



Designation: A743/A743M – 19

# Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application <sup>1</sup>

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 (  $\epsilon$  ) 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: <sup>2</sup>

A262 Practices for Detecting Susceptibility to Intergranular

<sup>1</sup> 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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](#).

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	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.
CF10SMnN	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	Heat to 2200 °F [1200 °C] minimum, hold for 4 h minimum, quench in water or rapid cool by other means.
CG6MMN, CN7M	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 <sup>A,B</sup>

Material Grade	TABLE 2 Chemical Requirements										
	Element, %										
	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Niobium <sup>c</sup>	Other
CA6N	0.02	0.02	0.02	1.00	10.5–12.5	6.0–8.0	...	...	...	...	...
CA6NM	0.04	0.03	0.03	1.00	11.5–14.0	3.5–4.5	0.40–1.0	...	...	...	...
CA15, CA15M, CA40, CA40F	0.04	0.04	0.04	1.50	11.5–14.0	1.00	0.50	...	...	...	...
CA28MWV	0.040	0.040	0.040	0.65	11.5–14.0	1.0	0.15–1.0	...	...	...	...

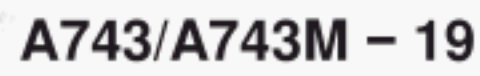


TABLE 2 Continued

Element, %									
Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Niobium <sup>c</sup>	Other	
	1.0	11.0–12.5	0.50–1.00	0.90–1.25	...	...	...	V: 0.20–0.30 W: 0.90–1.25	
		14.0	1.0	0.5	...	...	...	...	
			0	0.5	...	...	...	...	
				0.5	...	...	...	...	
				...	...	<i>E</i>	...	...	
					...	...	...	...	
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					...	...	...	...	
					...	...	...	...	
					0.20	...	...	...	
					...	...	...	...	
					...	...	<i>F</i>	...	
					...	...	...	...	
					0.08–0.18	...	...	...	
				1.50	...	...	...	Se: 0.20–0.35	
			10–12.0	0.40–0.80	...	...	...	...	
		21.0	8.0–11.0	...	...	...	...	...	
	1.50	18.0–21.0	9.0–13.0	3.0–4.0	...	...	...	...	
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









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 the low-stress stamps on all 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. [65 cm].<sup>2</sup> 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.



**A743/A743M – 19****TABLE S12.1 Tensile Requirements**

Grade	Type	Tensile Strength, min		Yield Strength, min		Elongation in 2 in. [50 mm], min, % <sup>A</sup>	Reduction of Area, min, %
		ksi	[MPa]	ksi	[MPa]		
CA6N	11 Chromium, 7 Nickel	140	[965]	135	[930]	15	50
CA6NM	12 Chromium, 4 Nickel	110	[755]	80	[550]	15	35
CA15 and CA15M	12 Chromium	90	[620]	65	[450]	18	30
CA28MWV <sup>C</sup>	12 Chromium, with Molybdenum, Tungsten, and Vanadium	140	[965]	110	[760]	10	24
CA40	12 Chromium	100	[690]	70	[485]	15	25
CA40F	12 Chromium, Free Machining	100	[690]	70	[485]	12	...
CB6	16 Chromium, 4 Nickel	115	[790]	85	[580]	16	35
CB30	20 Chromium	65	[450]	30	[205]	...	...
CC50	28 Chromium	55	[380]	...	...	...	...
CE30	29 Chromium, 9 Nickel	80	[550]	40	[275]	10	...
CF3	19 Chromium, 9 Nickel	70	[485]	30	[205]	35	...
CF3M	19 Chromium, Nickel, with Molybdenum	70	[485]	30	[205]	30	... 10
CF3MN	19 Chromium, 10 Nickel, with Molybdenum, and Nitrogen	75	[515]	37	[255]	35	...
CF8	19 Chromium, Nickel	70 <sup>B</sup>	[485] <sup>B</sup>	30 <sup>B</sup>	[205] <sup>B</sup>	35	... 9
CF8C	19 Chromium, 10 Nickel with Columbium	70	[485]	30	[205]	30	...
CF8M	19 Chromium, 10 Nickel, with Molybdenum	70	[485]	30	[205]	30	...
CF10SMnN	17 Chromium, 8.5 Nickel with Nitrogen, 9 Nickel	85	[585]	42	[290]	30	...
CF16F and CF16Fa	19 Chromium, 9 Nickel, Free Machining	70	[485]	30	[205]	25	...
CF20	19 Chromium, 9 Nickel	70	[485]	30	[205]	30	...

**A743/A743M – 19****TABLE** *Continued*

Grade	Type	Tensile Strength, min		Yield Strength, min		Elongation in 2 in. [50 mm], min, % <sup>A</sup>	Reduction of Area, min, %
		ksi	[MPa]	ksi	[MPa]		
CG3M	19 Chromium, 11 Nickel, with Molybdenum	75	[515]	35	[240]	25	...
CG6MMN	Chromium- Nickel- Manganese- Molybdenum	85	[585]	42	[290]	30	...
CG8M	19 Chromium, 11 Nickel, with Molybdenum	75	[520]	35	[240]	25	...
CG12	22 Chromium, 12 Nickel	70	[485]	28	[195]	35	...
CH10 and CH20	25 Chromium, 12 Nickel	70	[485]	30	[205]	30	...
CK3MCuN	20 Chromium 18 Nickel, with Copper and Molybdenum	80	[550]	38	[260]	35	...
CK35MN	23 Chromium, 21 Nickel, with Molybdenum and Nitrogen	83	[570]	41	[280]	35	...
CK20	25 Chromium, 20 Nickel	65	[450]	28	[195]	30	...
CN3M		63	[435]	25	[170]	30	...
CN3MN	21 Chromium, 24 Nickel, with Molybdenum, and Nitrogen	80	[550]	38	[260]	35	...
CN7M	20 Chromium, 29 Nickel, with Copper and Molybdenum	62	[425]	25	[170]	35	...
CN7MS	19 Chromium, 24 Nickel, with Copper and Molybdenum	70	[485]	30	[205]	35	...
HG10MNN	19 Chromium, 12 Nickel, 4 Manganese	76	[525]	33	[225]	20	...

<sup>A</sup> When ICI test bars are used in tensile testing as provided for in this specification, the gage length to reduced section diameter ratio shall be 4:1.<sup>B</sup> For low-ferrite or nonmagnetic castings of this grade, the following values shall apply: tensile strength, min, 65 ksi [450 MPa]; yield point, min, 28 ksi [195 MPa]. These<sup>C</sup> mechanical properties apply only when heat treatment (1) has been used.





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.

S14.2 The location where the Brinell hardness reading is to be taken and the frequency of such Brinell hardness inspection of the castings shall be established by agreement between the manufacturer and the purchaser.

#### S15. Low Ferrite in CF8

S15.1 When low-ferrite or nonmagnetic properties are required, the mechanical property requirements and volume fraction of ferrite as determined by S31 of Specification **A890/A890M** shall be by agreement between the manufacturer and the purchaser.

### SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A743/A743M – 17) that may impact the use of this standard. (Approved Mar. 1, 2019.)

(1) Reformatted **Table 2** (Chemical Requirements); added note about ellipses; noted all values are a maximum except where a range is provided; added Columbium (Cb) and Niobium (Nb)

are interchangeable names for the same element 41; listed both in each instance. Added max. for Cu content on grades CK35MN and HG10MNN.

Committee A01 has identified the location of selected changes to this standard since the last issue (A743/A743M – 13a<sup>e</sup>) that may impact the use of this standard. (Approved Nov. 1, 2017.)

(1) Removed Test Methods and Definitions A370 from Section

2.

(2) In Supplementary Requirement S12, removed references to A370 and replaced with references to Specifications **A781/A781M** and **A957/A957M** where necessary.

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