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AEROSPACE MATERIAL SPECIFICATION

AMS 5343B
Superseding AMS 5343A

Issued 7-15-63
Revised 1-1-85

STEEL CASTINGS, INVESTMENT, CORROSION RESISTANT
16Cr - 4.0Ni - 0.28 (Cb+Ta) - 3.1Cu
Homogenization, Solution, and Precipitation Heat Treated
150,000 psi (1035 MPa) Tensile Strength UNS J92200

1. SCOPE:

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

1.2 Application: Primarily for parts requiring good corrosion resistance and strength up to 600°F (315°C). Certain processing procedures and service conditions may cause these castings to become subject to stress- corrosion cracking. ARP 1110 recommends practices to minimize such conditions on wrought products.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications and Aerospace Recommended Practices 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

2.1.2 Aerospace Recommended Practices:

ARP 1110 - Minimizing Stress Corrosion Cracking in Heat Treatable Wrought Low Alloy and Martensitic Corrosion Resistant Steels

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 E192 - Reference Radiographs of Investment Steel Castings for Aerospace Applications
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

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

2.3.1 Military Specifications:

MIL-H-6875 - Heat Treatment of Steels, Process for

2.3.2 Federal Standards:

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

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, ø 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	--	0.06
Manganese	--	0.70
Silicon	0.50	1.00
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	15.50	16.70
Nickel	3.60	4.60
Columbium + Tantalum	0.15	0.40
Copper	2.80	3.50
Aluminum	--	0.05
Tin	--	0.02
Nitrogen	--	0.05

3.2 Condition: Homogenization, solution, and precipitation heat treated.

3.3 Casting: Castings shall be poured from remelted metal from a master heat or directly from a master heat. In either case, metal for casting shall be qualified as in 3.4.

3.3.1 A master heat is refined metal of a single furnace charge or is metal
Ø blended as in 3.3.2. Gates, sprues, risers, and rejected castings shall be used only in preparation of master heats; they shall not be remelted directly, without refining, for pouring castings.

3.3.2 Unless prohibited by purchaser, metal from two or more master heats may be blended provided that the composition of each master heat to be blended is
Ø within the limits of 3.1 and that the total weight of metal blended does not exceed 15,000 lb (6800 kg). Ingot and pig may be blended together, shot may be blended, but shot shall not be blended with ingot or pig. When two or master heats are blended, the resultant blend shall be considered a master heat.

3.4 Master Heat Qualification: Each master heat shall be qualified by evaluation of chemical analysis and tensile specimens conforming to 3.4.1 and 3.4.2, respectively. A master heat may be considered conditionally qualified if vendor's test results show conformance to all applicable requirements of this specification. However, except when purchaser waives confirmatory testing, final qualification shall be based on purchaser's test results. Conditional qualification of a master heat or master heat lot shall not be construed as a guarantee of acceptance of castings poured therefrom.

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 cast from remelted metal from each master heat except when castings are poured directly from a master heat, in which case the specimens shall also be poured directly from the master heat. Specimens shall be of standard proportions in accordance with ASTM A370 with 0.250 in. (6.25 mm) diameter at the reduced parallel gage section. They shall be cast to size or shall be cast oversize and subsequently machined to 0.250 in. (6.25 mm) diameter. Center gating may be used.

3.4.2.1 When permitted by purchaser, integrally-cast specimens from
Ø preproduction castings may be used for qualification of the master heat. Specimen size shall be as in 3.4.2.

3.5 Heat Treatment: Castings and representative tensile specimens shall be heat treated as follows; furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6875:

3.5.1 Homogenization Heat Treatment: Heat to 2100°F ± 25 (1150°C ± 15), hold at heat for not less than 90 min., and cool as required to below 70°F (20°C).

3.5.2 Solution Heat Treatment: Heat to 1900°F ± 25 (1040°C ± 15), hold at heat for 60 min. per inch (25 mm) of section thickness but not less than 30 min., and cool as required to below 70°F (20°C).

3.5.3 Precipitation Heat Treatment: Heat to a temperature within the range 985° - 1015°F (530° - 545°C), hold at the selected temperature within ±10°F (±5°C) for not less than 90 min., and cool in air to room temperature.

3.6 Properties: Castings and representative tensile specimens shall conform to
Ø the following requirements; tensile and hardness testing shall be performed in accordance with ASTM A370. Conformance to the requirements of 3.6.1 shall be used as the basis for acceptance of castings except when purchaser specifies that the requirements of 3.6.2.1 apply.

3.6.1 Castings:

3.6.1.1 Tensile Properties: Tensile specimens as in 4.3.4 machined from a casting shall conform to the following requirements. Size, location, and number of such specimens shall be as agreed upon by purchaser and vendor.

Tensile Strength, min	150,000 psi (1035 MPa)
Yield Strength at 0.2% Offset, min	130,000 psi (895 MPa)
Elongation in 4D, min	4%
Reduction of Area, min	12%

3.6.1.1.1 When tensile properties other than those shown in 3.6.1.1 are
Ø required, size, location, and number of specimens and required properties shall be as shown on the part drawing or as agreed upon by purchaser and vendor and may be defined as specified in AMS 2360.

3.6.1.2 Hardness: Should be not lower than 34 HRC, or equivalent, but castings
Ø shall not be rejected on the basis of hardness if the tensile property requirements of 3.6.1.1 are met.

3.6.2 Separately- and Integrally-Cast Specimens: Shall conform to the following
Ø requirements:

3.6.2.1 Tensile Properties:

Tensile Strength, min	150,000 psi (1035 MPa)
Yield Strength at 0.2% Offset, min	130,000 psi (895 MPa)
Elongation in 4D, min	8%
Reduction of Area, min	20%

3.7 Quality:

3.7.1 Castings, as received by purchaser, shall be uniform in quality and
Ø 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 by purchaser.

3.7.2 Castings shall be produced under radiographic control. This 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 Ø 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 Ø standards shall be as agreed upon by purchaser and vendor. ASTM E192 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:

4.2.1 Acceptance Tests: Except as specified in 4.2.1.1, tests to determine Ø conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed to represent each master heat or lot as applicable.

4.2.1.1 Tensile properties of separately-cast specimens shall be determined only when specified by purchaser or when specimens cut from castings are not Ø feasible. Tensile properties of separately-cast specimens need not be determined when tensile properties of specimens cut from castings are determined.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests Ø and shall be performed prior to or on the first-article shipment of a casting to a purchaser, 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.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when Ø 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 Ø castings of the same part number poured from a single master heat, homogenization, solution, and precipitation heat treated as a batch and presented for vendor's inspection at one time.

4.3.1 Two chemical analysis specimens in accordance with 3.4.1 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 lot except when properties of specimens machined from castings are determined.

4.3.4 One or more castings from each lot except when tensile properties of specimens machined from castings are not required.

4.4 Approval:

4.4.1 Sample castings from new or reworked master 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 separately for tensile specimens used for master heat qualification and for production of sample castings of each part number parameters for the process control factors which will produce tensile test specimens meeting master heat qualification requirements and acceptable castings; these shall constitute the approved casting procedures and shall be used for producing subsequent master heat qualification specimens and 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.