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

AEROSPACE MATERIAL SPECIFICATION

AMS5369B
Superseding AMS 5369A
Issued 3-1-48
Revised 1-15-77

STEEL CASTINGS, SAND, CORROSION AND HEAT RESISTANT
19.5Cr - 9.5Ni - 1.4Mo - 1.4W - 0.50(Cb + Ta) - 0.32Ti

1. SCOPE:

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

1.2 Application: Parts and assemblies, such as nozzle diaphragm assemblies, requiring high strength up to 1350° F (730° C), and oxidation resistance up to 1600° F (870° 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 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 A262 - Detecting Susceptibility to Intergranular Attack in Stainless Steels
ASTM E10 - Brinell Hardness of Metallic Materials
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 Ø 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	0.28	0.35
Manganese	0.75	1.50
Silicon	--	1.00
Phosphorus	--	0.04
Sulfur	--	0.04
Chromium	18.00	21.00
Nickel	8.00	11.00
Molybdenum	1.00	1.75
Tungsten	1.00	1.75
Columbium + Tantalum	0.30	0.70
Titanium	0.15	0.50
Copper	--	0.50

3.2 Condition: Solution and precipitation heat treated free from continuous carbide network.

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

3.4 Test Specimens: Chemical analysis specimens shall be of any convenient size, shape, and form for Ø 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.

3.5 Heat Treatment: Castings shall be solution heat treated by heating to 2000° F ± 50 (1093° C ± 30), Ø holding at heat for not less than 30 min., and cooling in air and precipitation heat treated by heating to 1600° F ± 25 (871° C ± 15), holding at heat for not less than 8 hr, and cooling in air.

3.6 Properties: Castings shall conform to the following requirements:

3.6.1 Hardness: Castings shall have hardness not higher than 229 HB or equivalent, determined in accordance with ASTM E10.

3.6.2 Embrittlement: Castings, or specimens cut from castings, after sensitizing treatment shall pass the copper/copper sulfate/sulfuric acid test performed in accordance with ASTM A262, Practice E, without evidence of intercrystalline surface attack when examined microscopically.

3.7 Quality:

3.7.1 Castings, as received by the purchaser, shall be uniform in quality and condition, sound, and free Ø 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 Ø 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 Ø AMS 2645.

3.7.4 Radiographic, fluorescent penetrant, and other quality standards shall be as agreed upon by Ø 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 Ø 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 Ø parent metal. 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. 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 Ø 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 speci- Ø fication 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 Ø castings shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

Ø 4.3 Sampling: Shall be in accordance with the following:

Ø 4.3.1 Two chemical analysis specimens in accordance with 3.4 and/or a casting from each melt.

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

4.4 Approval:

4.4.1 Sample castings from new or reworked patterns or molds and the casting procedure shall be approved Ø 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 Ø 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 castings. 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
Ø Gating and risering practices
Pouring temperature (variation of ± 50°F (± 30°C) from the established limit is permissible)
Solidification and cooling procedures
Cleaning operations
Methods of routine inspection