SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS5348	REV. B

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Superseding AMS5348A

Steel Castings, Tubular, Centrifugal, Corrosion Resistant 15Cr - 4.6Ni - 0.22 (Cb+Ta) - 2.8Cu Solution Heat Treated

RATIONALE

AMS5348B has been reaffirmed to comply with the SAE five-year review policy.

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 upon request.

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http://www.sae.org/technical/standards/AMS5348B

1. SCOPE:

1.1 Form:

This specification covers a corrosion-resistant steel in the form of tubular centrifugal castings.

1.2 Application:

Primarily for parts requiring good corrosion resistance and strength up to 600°F (315°C).

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Materials 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 2633	Ultrasonic Inspection, Centrifugally-Cast, Corrosion-Resistant Steel Tubular Cylinders
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:

Federal Test Methods Standard No. 151 Metals; Test Methods

2.3.2 Military Specifications:

MIL-C-6021 Castings, Classification and Inspection of
MIL-H-6875 Heat Treatment of Steel, Process for

2.3.3 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 analytical methods approved by purchaser:

	min		max
Carbon	- -		0.05
Manganese	- -		0.60
Silicon	0.50	-	1.00
Phosphorus	- -		0.025
Sulfur	- -		0.025
Chromium	14.00	-	15.50
Nickel	4.20	-	5.00
Columbium + Tantalum	0.15	-	0.30
Copper	2.50	-	3.20
Aluminum	- -		0.05
Tin	- -		0.02
Nitrogen	- -		0.05

3.2 Condition:

Solution heat treated. Castings may be given two solution heat treatments, and shall be so treated when specified by purchaser.

3.3 Casting:

A melt shall be the metal poured from a single furnace charge into rotating molds.

3.4 Test Specimens:

3.4.1 Chemical Analysis Specimens: Shall be of any convenient size, shape, and form from 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 machined from castings, unless purchaser permits use of standard keel blocks or cast-to-size specimens conforming to ASTM A370. Specimens shall be cast with each melt of metal and, when requested, shall be supplied with the castings. Standard keel blocks and cast-to-size specimens shall be cast in molds made of suitable core sand, shall be poured from the same ladle as the castings, and shall be kept in the mold until black.

3.5 Heat Treatment:

Castings, and representative tensile specimens shall be solution heat treated by heating to 1900°F ± 25 (1040°C ± 15), holding at heat for 1 hr per inch (25 mm) of section thickness but not less than 30 min., and cooling as required to below 90°F (30°C). Furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6875.

3.6 Properties:

Castings and representative tensile 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 Solution Heat Treated:

3.6.1.1 Hardness: Casting shall have hardness not higher than 363 HB or equivalent.

3.6.2 After Precipitation Heat Treatment: Castings and tensile specimens shall have the following properties after being precipitation heat treated by heating to 925°F ± 10 (495°C ± 5), holding at heat for 90 min. ± 15, and cooling in air:

3.6.2.1 Tensile Properties: Shall be as follows:

Tensile Strength, min	180,000 psi (1240 MPa)
Yield Strength at 0.2% Offset, min	150,000 psi (1035 MPa)
Elongation in 4D, min	6%
Reduction of Area, min	15%

3.6.2.2 Hardness of Castings: Should be 40 - 45 HRC or equivalent but the 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, 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, unless otherwise permitted by purchaser.

3.7.2 Castings, except those classified as Class II B (See 4.3.5.2), shall be ultrasonically tested in accordance with AMS 2633 and shall meet the requirements of ultrasonic discontinuity Grade A for longitudinal and shear modes.

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 radiographic inspection in accordance with AMS 2635, or combination thereof.

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 or 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; a lot shall be all castings of specified design, produced from a single melt, solution heat treated together as a batch, and presented for vendor's inspection at one time:

4.3.1 One chemical analysis specimens in accordance with 3.4.1 or each melt or a casting from each lot.

4.3.2 Two tensile specimens in accordance with 3.4.2 from each lot.

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

4.3.4 Each casting for hardness testing as in 3.6.1.1.

4.3.5 Castings for ultrasonic inspection in accordance with the requirements of Table I, 4.3.5.1, and 4.3.5.2 for the specified class established in accordance with MIL-C-6021.

TABLE I

Class IB		Class IIA	
Lot Size	Sample Size	Lot Size	Sample Size
2 - 5	All	2 - 4	All
6 - 8	5	5 - 6	4
9 - 11	6	7 - 11	5
12 - 15	7	12 - 17	6
16 - 20	8	18 - 27	7
21 - 26	9	28 - 48	8
27 - 36	10	49 and over	9
37 - 51	11		
52 - 82	12		
83 - 162	13		
163 - 971	14		
972 and over	15		
Acceptance No. is 0		Acceptance No. is 0	

4.3.5.1 For Class IA: Each casting.

4.3.5.2 For Class IIB: None required.

4.4 Approval:

4.4.1 Sample castings 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 separately for production of tensile specimens and sample castings of each part number the process control factors which will produce tensile specimens meeting test requirements and acceptable castings; these shall constitute the approved casting procedures and shall be used for producing subsequent tensile specimens and production castings. If necessary to make any change in 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.

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

Type of furnace
Furnace atmosphere
Fluxing or deoxidation procedure
Mold refractory formulation
Mold set up
Mold rotational speed
Mold preheating and metal pouring temperatures (variation of ±50°F (±30°C) from established limits is permissible)
Pouring, solidification, and cooling procedures
Cleaning operations
Methods of inspection

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

4.5 Reports:

4.5.1 The vendor of castings shall furnish with each shipment a report showing 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 melt represented, and the results of tests on each lot to determine conformance to the other technical requirements of this specification. This report shall include the purchase order number, melt number, AMS 5348B, part number, and quantity.