Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5372A
Superseding AMS 5372

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STEEL CASTINGS, SAND, CORROSION RESISTANT
16Cr - 1.9Ni (Type 431 Mod)

1. SCOPE:

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

1.2 Application: Primarily for small parts such as air valve components requiring corrosion resistance and strength up to 800°F (425°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., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2360 - Room Temperature Tensile Properties of Castings
AMS 2635 - Radiographic Inspection
AMS 2645 - Fluorescent Penetrant Inspection
AMS 2804 - Identification, Castings

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

ASTM A370 - Mechanical Testing of Steel Products
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E446 - Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness

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

2.3.1 Federal Standards:

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

2.3.2 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

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	0.12	0.20
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.04
Sulfur	--	0.04
Chromium	14.50	17.00
Nickel	1.50	2.25
Molybdenum	--	0.75
Copper	--	0.75

3.2 Condition: Normalized and tempered.

3.3 Casting: A melt shall be the metal poured from a single furnace charge of 10,000 lb (4540 kg) or less.

3.4 Test Specimens:

3.4.1 Chemical Analysis 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 Coupons: Shall be attached to castings, if practicable, or shall be standard keel blocks conforming to ASTM A370, unless purchaser permits use of cast-to-size specimens. Coupons shall be cast with each melt of metal for castings. Keel blocks shall be cast in molds made of suitable core sand, shall be poured directly after pouring the castings, and shall be kept in the mold until black. Metal for the coupons shall be part of the melt which is used for the castings. Tensile test specimens conforming to ASTM A370 shall be machined from the coupons after heat treatment as in 3.5.

3.5 Heat Treatment: Castings and representative tensile test coupons shall be normalized by heating to 1825°F ± 25 (996°C ± 15), holding at heat for 60 min. per inch (25 mm) of nominal cross-section but not less than 30 min., and cooling in air and tempered by heating to 1125°F ± 15 (607°C ± 8), holding at heat for not less than 2 hr, and cooling in air.

3.6 Properties: Castings and representative tensile test specimens produced in accordance with 3.4.2 shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A370:

3.6.1 As Normalized and Tempered:

3.6.1.1 Hardness: 255 - 311 HB or equivalent.

3.6.2 After Hardening and Tempering: Castings and representative tensile test specimens shall have the following properties after being hardened by heating to 1900°F ± 25 (1038°C ± 15), holding at heat for 30 min. ± 3, and quenching in oil and tempered by heating to 675°F ± 25 (357°C ± 15), holding at heat for 3 hr ± 0.25, and cooling in air:

3.6.2.1 Hardness: Not lower than 38 HRC or equivalent.

3.6.2.2 Tensile Properties: Shall be as follows:

3.6.2.2.1 Specimens Cut from Coupons:

Tensile Strength, min	180,000 psi (1241 MPa)
Yield Strength at 0.2% Offset, min	140,000 psi (965 MPa)
Elongation in 4D, min	8%

3.6.2.2.2 Specimens Cut from Castings: When specified on the drawing or when agreed upon by purchaser and vendor, tensile test specimens conforming to ASTM A370 shall be machined from castings selected at random from each melt. Property requirements for such specimens shall be as shown on the drawing or as agreed upon by purchaser and vendor and may be defined as specified in AMS 2360.

3.7 Quality:

3.7.1 Castings, as received by the purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the castings.

3.7.1.1 Castings shall have smooth surfaces and shall be well cleaned. Metallic shot or grit shall not be used for final cleaning, unless otherwise permitted.

3.7.2 Castings shall be produced under radiographic control, unless otherwise specified. This control 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 to fluorescent penetrant inspection in accordance with AMS 2645.

3.7.4 Radiographic, fluorescent penetrant, and other quality standards shall be as agreed upon by purchaser and vendor. ASTM E446 may be used to define radiographic acceptance standards.

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

3.7.5.1 When permitted in writing by purchaser, defects in castings may be removed and the castings repaired by welding provided the weld repair area has properties comparable to those of the parent metal. Repair welds shall be subjected to the same inspection procedures and acceptance standards required of the casting. Weld repair areas shall be suitably marked to facilitate inspection. The repair welding shall be performed prior to any heat treatment and nondestructive testing specified herein.

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 ensure that the castings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to composition (3.1), hardness (3.6.1.1 and 3.6.2.1), tensile properties of specimens cut from castings when specified (3.6.2.2.2), and quality (3.7) requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests to determine conformance to tensile properties of specimens cut from test coupons after hardening and tempering (3.6.2.2.1) are classified as periodic tests.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with the following:

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

4.3.2 Three tensile test coupons in accordance with 3.4.2 from each melt, when requested.

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

4.3.4 One or more castings from each melt when properties of specimens machined from castings are required. Specific size, locations, and number of specimens machined from castings shall be as specified on the drawing or as agreed upon by purchaser and vendor. When size, location, and number of test specimens are not specified, not less than two tensile test specimens, one from the thickest section and one from the thinnest section, shall be cut from a casting or castings from each melt.

4.4 Approval:

4.4.1 Sample castings from new or reworked 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 for production of sample castings of each part number the control factors of processing which will produce acceptable castings; these shall constitute the approved casting procedure and shall be used for producing production castings. If necessary to make any change in control factors of processing, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample test coupons, castings, or both. Production castings incorporating the revised operations shall not be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing 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
Gating and risering practices
Pouring temperature (variation of ±50°F (±30°C) from established limit is permissible)
Solidification and cooling procedures
Cleaning operations
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: