



Designation: A 447/A447M – 93 (Reapproved 1998)

Standard Specification for Steel Castings, Chromium-Nickel-Iron Alloy (25-12 Class), for High-Temperature Service¹

This standard is issued under the fixed designation A 447/A447M; 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-base, heat-resisting alloy castings of the 25 % chromium, 12 % nickel class, intended for structural elements, containers, and supports in electric furnaces, petroleum still tube supports, and for similar applications up to 2000°F [1095°C]. The purchaser should inform the manufacturer when the service temperatures are to exceed 1800°F [980°C].

1.2 In the absence of significant proportions of elements other than those prescribed in Section 4, the two types of alloys covered by this specification may in general be distinguished as follows:

1.2.1 *Type I*—Alloys characterized by relatively low limiting creep stress at temperatures between 1500 and 2000°F [815 and 1095°C], and relatively high ductility at ordinary temperatures after aging for short periods at temperatures between 1300 and 1500°F [705 and 815°C].

1.2.2 *Type II*—Alloys having relatively high limiting creep stress but which may develop low ductility at ordinary temperatures when aged for short periods at temperatures between 1350 and 1500°F [730 and 815°C].

1.3 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 781/A781M Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use²

¹ This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.18 on Castings.

Current edition approved Dec. 15, 1993. Published April 1994. Originally published as B 190 – 44 T. Redesignated as A 447 in 1961. Last previous edition A 447/A 447M – 87 (1992).

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

A 800/A800M Practice for Steel Castings, Austenitic Alloy, Estimating Ferrite Content Thereof²
E 8 Test Methods for Tension Testing of Metallic Materials³
E 21 Test Methods for Elevated Temperature Tension Tests of Metallic Materials³

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. Process

4.1 The alloy for the castings shall be made by the electric-furnace process or by any other process approved by the purchaser.

5. Heat Treatment

5.1 Except as otherwise agreed upon between the manufacturer and the purchaser, the manufacturer shall not be required to heat treat the castings.

6. Chemical Composition

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

7. Sampling

7.1 Material for the tests specified in Sections 10, 12, and 13 may be taken from separately cast test blocks of a form such as that shown in Fig. 1, from another type of test block, from the castings, or from coupons attached to the castings, as may be agreed upon between the manufacturer and the purchaser.

7.2 Material for the magnetic permeability test specimen (Section 11) may be taken, prior to heat treatment, from the same coupon as the specimen for the tension test after aging;

³ *Annual Book of ASTM Standards*, Vol 03.01.

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TABLE 1 Chemical Requirements

Element	Composition, %
Ni ^A	10.00–14.00
Cr	23.00–28.00
C	0.20–0.45
N, max	0.20
Mn, max	2.50
Si, max	1.75
P, max	0.05
S, max	0.05
Fe and other elements	as may be agreed upon between the manufacturer and the purchaser

^A Commercial nickel usually carries a small amount of cobalt, and within the usual limits cobalt shall be counted as nickel.

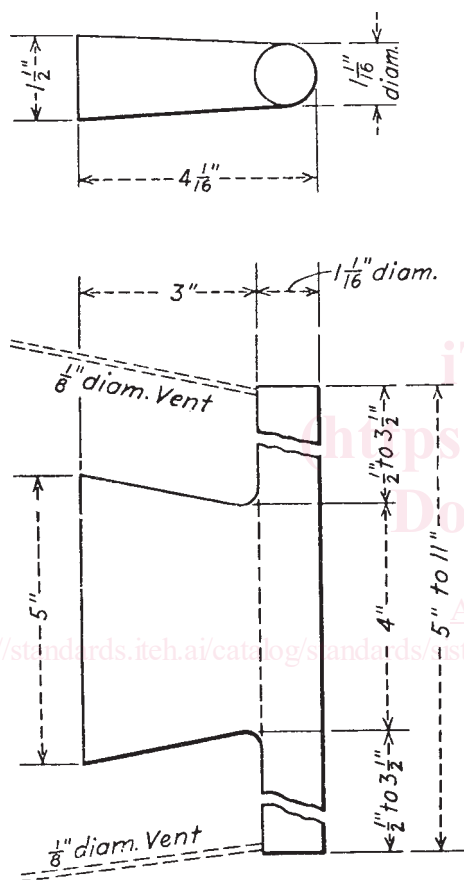


TABLE Continued

Metric Equivalents			
in.	[mm]	in.	[mm]
1/16	[3.2]	3 1/2	[88.9]
1/2	[12.7]	4	[101.6]
1 1/16	[27.0]	4 1/16	[103.2]
1 1/2	[38.1]	5	[127.0]
3	[76.2]	11	[279.4]

NOTE—Pour through head; cover molten head with powdered charcoal, coke dust, etc., immediately after pouring, in order to keep head fluid as long as possible.

FIG. 1 Test Block for Tension Test Specimen

from suitable specimens cast as parts of separately cast test blocks; or, by agreement between the manufacturer and the purchaser, from castings representing the melt.

7.3 In the case of castings for unusual or severe service, the test coupons shall be attached to the castings at convenient locations as may be agreed upon between the manufacturer and the purchaser.

7.4 In all cases, it shall be the manufacturer's duty to provide a sufficient number of samples for the specified tests.

8. Number of Tests

8.1 The purchaser shall specify not more than two tests. The tests shall be selected from the following list, with the restriction that not more than one of the tension tests at high temperature (that is, 8.1.3 or 8.1.4) may be required:

- 8.1.1 Tension test after aging,
- 8.1.2 Magnetic permeability test,
- 8.1.3 Stress-rupture test, and
- 8.1.4 Short-time high-temperature tension test.

9. Retests

9.1 *Mechanical Tests*—If any of the specimens first chosen for any of the mechanical tests agreed upon fail to conform to the specified requirements, an additional specimen from the same melt may be tested. This additional specimen shall conform to the requirements prescribed for the test in question.

9.2 *Magnetic Test*—If the magnetic permeability of the specimen first tested does not conform to the requirement prescribed in 11.1, three additional specimens from the same melt may be tested. At least two of these shall conform to the prescribed requirement.

10. Tensile Properties After Aging

10.1 The tensile properties of the material after aging shall conform to the following requirements:

	Type I	Type II
Tensile strength, min, ksi [MPa]	80 [550]	80 [550]
Elongation in 2 in. [50 mm], min, %	1841 dd/9 m-a447-a4 m-931998	4

10.2 Samples from which the tension specimens are to be taken shall be heated for 24 h at 1400 ± 25°F [760 ± 14°C] and allowed to cool at least down to 400°F [205°C] at rates not exceeding 200°F [110°C]/h. The tension test specimens shall be machined from the heat-treated sample, and shall conform to the dimensions shown in Fig. 1 of Test Methods E 8.

10.3 The tension test shall be made in accordance with Test Methods E 8. The speed of head of the testing machine shall be so adjusted that the rate of separation of the gage marks on the test specimen shall not exceed 0.1 in. [3 mm]/min.

11. Magnetic Permeability

11.1 The magnetic permeability of the material shall conform to the following requirements:

	Magnetic Permeability, max
Type I	1.70
Type II	1.05

NOTE 1—The magnetic permeability test gives a qualitative indication of the ferrite content for alloys falling within the range of chemical composition specified in Section 6, excluding iron and other elements as may be agreed upon. When special alloying elements are specified, the magnetic permeability test is not recommended because its significance