



# Standard Specification for Castings, Nickel-Aluminum Ordered Alloy<sup>1</sup>

This standard is issued under the fixed designation A1002; 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.

## 1. Scope\*

1.1 This specification covers nickel-aluminum ordered alloy castings intended for elevated-temperature applications such as heat-resisting alloy furnace rollers, supports, hangers, and so forth, in environments up to 2300°F (1260°C).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.2.1 The SI gage length for tension test specimens is in brackets and is considered standard.

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A781/A781M 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 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.

## 4. Ordering Information

4.1 The purchaser should specify the alloy grade desired and whether tension or impact 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 by any method unless otherwise agreed upon between the manufacturer and the purchaser. Casting 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 the 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. Mechanical Properties

7.1 Mechanical properties are not required unless specified in the purchase order.

7.2 *Tensile properties*, if required, of the alloy used for the castings shall conform to the requirements prescribed in the purchase order.

7.3 *Impact properties*, if required, of the alloy used for the castings shall conform to the requirements prescribed in the purchase order.

## 8. Test Specimens

8.1 Test specimens, if required, shall be prepared in accordance with Test Methods and Definitions A370. 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 tests 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 2-in. [50-mm] gage length specimen shown in Fig. 4 of Test Methods and Definitions A370.

<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.

Current edition approved Dec. 1, 2015. Published December 2015. Originally approved in 1999. Last previous edition approved in 2010 as A1002 – 10. DOI: 10.1520/A1002-10R15.

<sup>2</sup> 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**

Element	Composition, % by Weight
Carbon, max	0.08
Sulfur, max <sup>A</sup>	0.020
Aluminum	7.3–8.5
Chromium	7.5–8.5
Molybdenum	1.20–1.80
Boron	0.003–0.012
Silicon, max <sup>A</sup>	0.20
Iron, max	1.00
Nickel	Balance

<sup>A</sup> For welding applications, see S18 for restrictions on sulfur and silicon.

8.4 Impact test specimens shall conform to the length and cross-section dimensions shown in Fig. 10 of Test Methods and Definitions **A370**. The impact specimens are to be broken unnotched.

## 9. Number of Tests and Retests

9.1 *Tension Test*—One tension test, if required by the purchase order, shall be made from each heat.

9.2 *Impact Test*—One unnotched Charpy impact test, if required by the purchase order, shall be made from each heat.

## 9.3 Retests:

9.3.1 Retests of a duplicate specimen will be allowed if the results of the mechanical tests for any lot does not conform to the requirements specified in the purchase order.

9.3.2 If the elongation of any tension test specimen is less than specified, 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 casting; elevated temperature; heat-resistant alloy; heat-resisting; nickel aluminide; nickel aluminum

## SUPPLEMENTARY REQUIREMENTS

Supplementary requirements only apply when 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**. Supplementary Requirements S1 and S11 of Specification **A781/A781M** are not appropriate for this specification and shall not be specified. In addition, the following Supplementary Requirement S18, for welding applications, is not listed in Specification **A781/A781M**.

### S18. Welding Applications

S18.1 The sulfur shall be 0.003 % by weight or less and the silicon shall be 0.05 % by weight or less. Detailed information concerning welding is available from Materials Processing,

Metals and Ceramics Div., Oak Ridge National Laboratory,  
P.O. Box 2008, Oak Ridge, TN 37831-6083.

## SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A1002 – 99 (2009)) that may impact the use of this standard. (Approved April 1, 2010.)

(1) Table 1, Deleted Zr requirement, Modified Al and Mo upper limits.

*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 Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/*