SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5359E

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Noncurrent	JAN 1995
Reaf. Noncur.	NOV 2000
Cancelled	MAR 2007
Superseding	AMS 5359D

Steel Castings, Sand, Corrosion and Heat Resistant 15Cr - 4.0Ni - 2.3Mo - 0.08N Solution Heat Treated

UNS J92001

RATIONALE

AMS 5359D has been cancelled because survey of aerospace users and producers indicated that this product is not produced to this specification.

CANCELLATION NOTICE

This specification has been declared “CANCELLED” by the Aerospace Materials Division, SAE, as of March 2007. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications indicating that it has been “CANCELLED”.

Cancelled specifications are available from SAE.

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NONCURRENT NOTICE

This specification has been declared “NONCURRENT” by the Aerospace Materials Division, SAE, as of January 1995. It is recommended, therefore, that this specification not be specified for new designs.

“NONCURRENT” refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these as standard materials for future use in new designs. Each of these “NONCURRENT” specifications is available from SAE.

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant steel in the form of sand castings.

1.2 Application:

Primarily for parts requiring corrosion resistance, high strength, and oxidation resistance up to 850° (450°C), and especially where parts require welding during fabrication.

2. APPLICABLE DOCUMENTS:

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

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

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
AMS 2694	Repair Welding of Aerospace Castings
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 U.S. Government Publications:

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

2.3.1 Federal 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 or by spectrographic or other analytical methods approved by purchaser:

	min	max
Carbon	0.08	0.15
Manganese	0.40	1.10
Silicon	--	0.75
Phosphorus	--	0.04
Sulfur	--	0.03
Chromium	14.50	15.50
Nickel	3.50	4.50
Molybdenum	2.00	2.60
Nitrogen	0.05	0.11
Carbon + Nitrogen	0.15	0.25

3.2 Condition:

Solution heat treated except as specified in 3.5.2.

3.3 Casting:

A melt shall be the metal poured from a single furnace charge of 15,000 lb (6800 kg) or less. A lot shall be all castings of the same part number poured from a single melt in not more than eight consecutive hours and heat treated together as a batch.

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 Specimens: Shall be attached to the castings, if practicable, or shall be standard keel blocks conforming to ASTM A370, unless purchaser permits use of cast-to-size specimens. Specimens shall be cast with each melt of metal for castings and, when requested, shall be supplied with the 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 specimens shall be part of the melt which is used for the castings.

3.5 Heat Treatment:

All castings and separately-cast tensile specimens shall be heat treated as follows:

3.5.1 Solution Heat Treatment: Heat to 2000°F ± 50 (1095°C ± 30), hold at heat for not less than 1 hr per inch (25 mm) of maximum section thickness and cool rapidly in air for castings with all cross-sections 1 in. (25 mm) and under in nominal thickness and in water or oil for castings with any cross-section greater than 1 in. (25 mm).

3.5.2 Equalized and Overtempered: When specified by purchaser, castings, after heat treatment as in 3.5.1, shall be heated to 1400°F ± 50 (760°C ± 30), held at heat for not less than 3 hr, cooled in air to room temperature or below, reheated to 1050°F ± 25 (565°C ± 15), held at heat for not less than 3 hr, and cooled in air.

3.6 Properties:

Castings and separately-cast tensile specimens shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A370:

3.6.1 As Solution Heat Treated or As Solution Treated, Equalized, and Over Tempered:

3.6.1.1 Hardness: Castings shall have hardness not higher than 39 HRC, or equivalent.

3.6.2 After Austenite Conditioning, Sub-Zero Cooling, and Tempering: Tensile specimens and specimens cut from castings shall conform to the requirements of 3.6.2.1 and 3.6.2.2 after being austenite conditioned by heating to 1725° - 1850°F (940° - 1010°C), holding at heat for not less than 1 hr per inch (25 mm) of cross-section, and quenching in water or cooling as rapidly as possible to room temperature, sub-zero cooled by cooling to -100°F (-75°C) or colder, holding at that temperature for not less than 3 hr, and warming in air to room temperature, and tempered by heating to 1000°F ± 25 (540°C ± 15), holding at heat for not less than 3 hr, and cooling in air:

3.6.2.1 Tensile Properties:

Tensile Strength, min	165,000 psi (1140 MPa)
Yield Strength at 0.2% Offset, min	140,000 psi (965 MPa)
Elongation in 4D, min	8%

3.6.2.2 Hardness: Should not be lower than 37 HRC, or equivalent, but castings shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.7 Quality:

3.7.1 Castings, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from 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.

3.7.2 Castings shall be produced under radiographic control. 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 subjected to magnetic particle inspection in accordance with AMS 2640, to fluorescent penetrant inspection in accordance with AMS 2645, or to both.

3.7.4 Radiographic, magnetic particle, 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 in accordance with AMS 2694.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of castings shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure 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 tests and as preproduction tests and shall be performed prior to or on the first-article shipment of a casting to a purchaser, on each melt or lot as applicable, when a change in material, processing, or both requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1 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 from each melt or a casting from each lot.

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

4.3.3 Three tensile specimens in accordance with 3.4.2 from each melt, except when purchaser requires tensile properties of specimens cut from castings.

4.3.4 One or more castings from each lot when properties of specimens machined from castings are required. Sizes, location, 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 specimens are not specified, not less than two tensile specimens, one from the thickest section and one from the thinnest section, shall be cut from a casting or castings from each lot.

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 by purchaser.

4.4.2 Vendor shall establish for production of sample castings of each part number parameters for the process control factors 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 parameters for the process control factors, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, test specimens, sample castings, or both. Production castings incorporating the revised operations shall not be shipped prior to receipt of reapproval.