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

AEROSPACE MATERIAL SPECIFICATION

AMS 5368A
Superseding AMS 5368
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UNS S35500

STEEL CASTINGS, INVESTMENT, CORROSION RESISTANT
15Cr - 4.0Ni - 2.3Mo - 0.09N
Solution Heat Treated

1. SCOPE:

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

1.2 Application: Primarily for small structural parts requiring good corrosion resistance at temperatures up to 850°F (454°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 2360 - Room Temperature Tensile Properties of Castings
AMS 2635 - Radiographic Inspection
AMS 2640 - Magnetic Particle Inspection
AMS 2645 - Fluorescent Penetrant Inspection

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 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	0.08	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	0.13
Carbon + Nitrogen	0.15	0.25

3.2 Condition: Solution heat treated.

3.3 Casting: Castings shall be poured either from remelted metal from a master heat or directly Ø from a master heat. In either case, metal for casting shall be qualified as in 3.4. A master heat is refined metal of a single furnace charge or metal blended as in 3.3.1. 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 of castings.

3.3.1 Unless prohibited by purchaser, metal from two or more master heats may be blended, Ø provided that the composition of each master heat to be blended is within the limits of 3.1 and that the total weight of metal in the blend does not exceed 10,000 lb (4540 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 more 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 Ø and tensile test 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 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 Ø 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 cast from remelted metal from each master heat except when Ø castings are poured directly from a master heat, in which case the tensile test 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. (6.35 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. (6.35 mm) diameter. Center gating may be used.

3.5 Heat Treatment: Castings and separately-cast tensile test specimens shall be solution heat ø treated by heating to a temperature within the range 1875° - 1925°F (1023.9° - 1051.7°C), holding at the selected temperature within ±25°F (±14°C) for not less than 1 hr per inch (25 mm) of section thickness, and cooling rapidly in air for castings with all sections 1 in. (25 mm) or less in thickness and in water or oil for castings with any section greater than 1 in. (25 mm) in thickness.

3.6 Properties: Castings and representative test specimens shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A370:

3.6.1 Castings As Solution Heat Treated:

3.6.1.1 Hardness: Not higher than 39 HRC or equivalent.

3.6.2 After Austenite Conditioning, Sub-Zero Cooling, and Tempering: Specimens produced in ø accordance with 3.4.2 and castings, solution heat treated as in 3.5, shall conform to the requirements of 3.6.2.1 and 3.6.2.2 after being austenite conditioned by heating to a temperature within the range 1750° - 1825°F (954.4° - 996.1°C), holding at the selected temperature within ±25°F (±14°C) for not less than 1 hr per inch (25 mm) of cross-section thickness, and quenching in water or otherwise cooling as rapidly as possible to room temperature, cooling to -100°F (-73.3°C) or lower, holding at this temperature for not less than 3 hr, warming in air to room temperature, and tempered by heating to 850°F ± 25 (454.4°C ± 14), holding at heat for not less than 3 hr, and cooling in air.

3.6.2.1 Separately-Cast Test Specimens:

3.6.2.1.1 Tensile Properties:

Tensile Strength, min	200,000 psi	(1379 MPa)
Yield Strength at 0.2% Offset, min	150,000 psi	(1034 MPa)
Elongation in 1 in. (25.4 mm) or 4D, min	8%	

3.6.2.1.2 Hardness: Not lower than 40 HRC or equivalent.

3.6.2.2 Castings:

ø 3.6.2.2.1 Hardness: Not lower than 40 HRC or equivalent.

3.6.2.2.2 Tensile Properties: When specified on the drawing or when agreed upon by purchaser ø and vendor, tensile test specimens conforming to ASTM A370 shall be machined from castings selected at random from each master heat. Size, number, and location of such specimens and required properties shall be as shown on the drawing or as agreed upon by purchaser and vendor. Property requirements may be defined as specified in AMS 2360.

3.7 Quality:

3.7.1 Castings shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts. 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 Ø 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 subject to magnetic particle inspection in accordance with AMS 2640 and/or to fluorescent penetrant inspection in accordance with AMS 2645.

3.7.4 Radiographic, magnetic particle, fluorescent penetrant, and other quality standards shall be Ø as agreed upon by purchaser and vendor.

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 Ø repaired by welding provided the weld repair area has properties comparable to those of the parent metal. Repair welds shall be subjected to the same inspection procedures and acceptance standards required of the casting and the weld repair area shall be suitably marked to facilitate inspection. The 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 Ø 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 Ø specification are classified as acceptance or routine control rests.

4.2.1 For direct U.S. Military procurement, qualification test material and supporting test data Ø shall be submitted to the cognizant qualification agency as directed by the request for procurement, the procuring activity, or the contracting officer.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Two chemical analysis specimens in accordance with 3.4.1 and/or a casting from each Ø master heat.

4.3.2 Three tensile test specimens in accordance with 3.4.2 from each master heat, when Ø requested.

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

4.3.4 One casting from each master heat when properties of specimens machined from castings are Ø 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.