Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 5343A
Superseding AMS 5343
Issued 7-15-63
Revised 11-15-72

STEEL CASTINGS, INVESTMENT, CORROSION RESISTANT
16Cr - 4.0Ni - 3.1Cu
Solution and Precipitation Heat Treated, 150,000 psi (1034 MPa) Tensile Strength

1. SCOPE:

1.1 Form: This specification covers a corrosion-resistant steel in the form of investment castings.

1.2 Application: Primarily for parts requiring good corrosion resistance and strength at temperatures up to 600 F (316 C).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2635 - Radiographic Inspection
AMS 2640 - Magnetic Particle Inspection
AMS 2645 - Fluorescent Penetrant Inspection

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM E8 - Tension Testing of Metallic Materials
ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E353, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	--	0.06
Manganese	--	0.70
Silicon	0.50	1.00
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	15.50	16.70
Nickel	3.60	4.60
Columbium + Tantalum	0.15	0.40
Copper	2.80	3.50
Nitrogen	--	0.05

3.2 Condition: Homogenization, solution, and precipitation heat treated.

3.3 Casting: Castings shall be poured either from remelted metal from a master heat or master heat lot or directly from a master heat. In either case, metal for casting shall be qualified as in 3.4. A master heat is refined metal of a single furnace charge. Gates, sprues, risers, and rejected castings shall be used only in preparation of master heats; they shall not be remelted directly, without refining, for pouring of castings.

3.3.1 Unless prohibited by purchaser, metal from two or more master heats may be blended to form a master heat lot provided that the composition of each master heat to be blended is within the limits of 3.1 and that the total weight of metal in the master heat lot does not exceed 10,000 lb (4540 kg). Ingot and pig may be blended, shot may be blended, but shot shall not be blended with ingot or pig.

3.4 Master Heat Qualification: Each master heat or master heat lot shall be qualified by evaluation of chemical analysis and tensile test specimens conforming to 3.4.1 and 3.4.2, respectively. A master heat may be considered conditionally qualified if vendor's test results show conformance to all applicable requirements of this specification. However, except when purchaser waives confirmatory testing, final qualification shall be based on purchaser's test results. Conditional qualification of a master heat or master heat lot shall not be construed as a guarantee of acceptance of castings poured therefrom.

3.4.1 Chemical Analysis Specimens: Shall be cast from remelted metal from each master heat or master heat lot. Such specimens shall be of any convenient size, shape, and form for vendor's tests; when chemical analysis specimens are required by purchaser, specimens shall be cast to a size, shape, and form agreed upon by purchaser and vendor.

3.4.2 Tensile Test Specimens: Shall be cast from remelted metal from each master heat or master heat lot except that when castings are poured directly from a master heat, the tensile test specimens shall also be poured directly from the master heat. Tensile test specimens shall be of standard proportions in accordance with ASTM E8 with 0.250 in. (6.35 mm) diameter at the reduced parallel gage section. They shall be cast to size or shall be cast oversize and subsequently machined to 0.250 in. (6.35 mm) diameter. Center gating may be used. When requested, representative test specimens shall be supplied to the purchaser for confirmatory evaluation.

3.5 Heat Treatment: Castings and separately-cast tensile test specimens shall be heat treated as follows:

3.5.1 Homogenization Heat Treatment: Heat to 2100 F ± 25 (1148 C ± 14), hold at heat for not less than 90 min., and cool as required to below 70 F (21 C).

3.5.2 Solution Heat Treatment: Heat to 1900 F ± 25 (1037.8 C ± 14), hold at heat for 1 hr per inch (25 mm) of section but not less than 30 min., and cool as required to below 70 F (21 C).

3.5.3 Precipitation Heat Treatment: Heat to a temperature within the range 985 - 1015 F (529.4 - 546.1 C), hold at the selected temperature within ± 10 F (± 5.6 C) for not less than 90 min., and cool in air to room temperature.

3.6 Properties:

3.6.1 Tensile Properties of Separately Cast Test Specimens: Shall be as follows, determined in accordance with ASTM E8:

Tensile Strength, min	150,000 psi (1034 MPa)
Yield Strength at 0.2% Offset, min	130,000 psi (896 MPa)
Elongation in 4D, min	8%
Reduction of Area, min	20%

3.6.2 Properties of Castings:

3.6.2.1 Tensile Properties: Tensile specimens machined from a casting shall conform to the following, determined in accordance with ASTM E8. Size and location of such specimens shall be as agreed upon by purchaser and vendor.

Tensile Strength, min	150,000 psi (1034 MPa)
Yield Strength at 0.2% Offset, min	130,000 psi (896 MPa)
Elongation in 4D, min	4%
Reduction of Area, min	12%

3.6.2.1.1 When properties other than those shown above are required, size and location of test specimens and required properties shall be as shown on the part drawing or as agreed upon by purchaser and vendor.

3.6.2.2 Hardness: Castings should have hardness not lower than 34 HRC or equivalent, determined in accordance with ASTM E18, but castings shall not be rejected on the basis of hardness if the tensile property requirements of 3.6.2.1 are met.

3.7 Quality:

3.7.1 Castings shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts. Castings shall have smooth surfaces and shall be well cleaned. Unless otherwise specified, metallic shot or grit shall not be used for final cleaning.

3.7.2 Castings shall be produced under radiographic control unless otherwise specified. This shall consist of radiographic examination of castings in accordance with AMS 2635 until proper foundry technique, which will produce castings free from harmful internal imperfections, is established for each part number and of production castings as necessary to ensure maintenance of satisfactory quality.

3.7.3 When specified, castings shall be subject either to magnetic particle inspection in accordance with AMS 2640 or to fluorescent penetrant inspection in accordance with AMS 2645.

3.7.4 Radiographic, magnetic particle, fluorescent penetrant, and other quality standards shall be as agreed upon by purchaser and vendor.

3.7.5 Castings shall not be repaired by plugging, welding, or other methods without written permission from purchaser.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of castings shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the castings conform to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

4.3 Sampling: Shall be in accordance with the following, unless otherwise specified:

4.3.1 Two chemical analysis specimens in accordance with 3.4.1 and/or a casting from each master heat or master heat lot.

4.3.2 Two preproduction castings in accordance with 4.4.1 of each part number.

4.3.3 Three tensile test specimens in accordance with 3.4.2 from each master heat or master heat lot, when requested.

4.3.4 One casting shall be selected at random from each master heat or master heat lot.

4.4 Approval:

4.4.1 Sample castings from new or reworked master patterns and the casting procedure shall be approved by purchaser before castings for production use are supplied, unless such approval be waived.

4.4.2 Vendor shall establish separately for tensile test specimens used for master heat qualification and for production of sample castings of each part number the control factors of processing which will produce tensile test specimens meeting master heat qualification requirements and acceptable castings; these shall constitute the approved casting procedures and shall be used for producing subsequent master heat qualification specimens and production castings. If necessary to make any change in control factors of processing which could affect quality or properties of the castings, vendor shall submit for reapproval a statement of the revised operations and, when requested, sample test specimens, castings, or both. No production castings incorporating the revised operations shall be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing test specimens and castings include, but are not limited to, the following:

Type of furnace and its capacity
Size of furnace charge
Furnace atmosphere
Fluxing or deoxidation procedure
Mold refractory formulation
Mold back-up material
Gating practices
Pouring temperature and mold preheat temperature (variations of ± 25 F (± 14 C) from established limits are permissible)
Solidification rate and subsequent cooling procedures
Cleaning operation
Methods of routine inspection

4.4.2.1.1 Any of the above control factors of processing considered proprietary by the vendor may be assigned a code designation. Each variation in such factors shall be assigned a modified code designation.

4.5 Reports:

4.5.1 The vendor of castings shall furnish with each shipment three copies of a report of the results of tests for chemical composition of at least one casting, or of specimens as in 3.4.1 cast in a mold with parts, from each master heat or master heat lot represented, the results of tests of separately cast test specimens from each master heat to determine conformance to the other technical requirements of this specification, and the results of tests of specimens cut from castings to determine conformance of castings to the specified tensile properties and hardness. This report shall include the purchase order number, master heat or master heat lot number (and code symbol if used), material specification number and its revision letter, part number, and quantity from each master heat or master heat lot.