



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

This standard is issued under the fixed designation A 1002; 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 heat-resisting and elevated-temperature applications such as heat-resistant alloy structural members, containers, supports, hangers, spacers, and so forth, in environments up to 2300°F (1260°C).

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 this specification.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>2</sup>

A 781/A 781M Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use<sup>2</sup>

### 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 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 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 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 A 370.

8.4 Impact test specimens shall conform to the length and cross-section dimensions 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 by the purchase order, shall be made from each heat.

9.2 *Impact Test*—One unnotched Charpy impact test, if

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.02.

**TABLE 1 Chemical Requirements**

Element	Composition, % by Weight
Carbon, max	0.08
Sulfur, max <sup>A</sup>	0.020
Aluminum	7.3–8.3
Chromium	7.5–8.5
Molybdenum	1.20–1.70
Zirconium	1.6–2.10
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.

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 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 A 781/A 781M. Supplementary Requirements S1 and S11 of Specification A 781/A 781M 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 A 781/A 781M.

**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.

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