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

AEROSPACE MATERIAL SPECIFICATION

AMS 5348

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Revised

STEEL CASTINGS, TUBULAR, CENTRIFUGAL, CORROSION RESISTANT
15Cr - 4.6Ni - 0.22(Cb+Ta) - 2.8Cu
Solution Heat Treated

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 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 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 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

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 Specifications:

MIL-C-6021 - Castings, Classification and Inspection of

Printed in U.S.A.

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 approved analytical methods:

	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
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 the 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 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 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 directly after pouring the castings, and shall be kept in the mold until black.

3.5 Heat Treatment: Castings and representative tensile test specimens shall be solution heat treated by heating to 1900°F ± 25 (1038° C ± 15), holding at heat for 1 hr per inch (25 mm) of section but not less than 30 min., and cooling as required to below 90°F (32°C).

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 Solution Heat Treated:

3.6.1.1 Hardness: Castings shall have hardness not higher than 33 HRC or equivalent.

3.6.2 After Precipitation Heat Treatment: Castings and test specimens shall have the following properties after being precipitation heat treated by heating to 925°F ± 10 (496°C ± 6), holding at heat for 90 min. ± 15, and cooling in air:

3.6.2.1 Hardness: Shall be 40 - 47 HRC or equivalent.

3 6.2.2 Tensile Properties: Shall be as follows:

Tensile Strength, min	180,000 psi (1241 MPa)
Yield Strength at 0.2% Offset, min	150,000 psi (1034 MPa)
Elongation in 2 in. (50.8 mm) or 4D, min	6%
Reduction of Area, min	15%

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 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, and/or to radiographic inspection in accordance with AMS 2635.

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 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. In-process heat treatment to facilitate welding is permissible. Repair welds shall be subjected to the same inspection procedures and acceptance standards required of the castings. Weld repair areas shall be suitably marked to facilitate inspection. Final heat treatment and nondestructive testing specified herein shall be performed after completion of repair welding.

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

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 a specific design, produced from a single melt, and submitted for vendor's inspection at one time:

4.3.1 One chemical analysis specimen in accordance with 3.4.1 from each lot.

4.3.2 Two tensile test specimens in accordance with 3.4.2 from each lot, heat treated in accordance with 3.5 and 3.6.2.

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

4.3.4 Each casting, for hardness testing.

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 or equivalent.

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.

4.4.2 Vendor shall establish separately for production of tensile test specimens and sample castings of each part number the control factors of processing which will produce tensile test specimens meeting test requirements and acceptable castings; these shall constitute the approved casting procedures and shall be used for producing subsequent tensile test specimens and 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 specimens, castings, or both. Production castings incorporating the revised operations shall not be shipped prior to receipt of reapproval.