



Designation: A744/A744M – 21a

Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service¹

This standard is issued under the fixed designation A744/A744M; 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 covers iron-chromium-nickel alloy stainless steel castings intended for particularly severe corrosive applications.

1.2 This specification requires post-weld heat treatment of all weld repairs affecting surfaces intended to be wetted by the corrosive medium. For applications for which post-weld heat treatment is not considered mandatory for retention of acceptable corrosion resistance, refer to Specification [A743/A743M](#).

NOTE 1—For general corrosion-resistant alloy castings, reference should be made to Specification [A743/A743M](#). For general heat-resistant alloy castings, reference should be made to Specification [A297/A297M](#). For nickel-base alloy castings, refer to Specification [A494/A494M](#).

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 nonconformance with the standard.

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

1.3.2 Inch-pound units are applicable for material ordered to Specification A744 and SI units for material ordered to Specification A744M.

1.4 *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.*

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 A01.18 on Castings.

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2. Referenced Documents

2.1 ASTM Standards:²

[A262](#) Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

[A297/A297M](#) Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application

[A494/A494M](#) Specification for Castings, Nickel and Nickel Alloy

[A743/A743M](#) Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

[A781/A781M](#) Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use

[A957/A957M](#) Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use

2.2 American Welding Society Standards:³

[AWS A5.11](#) Specification for Nickel and Nickel Alloy Covered Welding Electrodes

[AWS A5.14](#) Specification for Nickel and Nickel Alloy Bare Welding Rods and Electrodes

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *wetted surface, n*—one that contacts a corrosive environment.

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 The American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126.

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

4. General Conditions for Delivery

4.1 Except for investment castings, castings furnished to this specification shall conform to the requirements of Specification **A781/A781M**, including any supplementary requirements that are indicated on the purchase order. Failure to comply with the general requirements of Specification **A781/A781M** constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification **A781/A781M**, this specification shall prevail.

4.2 Steel investment castings furnished to this specification shall conform to the requirements of Specification **A957/A957M**, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification **A957/A957M** constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification **A957/A957M**, Specification **A957/A957M** shall prevail.

5. Ordering Information

5.1 Orders for material to this specification should include the following, as required, to describe the material adequately:

- 5.1.1 Description of the casting by pattern number or drawing (dimensional tolerances shall be included on the casting drawing),
- 5.1.2 Grade,
- 5.1.3 Heat treatment,
- 5.1.4 Identify wetted surface(s),
- 5.1.5 Options in the specification,
- 5.1.6 Whether casting are to be produced using the investment casting process, and
- 5.1.7 Supplementary requirements desired, including the standards of acceptance.

6. Process

6.1 Alloys shall be melted by the electric furnace process with or without separate refining, such as argon-oxygen-decarburization (AOD).

7. Heat Treatment

7.1 Castings shall be heat treated in accordance with the requirements in **Table 1**.

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.

8. Chemical Composition Requirements

8.1 The materials shall conform with the chemical composition requirements prescribed in **Table 2**.

9. Workmanship, Finish, and Appearance

9.1 Machined welding ends shall be suitably protected against damage during shipping.

10. Repair by Welding

10.1 The weld metal composition shall be similar to that of the casting except for grades CK3MCuN and CN3MN.

10.1.1 For CK3MCuN, when post-weld heat treatment is required, the weld metal composition shall be similar to that of the casting or AWS A5.14 ER NiCrMo-3 (UNS N06625) or AWS A5.11 E NiCrMo-3 (UNS W86112). When post-weld heat treatment is not required, the weld metal composition shall be similar to that of AWS A5.14 ER NiCrMo-3 (UNS N06625) or AWS A5.11 E NiCrMo-3 (UNS W86112).

10.1.2 For CN3MN, when post-weld heat treatment is or is not required, the weld metal composition shall be similar to that of AWS A5.14 ER NiCrMo-3 (UNS N06625), ER NiCrMo-4 (UNS N10276), ER NiCrMo-10 (UNS N06022), or ER NiCrMo-14 (UNS N06686); or AWS A5.11 E NiCrMo-3 (UNS W86112), E NiCrMo-4 (UNS W80276), E NiCrMo-10 (UNS W86022), or E NiCrMo-14 (UNS W86686).

10.2 Weld repairs shall be considered major in the case of a casting that has leaked on hydrostatic test or when the depth of the cavity after preparation for repair exceeds 20 % of the actual wall thickness, or 1 in. [25 mm], whichever is smaller, or when the extent of the cavity exceeds approximately 10 in.² [65 cm²]. All other weld repairs shall be considered minor. Major and minor weld repairs shall be subject to the same quality standards as are used to inspect the castings. When methods involving high temperatures are used in the removal of discontinuities, castings shall be preheated to 50 °F [10 °C] min.

TABLE 1 Heat Treatment Requirements

Grade	Heat Treatment
CF8 (J92600), CG8M (J93000), CF8M (J92900), CF8C (J92710), CF3 (J92500), CF3M (J92800), CG3M (J92999) ^A	Heat to 1900 °F [1040 °C] minimum, hold for sufficient time to heat casting to temperature, quench in water or rapid cool by other means.
CN7M (N08007), CN3MCu (J80020)	Heat to 2050 °F [1120 °C] minimum, hold for sufficient time to heat casting to temperature, quench in water or rapid cool by other means.
CN7MS (J94650)	Heat to 2100 °F [1150 °C] minimum, 2150 °F [1180 °C] maximum, hold for sufficient time (2 h min) to heat casting to temperature, and quench in water.
CK3MCuN (J93254), CN3MN (J94651)	Heat to 2200 °F [1200 °C] minimum, hold for a minimum of 4 h, quench in water or cool rapidly by other means.

^A For optimum tensile strength, ductility, and corrosion resistance, the solution heat treatment temperatures for Grades CF8M, CG8M, and CF3M should be in excess of 1900 °F [1040 °C].