Designation: A 560/A 560M – 05

Standard Specification for Castings, Chromium-Nickel Alloy[1]

This standard is issued under the fixed designation A 560/A 560M; 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 chromium-nickel alloy castings intended for heat-resisting and elevated-temperature corrosion applications, such as structural members, containers, supports, hangers, spacers, and the like, in corrosive environments up to 2000°F [1090°C].

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the test, 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:* [2]

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

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

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 purchaser should specify the alloy grade desired and whether tension tests are required, and shall include standards of acceptance where necessary.

5. Materials and Manufacture

5.1 *Process*—The alloy for the castings shall be made by the electric-arc or induction-furnace process unless otherwise agreed upon between the manufacturer and the purchaser. Castings may be poured in sand, shell, investment, or centrifugal molds.

5.2 *Heat Treatment*—Castings may be shipped in the as-cast condition. If heat treatment is required, the treatment shall be established by mutual consent between the manufacturer and purchaser and shall be so specified in the inquiry, purchase order, or contract.

6. Chemical Composition

6.1 The castings shall conform to the requirements as to chemical composition prescribed in Table 1.

7. Tensile Properties

7.1 Tensile properties, if required, of the alloy used for the castings shall conform to the requirements prescribed in Table 2.

7.2 Tension tests, if required, shall be performed in accordance with Test Methods and Definitions A 370.

8. Test Specimens

8.1 Test specimens, if required, shall be prepared in accordance with Test Methods and Definitions A 370. Test bars shall be poured in special blocks from the same heat as the castings represented. Test bars, if required, shall be furnished in sufficient number to furnish specimens for the test required in Section 9.

8.2 The test coupons shall be cast from the same melt from which the castings they represent are poured, and shall represent the full melting practice. Chemical composition of the test coupons shall conform to the requirements prescribed in Table 1.

8.3 Tension test specimens shall be machined to the form and dimensions of the standard round 2-in. [50-mm] gage length specimen shown in Fig. 4 of Test Methods and Definitions A 370.

[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.

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

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TABLE 1 Chemical Requirements[A]

Element	Composition, %		
	Grade		
	50 Cr-50 Ni (R20500)	60 Cr-40 Ni (R20600)	50 Cr-50 Ni-Cb (R20501)
Carbon, max	0.10	0.10	0.10
Manganese, max	0.30	0.30	0.30
Silicon, max	1.00	1.00	0.50
Sulfur, max	0.02	0.02	0.02
Phosphorus, max	0.02	0.02	0.02
Nitrogen, max	0.30	0.30	0.16
Nitrogen + Carbon, max	. . .	. . .	0.20
Iron, max	1.00	1.00	1.00
Titanium, max	0.50	0.50	0.50
Aluminum, max	0.25	0.25	0.25
Columbium	. . .	. . .	1.4–1.7
Chromium	48.0–52.0	58.0–62.0	47.0–52.0
Nickel	balance	balance	balance

[A] The total of the nickel, chromium, and columbium contents must exceed 97.5 %.

8.4 Impact test specimens shall conform to the length and cross section dimensions of the specimens shown in Fig. 10 of Test Methods and Definitions A 370. The impact specimens are to be broken unnotched.

9. Number of Tests and Retests

9.1 *Tension Test*—One tension test, if required, shall be made from each melt.

TABLE 2 Room Temperature Tensile and Charpy Requirements

	50 Cr-50 Ni	60 Cr-40 Ni	50 Cr-50 Ni-Cb
Tensile strength, min, ksi [MPa]	80 [550]	110 [760]	80 [550]
Yield point, min, ksi [MPa]	50 [340]	85 [590]	50 [345]
Elongation in 2 in. [50 mm], min, %	5.0	. . .	5.0
Impact, unnotched, Charpy, min, ft·lbf [J]	50 [78]	10 [14]	. . .

9.2 *Impact Test*—One unnotched Charpy impact test, if required, shall be made from each melt.

9.3 *Retests*:

9.3.1 Retest of a duplicate specimen will be allowed if the results of the mechanical tests for any lot do not conform to the requirements specified in Table 2.

9.3.2 If the percentage of elongation of any tension test specimen is less than specified in Table 2 and any part of the fracture is more than ¾ in. [19.0 mm] from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

10. Keywords

10.1 chromium-nickel alloys; corrosion; high temperature applications; 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 A 781/A 781M. Those which are ordinarily considered suitable for use with this specification are given below. Others enumerated in Specification A 781/A 781M may be used with this specification upon agreement between the manufacturer and the purchaser.

S2. Radiographic Examination

S3. Liquid Penetrant Examination

S8. Marking

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue, A 560/A 560M - 93(1998), that may impact the use of this standard. (Approved May 1, 2005.)

(1) Added UNS numbers for 50 Cr-50 Ni and 60 Cr-40 Ni in Table 1.

(2) Deleted UNS number for 50 Cr-50 Ni-Cb in Table 2.

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