



Standard Specification for Castings, Chromium-Nickel Alloy¹

This standard is issued under the fixed designation A560/A560M; 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 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 non-conformance with the standard.

2. Referenced Documents

2.1 ASTM Standards:²

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 steel 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 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 with this specification and Specification A957/A957M, A957/A957M shall prevail.

4. Ordering Information

4.1 Orders for material under this specification should include the following information in proper sequence:

4.1.1 Quantity;

4.1.2 Specification and grade (50 Cr-50 Ni, R20500; 60 Cr-40 Ni, R20600; 50 Cr-50 Ni-Cb, R20501);

4.1.3 Description of the casting by pattern number or drawing;

4.1.4 Options in the specification:

4.1.4.1 Process,

4.1.4.2 Heat treatment,

4.1.4.3 Tensile properties,

4.1.4.4 Tension tests,

4.1.4.5 Charpy impact tests, and

4.1.4.6 Test specimens or test bars.

4.1.5 Supplementary requirements desired, including standards of acceptance.

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.

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 Nov. 1, 2012. Published November 2012. Originally approved in 1966. Last previous edition approved in 2011 as A560/A560M – 11. DOI: 10.1520/A0560_A0560M-12.

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.

TABLE 1 Chemical Requirements^{A,B}

Element	Composition, %		
	Grade		
	50 Cr-50 Ni (R20500)	60 Cr-40 Ni (R20600)	50 Cr-50 Ni-Cb (R20501)
Carbon	0.10	0.10	0.10
Manganese	0.30	0.30	0.30
Silicon	1.00	1.00	0.50
Sulfur	0.02	0.02	0.02
Phosphorus	0.02	0.02	0.02
Nitrogen	0.30	0.30	0.16
Nitrogen + Carbon	0.20
Iron	1.00	1.00	1.00
Titanium	0.50	0.50	0.50
Aluminum	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 %.

^B All values are maximum, unless a range or minimum is indicated. Where ellipses appear (...) in this table, there is no minimum and analysis for the element need not be determined or reported.

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](#).

8. Test Specimens

8.1 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 repre-

TABLE 2 Room Temperature Tensile and Charpy Requirements^A

	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]	...

^A Where ellipses (...) appear in this table, there is no requirement.

sent the full melting practice. Chemical composition of the test coupons shall conform to the requirements prescribed in [Table 1](#).

8.3 Impact test specimens are to be broken un-notched.

9. Number of Tests and Retests

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

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 $\frac{3}{4}$ 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; investment castings; 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 Specifications [A781/A781M](#) and [A957/A957M](#). Those that are ordinarily considered suitable for use with this specification are given below. Others enumerated in Specifications [A781/A781M](#) and [A957/A957M](#) may be used with this specification upon agreement between the manufacturer and the purchaser.

S2. Radiographic Examination

S8. Marking

S3. Liquid Penetrant Examination



SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue, (A560/A560M – 11), that may impact the use of this standard. (Approved Nov. 1, 2012.)

- (1) Editorially revised 1.2.
- (2) Revised sections/subsections 2, 3, 7.2 (deleted), 8, and 10 and introductory paragraph to Supplementary Requirements to reference investment castings and to delete references to A370.
- (3) Revised Section 4 and Table 1.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the ASTM website (www.astm.org/COPYRIGHT/).