



Designation: A743/A743M – 21

Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application¹

This standard is issued under the fixed designation A743/A743M; 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 and iron-chromium-nickel alloy castings for general corrosion-resistant application. The grades covered by this specification represent types of alloy castings suitable for broad ranges of application which are intended for a wide variety of corrosion environments.

NOTE 1—For alloy castings for severe corrosion-resistant service, reference should be made to Specification [A744/A744M](#). For general heat-resistant alloy castings, reference should be made to Specification [A297/A297M](#). For nickel alloy castings for corrosion-resistant service, reference should be made to Specification [A494/A494M](#).

1.2 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. Inch-pound units are applicable for material ordered to Specification A743 and SI units for material ordered to Specification A743M.

1.3 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[A262 Practices for Detecting Susceptibility to Intergranular](#)

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 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.

[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](#)
[A744/A744M Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service](#)
[A781/A781M Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use](#)
[A890/A890M Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex \(Austenitic/Ferritic\) for General Application](#)
[A957/A957M Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use](#)

3. General Conditions for Delivery

3.1 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.

3.2 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.

4. Ordering Information

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

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

- 4.1.1 Description of the casting by pattern number or drawing,
- 4.1.2 Grade,
- 4.1.3 Heat treatment,
- 4.1.4 Options in the specification,
- 4.1.5 Whether castings are to be produced using the investment casting process, and
- 4.1.6 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 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.

7. Chemical Requirements

7.1 The chemical requirements are shown in [Table 2](#).

8. Repair by Welding

8.1 Repair welding of Grade CA28MWV is not permitted unless by agreement between the manufacturer and the purchaser.

8.2 When methods involving high temperature are used in the removal of discontinuities, castings shall be preheated in accordance with [Table 3](#). Weld repairs shall be subject to the same quality standards as are used to inspect the castings.

8.3 Post-weld heat treatment, if required, shall be in accordance with [Table 1](#).

8.3.1 The martensitic grades CA6NM, CA15, CA15M, CB6, and CA40 shall be retempered after weld repairing, except that local tempering will be permitted if, in the opinion of the manufacturer, furnace heat treating will be damaging to the finished surface of a machined casting. Heat treatment, other than tempering, of grades CA6NM, CA15, CA15M, CB6, and CA40 after weld repairing shall be performed only when agreed upon between the manufacturer and the purchaser. Weld repair on Grade CA40F is not recommended because of the risk of local hardening and possible cracking in the heat-affected zone.

8.3.2 Post-weld heat treatment is not required on the other grades of this specification. When post-weld heat treatment is believed necessary for adequate corrosion resistance in the service environment, castings should be ordered in accordance with Specification [A744/A744M](#).

8.3.3 For Grade HG10MNN, the filler metal to be used shall be established by mutual agreement between the manufacturer and the purchaser.

9. Product Marking

9.1 Castings shall be marked for material identification with the ASTM specification number (A743/A743M) and grade symbol, that is, CF8, CA15, CB30, etc. In addition, the manufacturer's name or identification mark and the pattern number shall be cast or stamped using low-stress stamps on all

[ASTM A743/A743M-21](https://standards.iteh.ai/catalog/standards/sist/b17d3aa8-88ea-4b30-92c3-68bc9937ce9c/astm-a743-a743m-21)

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TABLE 1 Heat Treatment Requirements

Grade	Heat Treatment
CA6N	Heat to 1900 °F [1040 °C], air cool, reheat to 1500 °F [815 °C], air cool, and age at 800 °F [425 °C], holding at each temperature sufficient time to heat casting uniformly to temperature.
CA6NM	Heat to 1850 °F [1010 °C] minimum, air cool to 200 °F [95 °C] or lower prior to any optional intermediate temper and prior to the final temper. The final temper shall be between 1050 °F [565 °C] and 1150 °F [620 °C].
CA15, CA15M, CA40, CA40F	(1) Heat to 1750 °F [955 °C] minimum, air cool and temper at 1100 °F [595 °C] minimum, or (2) Anneal at 1450 °F [790 °C] minimum.
CA28MWV	(1) Heat to 1875–1925 °F [1025–1050 °C], quench in air or oil, and temper at 1150 °F [620 °C] minimum, or (2) Anneal at 1400 °F [760 °C] minimum.
CB30, CC50	(1) Heat to 1450 °F [790 °C] minimum, and air cool, or (2) Heat to 1450 °F [790 °C] minimum, and furnace cool.
CB6	Heat between 1800 °F [980 °C] and 1920 °F [1050 °C], forced air, cool to 120 °F [50 °C] maximum, and temper between 1100 °F and 1160 °F [595 °C and 625 °C].
CE30, CH10, CH20, CK20	Heat to 2000 °F [1093 °C] minimum, hold for sufficient time to heat casting to temperature, quench in water or rapid cool by other means.
CF3, CF3M, CF3MN	(1) 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. (2) As cast if corrosion resistance is acceptable.
CF8, CF8C, CF8M, CF16F, CF16Fa, CF20, CG3M, CG8M, CG12 CF10SMnN	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. Heat to 1950 °F [1065 °C] minimum, hold for sufficient time to heat casting to temperature, quench in water or rapid cool by other means.
CK3MCuN, CK35MN, CN3M, CN3MN CG6MMN, CN7M	Heat to 2200 °F [1200 °C] minimum, hold for 4 h minimum, quench in water or rapid cool by other means. 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	Heat to 2100 °F [1150 °C] minimum, 2150 °F [1180 °C] maximum, hold for sufficient time (2 h minimum) to heat casting to temperature and quench in water.
HG10MNN	As cast

TABLE 2 Chemical Requirements^{A,B}

Material Grade Type (UNS)	Element, %											
	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Niobium ^C	Other
CA6N 11Cr-7Ni	0.06	0.50	0.02	0.02	1.00	10.5–12.5	6.0–8.0	...	...	...	...	...
CA6NM 12Cr-4Ni (J91540)	0.06	1.00	0.04	0.03	1.00	11.5–14.0	3.5–4.5	0.40–1.0	...	...	...	...
CA15 12 Cr (J91150)	0.15	1.00	0.04	0.04	1.50	11.5–14.0	1.00	0.50	...	...	...	...
CA15M 12 Cr (J91151)	0.15	1.00	0.040	0.040	0.65	11.5–14.0	1.0	0.15–1.0	...	...	...	...
CA28MWV 12Cr-Mo-W-V (J91422)	0.20–0.28	0.50–1.00	0.030	0.030	1.0	11.0–12.5	0.50–1.00	0.90–1.25	...	...	...	V: 0.20–0.30 W: 0.90–1.25
CA40 12 Cr (J91153)	0.20–0.40	1.00	0.04	0.04	1.50	11.5–14.0	1.0	0.5	...	...	...	...
CA40F ^D 12 Cr (J91154)	0.20–0.40	1.00	0.04	0.20–0.40	1.50	11.5–14.0	1.0	0.5	...	...	...	...
CB6 16Cr-4Ni (J91804)	0.06	1.00	0.04	0.03	1.00	15.5–17.5	3.5–5.5	0.5	...	...	...	...
CB30 20 Cr (J91803)	0.30	1.00	0.04	0.04	1.50	18.0–21.0	2.00	...	...	^E	...	...
CC50 28 Cr (J92615)	0.50	1.00	0.04	0.04	1.50	26.0–30.0	4.00	...	...	...	...	...
CE30 29Cr-9Ni (J93423)	0.30	1.50	0.04	0.04	2.00	26.0–30.0	8.0–11.0	...	...	...	...	...
CF3 19Cr-9Ni (J92500)	0.03	1.50	0.04	0.04	2.00	17.0–21.0	8.0–12.0	...	...	...	...	...
CF3M 19Cr-10Ni-Mo (J92800)	0.03	1.50	0.04	0.04	1.50	17.0–21.0	9.0–13.0	2.0–3.0	...	...	...	...
CF3MN 19Cr-10Ni-Mo-N (J92804)	0.03	1.50	0.040	0.040	1.50	17.0–22.0	9.0–13.0	2.0–3.0	0.10–0.20	...	...	...
CF8 19Cr-9Ni (J92600)	0.08	1.50	0.04	0.04	2.00	18.0–21.0	8.0–11.0	...	...	...	...	...
CF8C 19Cr-10Ni-Nb (J92710)	0.08	1.50	0.04	0.04	2.00	18.0–21.0	9.0–12.0	...	...	...	^F	...
CF8M 19Cr-10Ni-Mo (J92900)	0.08	1.50	0.04	0.04	2.00	18.0–21.0	9.0–12.0	2.0–3.0	...	...	...	...
CF10SMnN 17Cr-8.4Ni-N (J92972)	0.10	7.00–9.00	0.060	0.030	3.50–4.50	16.0–18.0	8.0–9.0	...	0.08–0.18	...	...	...



TABLE 2 Continued

Material Grade Type (UNS)	Element, %											
	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Niobium ^C	Other
CF16F ^D 19Cr-9Ni (J92701)	0.16	1.50	0.17	0.04	2.00	18.0–21.0	9.0–12.0	1.50	...	...	...	Se: 0.20–0.35
CF16Fa ^D 19Cr-9Ni	0.16	1.50	0.04	0.20–0.40	2.00	18.0–21.0	9.0–12.0	0.40–0.80	...	...	...	...
CF20 19Cr-9Ni (J92602)	0.20	1.50	0.04	0.04	2.00	18.0–21.0	8.0–11.0	...	...	...	...	...
CG3M 19Cr-11Ni-Mo (J92999)	0.03	1.50	0.04	0.04	1.50	18.0–21.0	9.0–13.0	3.0–4.0	...	...	...	...
CG6MMN (J93790)	0.06	4.00–6.00	0.04	0.03	1.00	20.5–23.5	11.5–13.5	1.50–3.00	0.20–0.40	...	0.10–0.30	V: 0.10–0.30
CG8M 19Cr-11Ni-Mo (J93000)	0.08	1.50	0.04	0.04	1.50	18.0–21.0	9.0–13.0	3.0–4.0	...	...	...	...
CG12 22Cr-12Ni (J93001)	0.12	1.50	0.04	0.04	2.00	20.0–23.0	10.0–13.0	...	...	...	...	...
CH10 25Cr-12 Ni (J93401)	0.10	1.50	0.04	0.04	2.00	22.0–26.0	12.0–15.0	...	...	...	...	...
CH20 25Cr-12Ni (J93402)	0.20	1.50	0.04	0.04	2.00	22.0–26.0	12.0–15.0	...	...	...	...	...
CK35MN 23Cr-21Ni-Mo-N	0.035	2.00	0.035	0.020	1.00	22.0–24.0	20.0–22.0	6.0–6.8	0.21–0.32	0.40	...	...
CK3MCuN 20Cr-18Ni-Cu-Mo (J93254)	0.025	1.20	0.045	0.010	1.00	19.5–20.5	17.5–19.5	6.0–7.0	0.180–0.240	0.50–1.00	...	...
CK20 25Cr-20Ni (J94202)	0.20	2.00	0.04	0.04	2.00	23.0–27.0	19.0–22.0	...	...	...	...	...
CN3M (J94652)	0.03	2.0	0.03	0.03	1.0	20.0–22.0	23.0–27.0	4.5–5.5	...	...	...	...
CN3MN 21Cr-24Ni-Mo-N (J94651)	0.03	2.00	0.040	0.010	1.00	20.0–22.0	23.5–25.5	6.0–7.0	0.18–0.26	0.75	...	...
CN7M 20Cr-29Ni-Cu-Mo (N08007)	0.07	1.50	0.04	0.04	1.50	19.0–22.0	27.5–30.5	2.0–3.0	...	3.0–4.0	...	...
CN7MS 19Cr-24Ni-Cu-Mo (J94650)	0.07	1.00	0.04	0.03	2.50–3.50	18.0–20.0	22.0–25.0	2.5–3.0	...	1.5–2.0	...	...
HG10MNN 19Cr-12Ni-4Mn J92604	0.07–0.11	3.0–5.0	0.040	0.030	0.70	18.5–20.5	11.5–13.5	0.25–0.45	0.20–0.30	0.50	^G	...

^A All values are maximums except where a range is provided.

^B Where ellipses (...) appear in this table, there is no requirement, and the element need not be analyzed for or reported.

^C Columbium (Cb) and niobium (Nb) are interchangeable names for the same element 41.

^D Free machining grade.

^E For Grade CB30, a copper content of 0.90 to 1.20 % is optional.

^F Grade CF8C shall have a niobium content of not less than eight times the carbon content and not more than 1.0 %. If a niobium-plus-tantalum alloy in the approximate Nb:Ta ratio of 3:1 is used for stabilizing this grade, the total niobium-plus-tantalum content shall not be less than nine times the carbon content and shall not exceed 1.1 %.

^G Grade HG10MNN shall have a niobium content of not less than eight times the carbon, but not over 1.00 %.

TABLE 3 Minimum Preheat Temperatures

Grade	Minimum Preheat Temperatures	
	°F	°C
CA15, CA15M CA28MWV, CA40	400	[205]
Others	50	[10]

castings. Small-size castings may be such that marking must be

limited consistent with the available area. The marking of heat numbers on individual castings shall be agreed upon between the manufacturer and the purchaser. Marking shall be in such position as not to injure the usefulness of the casting.

10. Keywords

10.1 corrosion resistant; iron-chromium; iron-chromium-nickel; steel castings

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall not apply unless specified in the purchase order. A list of standardized supplementary requirements for use at the option of the purchaser is included in Specification **A781/A781M**. Those which are ordinarily considered suitable for use with this specification are given below. Others enumerated in **A781/A781M** may be used with this specification upon agreement between the manufacturer and purchaser.

S1. Magnetic Particle Examination

S2. Radiographic Examination

S3. Liquid Penetrant Examination

S4. Ultrasonic Examination

S5. Examination of Weld Preparation

S6. Certification

S7. Prior Approval of Major Weld Repairs

S11. Intergranular Corrosion Test

S11.1 An intergranular corrosion test shall be performed in accordance with the appropriate practice for the particular grade involved as listed in Practices **A262**, or as agreed upon with the purchaser. Intergranular corrosion tests on stabilized or 0.03 % carbon maximum grades (CF3, CF3M, CF8C, and CG3M) shall be made on sensitized specimens. On all other grades of chromium-nickel steels, intergranular corrosion tests shall be made on specimens representative of the as-shipped condition.

S12. Tension Test

S12.1 Tensile properties shall be determined from material representing each heat. Testing shall be performed in accordance with Specification **A781/A781M** or **A957/A957M** for investment castings. The results shall conform to the requirements specified in **Table S12.1**.

S12.2 Test bars shall be poured in separately cast keel blocks.

S12.3 Tension test specimens may be cut from heat-treated castings, or from as-cast castings if no heat treatment is specified for the castings, instead of from test bars, when agreed upon between the manufacturer and the purchaser.

S12.4 Test specimens shall be machined to the form and dimensions of the standard round 2-in. [50-mm] gage length specimen.

S12.5 At the manufacturer's option, castings may be reheat treated and retested. When castings are reheat treated, they may not be re-austenitized more than three times without the approval of the purchaser. Testing after reheat treatment shall consist of the full number of specimens taken from locations complying with the specification or order.

S12.6 If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted from the same heat.

S13. Post-Weld Heat Treatment

S13.1 Weld repairs shall be considered major in the case of a casting which 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.

S13.2 Grades CF8, CG3M, CG8M, CG12, CF20, CF8M, CF8C, CF16F, CF16Fa, CH10, CH20, CE30, CK3MCuN, CK35MN, CK20, CF3, CF3M, CF3MN, CN3M, CN3MN, CN7M, CN7MS, CB30, CC50, CA6N, and CK3MCuN shall be heat treated after major weld repairs, but it is not required after minor repairs except by agreement between the manufacturer and the purchaser.

S13.2.1 The post-weld treatment for grades CK3MCu, CK35MN, CN3M, and CN3MN shall be as specified in **Table 1**, except that the minimum soak time for castings that have already been heat treated according to **Table 1** may be 1 h.

S14. Hardness Tests

S14.1 Brinell tests on non-austenitic grades shall be conducted. Grades CA15, CA15M, CB30, and CC50 shall have a Brinell hardness of 241 HB maximum. Grade CA6NM shall have a Brinell hardness of 285 HB maximum, Grades CA40 and CA40F, 269 HB maximum, and Grade CA28MWV, 302 to 352 HB, except for the annealed condition, when the Brinell hardness of this grade shall not exceed 269 HB.