C].

1.3 Supplementary requirements of an optional nature are provided for use at the option of the purchaser. The Supplementary requirements shall apply only when specified individually by the purchaser in the purchase order or contract.

1.4 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.

1.4.1 This specification is expressed in both inch-pound units and in SI units; however, unless the purchase order or

contract specifies the applicable M specification designation (SI units), the inch-pound units shall apply. Within the text, the SI units are shown in brackets or parentheses.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

- A216/A216M** Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
- A217/A217M** Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service
- A488/A488M** Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel
- A703/A703M** Specification for Steel Castings, General Requirements, for Pressure-Containing Parts
- A985/A985M** Specification for Steel Investment Castings General Requirements, for Pressure-Containing Parts
- A995/A995M** Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts
- E165** Practice for Liquid Penetrant Examination for General Industry
- E709** Guide for Magnetic Particle Testing

### 2.2 Manufacturers Standardization Society of the Valve and Fittings Industry Standard:<sup>4</sup>

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

## 3. General Conditions for Delivery

3.1 Other than investment castings – Material furnished to this specification shall conform to the requirements of Specification **A703/A703M**, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification **A703/A703M** constitutes nonconformance with this specification. In

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-351/SA-351M in Section II of that code.

<sup>3</sup> 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.

<sup>4</sup> Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, http://www.mss-hq.com.

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

case of conflict between the requirements of this specification and Specification **A703/A703M**, this specification shall prevail.

3.2 Investment Castings – Material furnished to this specification shall conform to the requirements of Specification **A985/A985M**, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification **A985/A985M** constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification **A985/A985M**, Specification **A985/A985M** shall prevail.

3.3 The post weld heat treatment requirements of Supplementary Requirement S11 may be specified when austenitic castings other than HK, HT, or CT15C are to be subjected to severe corrosive service.

#### 4. Ordering Information

4.1 The inquiry and order should include or indicate the following:

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 Supplementary requirements desired, including the standards of acceptance.

#### 5. Process

5.1 The steel shall be made by the electric furnace process with or without separate refining such as argon-oxygen decarburization (AOD).

#### 6. Heat Treatment

6.1 All castings shall receive a heat treatment at the temperature specified in **Table 1**, followed by a quench in water or rapid cool by other means except as noted.

**TABLE 1 Heat-Treatment Requirements**

Grade	Temperature, min	
	°F	°C
HK30, HK40, HT30, CT15C	as-cast	as-cast
CF3, CF3A, CF8, CF8A, CF3M, CF3MA, CF8M, CF3MN, CG3M, CF10, CF10M, CG8M	1900	1040
CF10SMnN, CF8C, CF10MC	1950	1065
CN7M, CG6MMN, CE8MN	2050	1120
CK3MCuN, CN3MN, CH8, CH10, CH20, CK20	2100	1150
CE20N <sup>A</sup>	2225	1220

<sup>A</sup> Grade shall be quenched in water or the castings may be furnace cooled to 2050°F [1120°C] minimum, held for 15 min minimum and then quenched in water or rapidly cooled by other means.

NOTE 2—Proper heat treatment of these alloys is usually necessary to enhance corrosion resistance and in some cases to meet mechanical properties. Minimum heat-treat temperatures are specified; however, it is sometimes necessary to heat-treat at higher temperatures, hold for some minimum time at temperature, and then rapidly cool the castings in order to enhance the corrosion resistance and meet mechanical properties.

#### 7. Chemical Composition

7.1 The steel shall conform to the requirements as to chemical composition prescribed in **Table 2**.

#### 8. Tensile Properties

8.1 Steel used for the castings shall conform to the requirements as to tensile properties prescribed in **Table 3**.

#### 9. Quality

9.1 The surface of the casting shall be examined visually and shall be free of adhering sand, scale, cracks, and hot tears. Other surface discontinuities shall meet the visual acceptance standards specified in the order. Visual Method SP-55 or other visual standards may be used to define acceptable surface discontinuities and finish. Unacceptable visual surface discontinuities shall be removed and their removal verified by visual examination of the resultant cavities.

9.2 When additional inspection is desired, Supplementary Requirements S5, S6, and S10 may be ordered.

9.3 The castings shall not be peened, plugged, or impregnated to stop leaks.

#### 10. Repair by Welding

10.1 Repairs shall be made using procedures and welders qualified under Practice **A488/A488M**.

10.2 Weld repairs shall be inspected to the same quality standards that are used to inspect the castings. When castings are produced with Supplementary Requirement S5 specified, weld repairs on castings that have leaked on hydrostatic test, or on castings in which the depth of any cavity prepared for repair welding exceeds 20 % of the wall thickness or 1 in. [25 mm], whichever is smaller, or on castings in which any cavity prepared for welding is greater than approximately 10 in.<sup>2</sup> [65 cm<sup>2</sup>], shall be radiographed to the same standards that are used to inspect the castings. When castings are produced with Supplementary Requirement S6 specified, weld repairs shall be inspected by liquid penetrant examination to the same standards that are used to inspect the castings.

NOTE 3—When austenitic steel castings are to be used in services where they will be subject to stress corrosion, the purchaser should so indicate in his order and such castings should be solution-heat treated following all weld repairs.

#### 11. Keywords

11.1 austenitic stainless steel; pressure containing parts; stainless steel; steel castings