Designation: A 297/A 297M – 97 (Reapproved 2003)

Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application[1]

This standard is issued under the fixed designation A 297/A 297M; 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 Specification A 351/A 351M, A 217/A 217M, and A 447/A 447M.

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.

2. Referenced Documents

2.1 *ASTM Standards:*

A 217/A 217M Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure–Containing Parts, Suitable for High-Temperature Service[2]

A 351/A 351M Specification for Castings, Austenitic, Austenitic–Ferritic (Duplex), for Pressure–Containing Parts[2]

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products[3]

A 447/A 447M Specification for Steel Castings, Chromium-Nickel-Iron Alloy (25-12 Class), for High-Temperature Service[2]

A 781/A 781M Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use[2]

3. General Conditions for Delivery

3.1 Material furnished to this specification shall conform to the requirements of Specification A 781/A 781M, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification A 781/A 781M constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A 781/A 781M, this specification 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.

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 The composition of the deposited weld metal shall be similar to the composition of the casting. All weld repairs shall be subjected to the same inspection standards as the casting.

[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.

Current edition approved April 10, 2003. Published April 2003. Originally approved in 1946. Last previous edition approved in 1998 as A 297/A 297M – 97 (1998).

[2] *Annual Book of ASTM Standards*, Vol 01.02.

[3] *Annual Book of ASTM Standards*, Vol 01.03.

TABLE 1 Chemical Requirements

Grade	Type	Composition, %							
		Carbon	Manganese, max	Silicon, max	Phosphorus, max	Sulfur, max	Chromium	Nickel	Molybdenum, max[A]
HF	19 Chromium, 9 Nickel	0.20–0.40	2.00	2.00	0.04	0.04	18.0–23.0	8.0–12.0	0.50
HH	25 Chromium, 12 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	24.0–28.0	11.0–14.0	0.50
HI	28 Chromium, 15 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	26.0–30.0	14.0–18.0	0.50
HK	25 Chromium, 20 Nickel	0.20–0.60	2.00	2.00	0.04	0.04	24.0–28.0	18.0–22.0	0.50
HE	29 Chromium, 9 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	26.0–30.0	8.0–11.0	0.50
HT	15 Chromium, 35 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	15.0–19.0	33.0–37.0	0.50
HU	19 Chromium, 39 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	17.0–21.0	37.0–41.0	0.50
HW	12 Chromium, 60 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	10.0–14.0	58.0–62.0	0.50
HX	17 Chromium, 66 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	15.0–19.0	64.0–68.0	0.50
HC	28 Chromium	0.50 max	1.00	2.00	0.04	0.04	26.0–30.0	4.00 max	0.50
HD	28 Chromium, 5 Nickel	0.50 max	1.50	2.00	0.04	0.04	26.0–30.0	4.0–7.0	0.50
HL	29 Chromium, 20 Nickel	0.20–0.60	2.00	2.00	0.04	0.04	28.0–32.0	18.0–22.0	0.50
HN	20 Chromium, 25 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	19.0–23.0	23.0–27.0	0.50
HP	26 Chromium, 35 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	24–28	33–37	0.50

[A] Castings having a specified molybdenum range agreed upon by the manufacturer and the purchaser may also be furnished under these specifications.

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 $in.^2$ [65 cm^2].

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 A 781/A 781M. Those which are ordinarily considered suitable for use with this specification are given below. Others enumerated in A 781/A 781M 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
S9. Tension Test

S9.1 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 S9.1.

S9.2 Test bars shall be poured in separately cast keel blocks similar to Fig. 3 of Test Methods and Definitions A 370 of Fig.1 of Specification A 447/A 447M.

S9.3 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.

S9.4 Test specimens shall be machined to the form and dimensions of the standard round 2-in. [50-mm] gage length specimen shown in Fig. 6 of Test Methods and Definitions A 370 and shall be tested in accordance with Test Methods and Definitions A 370.

S9.5 If the results of the mechanical tests for any heat do not conform to the requirements specified, the castings may be

TABLE S9.1 Tensile Requirements

Grade	Type	Tensile Strength, min		Yield Point, min		Elongation in 2 in. [50 mm], min, %[A]
		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

[A] 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.

re-heat treated and re-tested, but may not be solution treated or re-austenitized more than twice.

S9.6 If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted from the same heat.