



Standard Specification for Castings, Investment, Carbon and Low Alloy Steel for General Application, and Cobalt Alloy for High Strength at Elevated Temperatures¹

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1. Scope

1.1 This specification covers carbon and low-alloy steel castings made by the investment casting process.

1.2 Fifteen grades of steel and two cobalt alloy grades are covered (see Appendix).

NOTE 1—An investment casting is one that is produced in a mold, obtained by investing (surrounding) an expendable pattern with a refractory slurry which is allowed to solidify. The expendable pattern may consist of wax, plastic, or other material and is removed by heating prior to filling the mold with liquid metal.

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 370 Test Methods and Definitions for Mechanical Testing of Steel Products²
- A 488/A488M Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel³
- A 919 Terminology Relating to Heat Treatment of Metals³
- E 21 Test Methods for Elevated Temperature Tension Tests of Metallic Materials⁴
- E 30 Test Methods for Chemical Analysis of Steel, Cast Iron, Open-Hearth Iron, and Wrought Iron⁵
- E 94 Guide for Radiographic Testing⁶
- E 125 Reference Photographs for Magnetic Particle Indications on Ferrous Castings⁶
- E 139 Practice for Conducting Creep, Creep-Rupture, and

Stress-Rupture Tests of Metallic Materials⁴

E 165 Test Method for Liquid Penetrant Examination⁶

E 192 Reference Radiographs of Investment Steel Castings for Aerospace Applications⁶

E 350 Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron⁵

E 446 Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness⁶

E 709 Guide for Magnetic Particle Examination⁶

3. Ordering Information

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

- 3.1.1 Description of the casting by part or pattern number or drawing,
- 3.1.2 ASTM designation and year of issue,
- 3.1.3 Grade of steel,
- 3.1.4 Quantity,
- 3.1.5 Options in the specification (4.1, 5.3, 6.1, 9.1, and 10.3), and
- 3.1.6 Supplementary requirements.

4. Heat Treatment

4.1 Castings shall be supplied in the heat-treated condition with the exception of Grades 21 and 31. Heat treatment shall be either annealing, normalizing and tempering, or quenching and tempering to obtain either the specified properties or other properties that might be agreed upon within each grade. In this latter instance, Supplementary Requirement S19 should be used. Grades 21 and 31 shall be supplied in the as-cast condition unless otherwise agreed upon.

4.2 Heat treatment shall be performed after the castings have been allowed to cool below the transformation range.

4.3 Definitions of terms relating to heat treatment shall be in accordance with Terminology A 919.

5. Chemical Composition

5.1 The castings shall conform to the requirements for chemical composition specified in Table 1 and Table 2.

5.2 *Cast or Heat Analysis*—An analysis of each cast or heat shall be made by the manufacturer to determine the percentages of the elements specified in Table 1 and Table 2. The

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² Annual Book of ASTM Standards, Vols 01.02 and 01.03.

³ Annual Book of ASTM Standards, Vol 01.02.

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁵ Annual Book of ASTM Standards, Vol 03.05.

⁶ Annual Book of ASTM Standards, Vol 03.03.