



Designation: A297/A297M – 17

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

This standard is issued under the fixed designation A297/A297M; 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 iron-chromium and iron-chromium-nickel alloy castings for heat-resistant service. The grades covered by this specification are general purpose alloys and no attempt has been made to include heat-resisting alloys used for special production application.

NOTE 1—For heat-resisting alloys used for special product application, reference should be made to Specifications [A351/A351M](#), [A217/A217M](#), and [A447/A447M](#).

1.2 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 *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>

[A217/A217M](#) Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service

[A351/A351M](#) Specification for Castings, Austenitic, for Pressure-Containing Parts

[A370](#) Test Methods and Definitions for Mechanical Testing of Steel Products

[A447/A447M](#) Specification for Steel Castings, Chromium-

Nickel-Iron Alloy (25-12 Class), for High-Temperature Service

[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

## 3. General Conditions for Delivery

3.1 Except for investment castings, material furnished to this specification shall conform to the requirements of Specification [A781/A781M](#), including any supplementary requirements that are indicated in 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 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 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 The supplementary requirements desired including the standards of acceptance.

## 5. Process

5.1 Alloys shall be made by the following processes: electric-arc, electric-induction, or other approved processes.

<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.

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

TABLE 1 Chemical Requirements<sup>A</sup>

Grade/ UNS Number	Type	Composition, % (max, except where range is given)								
		Carbon	Manganese	Silicon	Phosphorus	Sulfur	Chromium	Nickel	Molybdenum <sup>B</sup>	Other <sup>C</sup>
HF	19 Chromium,	0.20 – 0.40	2.00	2.00	0.04	0.04	18.0 – 23.0	8.0 – 12.0	0.50	
J92603	9 Nickel									
HH	25 Chromium,	0.20 – 0.50	2.00	2.00	0.04	0.04	24.0 – 28.0	11.0 – 14.0	0.50	
J93503	12 Nickel									
HI	28 Chromium,	0.20 – 0.50	2.00	2.00	0.04	0.04	26.0 – 30.0	14.0 – 18.0	0.50	
J94003	15 Nickel									
HK	25 Chromium,	0.20 – 0.60	2.00	2.00	0.04	0.04	24.0 – 28.0	18.0 – 22.0	0.50	
J94224	20 Nickel									
HE	29 Chromium,	0.20 – 0.50	2.00	2.00	0.04	0.04	26.0 – 30.0	8.0 – 11.0	0.50	
J93403	9 Nickel									
HT	15 Chromium,	0.35 – 0.75	2.00	2.50	0.04	0.04	15.0 – 19.0	33.0 – 37.0	0.50	
N08605	35 Nickel									
HU	19 Chromium,	0.35 – 0.75	2.00	2.50	0.04	0.04	17.0 – 21.0	37.0 – 41.0	0.50	
N08004	39 Nickel									
HW	12 Chromium,	0.35 – 0.75	2.00	2.50	0.04	0.04	10.0 – 14.0	58.0 – 62.0	0.50	
N08001	60 Nickel									
HX	17 Chromium,	0.35 – 0.75	2.00	2.50	0.04	0.04	15.0 – 19.0	64.0 – 68.0	0.50	
N06006	66 Nickel									
HC	28 Chromium	0.50 max	1.00	2.00	0.04	0.04	26.0 – 30.0	4.00	0.50	
J92605										
HD	28 Chromium,	0.50 max	1.50	2.00	0.04	0.04	26.0 – 30.0	4.0 – 7.0	0.50	
J93005	5 Nickel									
HL	29 Chromium,	0.20 – 0.60	2.00	2.00	0.04	0.04	28.0 – 32.0	18.0 – 22.0	0.50	
N08604	20 Nickel									
HN	20 Chromium,	0.20 – 0.50	2.00	2.00	0.04	0.04	19.0 – 23.0	23.0 – 27.0	0.50	
J94213	25 Nickel									
HP	26 Chromium,	0.35 – 0.75	2.00	2.50	0.04	0.04	24 – 28	33 – 37	0.50	
N08705	35 Nickel									
HG10	19 Chromium,	0.07 – 0.11	3.0 – 5.0	0.70	0.040	0.03	18.5 – 20.5	11.5 – 13.5	0.25 – 0.45	Cu 0.50 Nb(Cb) <sup>D</sup> N 0.20–0.30
MNN	12 Nickel,									
J92604	4 Manganese									
CT15C	20 Chromium,	0.05 – 0.15	0.15 – 1.50	0.15 – 1.50	0.03	0.03	19.0 – 21.0	31.0 – 34.0	...	Nb 0.50 – 1.50
N08151	33 Nickel, 1 Niobium									

<sup>A</sup>Where ellipses ( . . . ) appear in this table there is no requirement, and the element need not be analyzed or reported.

<sup>B</sup>Castings having a specified molybdenum range agreed upon by the manufacturer and the purchaser may also be furnished under these specifications.

<sup>C</sup>Niobium (Nb) and Columbium (Cb) both designate element 41.

<sup>D</sup>Grade HG10MNN shall have a niobium content of not less than 8× the carbon, but not over 1.00 %.

## 6. Heat Treatment

6.1 Castings for heat-resistant service may be shipped in the as-cast condition without heat treatment. If heat treatment is required, the treatment shall be established by mutual agreement between the manufacturer and the purchaser and shall be so specified in the inquiry, contract, or order.

## 7. Chemical Composition

7.1 Alloys shall conform to the requirements as to chemical composition prescribed in Table 1.

## 8. Repair by Welding

8.1 Except for Grade HG10MNN, the composition of the deposited weld metal shall be similar to the composition of the casting. For Grade HG10MNN, the filler metal to be used shall be established by mutual agreement between the manufacturer

and the purchaser. All weld repairs shall be subjected to the same inspection standards as the casting.

8.2 Castings with major weld repairs shall be heat treated in accordance with Section 6.

8.3 Weld repairs shall be considered major 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.<sup>2</sup> [65 cm<sup>2</sup>].

8.3.1 When Supplementary Requirement S7 is specified on the purchase order or inquiry, major weld repairs shall be subject to the prior approval of the purchaser.

8.4 All other weld repairs shall be considered minor and may be made at the discretion of the manufacturer without prior approval of the purchaser.



## 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** or **A957/A957M**. Those which are ordinarily considered suitable for use with this specification are given below. Others enumerated in Specification **A781/A781M** or **A957/A957M** 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****S8. Marking****S14. Tension Test**

S14.1 One tension test shall be made from material representing each heat. The bar from which the test specimen is taken shall be heat treated in production furnaces to the same procedure as the castings it represents. The results shall conform to the requirements specified in **Table S14.1**.

S14.2 Test bars shall be poured in separately cast keel blocks shown in Specification **A781/A781M**, unless the purchase order is for investment castings, in which case, test material shall be poured in accordance with the requirements of Specification **A957/A957M**.

S14.3 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 or at the option of the producer if suitable separately cast test material is not available.

S14.4 Test specimens shall be the standard round 2-in. [50-mm] gage length specimen shown in Specification **A370**, unless the purchase order is for investment castings, in which case, the specimen shall be in accordance with Specification **A957/A957M**.

S14.5 If the results of the mechanical tests for any heat do not conform to the requirements specified, the castings may be re-heat treated and retested, but may not be solution heat treated or re-austenitized more than twice.

**TABLE S14.1 Tensile Requirements<sup>A</sup>**

Grade	Type	Tensile Strength, min		Yield Point, min		Elongation in 2 in. [50 mm], min, % <sup>B</sup>
		ksi	(MPa)	ksi	(MPa)	
HF	19 Chromium, 9 Nickel	70	(485)	35	(240)	25
HH	25 Chromium, 12 Nickel	75	(515)	35	(240)	10
HI	28 Chromium, 15 Nickel	70	(485)	35	(240)	10
HK	25 Chromium, 20 Nickel	65	(450)	35	(240)	10
HE	29 Chromium, 9 Nickel	85	(585)	40	(275)	9
HT	15 Chromium, 35 Nickel	65	(450)	...	...	4
HU	19 Chromium, 39 Nickel	65	(450)	...	...	4
HW	12 Chromium, 60 Nickel	60	(415)	...	...	...
HX	17 Chromium, 66 Nickel	60	(415)	...	...	...
HC	28 Chromium	55	(380)	...	...	...
HD	28 Chromium, 5 Nickel	75	(515)	35	(240)	8
HL	29 Chromium, 20 Nickel	65	(450)	35	(240)	10
HN	20 Chromium, 25 Nickel	63	(435)	...	...	8
HP	26 Chromium, 35 Nickel	62.5	(430)	34	(235)	4.5
HG	19 Chromium, 12 Nickel,	76	(525)	33	(225)	20
10						
MNN	4 Manganese					
CT15C	20 Chromium, 33 Nickel,	63	435	25	170	20.0
	1 Niobium					

<sup>A</sup>Where ellipses (...) appear in this table there is no requirement, and the element need not be analyzed or reported.

<sup>B</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 to 1.

S14.6 If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted from the same heat.



## SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A297/A297M – 14) that may impact the use of this standard. (Approved May 1, 2017.)

(1) “Solution treated” changed to “solution heat treated” in paragraph S14.5 for consistency with Terminology A941.

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