



Designation: A874/A874M – 98 (Reapproved 2022)

# Standard Specification for Ferritic Ductile Iron Castings Suitable for Low-Temperature Service<sup>1</sup>

This standard is issued under the fixed designation A874/A874M; 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 ductile iron castings suitable for service at temperatures of  $-40$  °F [ $-40$  °C] and above.

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 nonconformance with the standard.

1.3 The following precautionary statement pertains only to the test methods portion, Section 11, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

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

A247 Test Method for Evaluating the Microstructure of Graphite in Iron Castings

E8/E8M Test Methods for Tension Testing of Metallic Materials

E30 Test Methods for Chemical Analysis of Steel, Cast Iron,

Open-Hearth Iron, and Wrought Iron (Withdrawn 1995)<sup>3</sup>

E59 Practice for Sampling Steel and Iron for Determination of Chemical Composition (Withdrawn 1996)<sup>3</sup>

E94/E94M Guide for Radiographic Examination Using Industrial Radiographic Film

E165/E165M Practice for Liquid Penetrant Testing for General Industry

E351 Test Methods for Chemical Analysis of Cast Iron—All Types

E562 Test Method for Determining Volume Fraction by Systematic Manual Point Count

E689 Reference Radiographs for Ductile Iron Castings

E709 Guide for Magnetic Particle Testing

## 3. Ordering Information

3.1 Orders for material under this specification shall include the following applicable information:

3.1.1 Drawing, catalog number, or part identification,

3.1.2 Quantity (weight or number of pieces),

3.1.3 ASTM designation and year of issue,

3.1.4 Marking instructions (see Section 15),

3.1.5 Place of inspection (see 13.1),

3.1.6 Limits on residual elements (see 5.2),

3.1.7 Visual and dimensional acceptance standard (see 7.1),

3.1.8 Sampling plan (see Section 9), and

3.1.9 Supplementary requirements.

## 4. Materials and Manufacture

4.1 Castings may be supplied either as cast or heat treated and shall have essentially a ferritic structure that contains no massive carbides.

## 5. Chemical Composition

5.1 The iron shall conform to the requirements for chemical composition shown in Table 1.

5.2 By agreement between the manufacturer and purchaser, analysis may be required and limits established for elements not specified in Table 1.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A04 on Iron Castings and is the direct responsibility of Subcommittee A04.02 on Malleable and Ductile Iron Castings.

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<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.

<sup>3</sup> The last approved version of this historical standard is referenced on www.astm.org.

**TABLE 1 Chemical Composition**

Element	Minimum, %	Maximum, %
Total carbon	3.0	3.7
Carbon equivalent (carbon + 1/3 silicon)	...	4.5
Silicon	1.2	2.3
Phosphorous	...	0.03
Magnesium	...	0.07
Manganese	...	0.25
Copper	...	0.1
Nickel	...	1.0
Chromium	...	0.07

## 6. Mechanical and Microstructural Properties

6.1 *Tensile Properties*—The iron shall conform to the requirements for tensile properties shown in [Table 2](#).

6.2 *Microstructure*—Graphite contained in the microstructure shall be evaluated in accordance with Test Method [A247](#). The percent of each graphite type shall be estimated, and the total of all estimates shall equal 100 %. The total percent of Types 1 and 2 graphite shall be a minimum of 90 %.

## 7. Workmanship, Finish, and Appearance

7.1 The surface of the casting shall be examined visually and shall be free from adhering sand, scale, cracks, and hot tears. Other surface discontinuities shall meet visual and dimensional acceptance standards specified in the order.

7.2 Conditioning of castings is permitted to the extent that the removal of metal does not extend into the envelope of the finished container and does not alter the properties of the metal remaining in the finished container.

## 8. Repair

8.1 Castings shall not be repaired by plugging, welding, brazing, impregnation, or any other means.

## 9. Sampling

9.1 Test coupons will be obtained from the casting. The location in the casting from which the test coupons are obtained and the number obtained from each location shall be agreed upon between the manufacturer and purchaser.

9.2 Metallographic samples shall be obtained from the same location as the mechanical test coupons.

9.3 Nondestructive examination methods for estimating microstructure may be used to supplement the destructive examination sampling plan.

9.4 Sampling for chemical analysis shall be in accordance with Practice [E59](#).

9.4.1 The chemical analysis for total carbon shall be made on either chilled cast pencil-type specimens or thin wafers approximately 1/32 in. [0.8 mm] thick cut from test coupons.

**TABLE 2 Tensile Properties**

Tensile Strength, min, psi [MPa]	Yield Strength, min, psi [MPa]	Elongation in 2 in. [50 mm], min, %
45 000 [300]	30 000 [200]	12 [12]

## 10. Number of Tests and Retests

10.1 The number of tension tests and the number of microstructural examinations shall be agreed upon between the manufacturer and purchaser.

10.2 If any tension test specimen shows obvious defects, it may be discarded and another from the same coupon may be tested.

## 11. Test Methods

11.1 Conduct the tension test in accordance with Test Methods [E8/E8M](#).

11.2 Determine the yield strength using one of the following methods:

11.2.1 The 0.2 % offset method, or

11.2.2 Extension-under-load method where the yield strength may be determined as the stress producing an elongation under load of 0.330 %, that is, 0.0066 in. [0.165 mm] in a gage length of 2 in. [50 mm].

11.3 Determine the percent of each graphite nodule type by manual counting, semi-automatic, or automatic image analysis methods. The manual count method shall prevail when the results of other methods differ. Magnification shall be at 100×.

11.4 Spectrometric methods may be used for chemical analysis. Should a dispute arise concerning chemical composition, use Test Methods [E351](#) and [E30](#) for referee methods.

## 12. Records

12.1 Records of the chemical composition, mechanical properties, and the metallographic examination shall be systematically made and maintained.

## 13. Inspection

13.1 Unless otherwise specified in the contract or purchase order, the manufacturer shall perform all of the tests and inspections required by the specification.

13.2 All tests and inspections shall be made at the place of manufacture or a mutually agreed-upon location.

13.3 The inspector representing the purchaser shall have entry at all times, while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy that the material is being furnished in accordance with these specifications. The inspector representing the purchaser shall not interfere unnecessarily with the operation of the works.

## 14. Certification

14.1 The manufacturer's certification shall be furnished to the purchaser stating the material was manufactured, sampled, tested, and inspected in accordance with this specification (including the year of issue) and was found to meet the requirement(s). In addition, a test report shall be included with the certification giving the results of all tests performed, including chemical analysis.