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

AEROSPACE MATERIAL SPECIFICATION

AMS 5383A
Superseding AMS 5383
Issued 9-30-66
Revised 1-15-77

UNS N07718

ALLOY CASTINGS, INVESTMENT, CORROSION AND HEAT RESISTANT
52.5Ni - 19Cr - 3.0Mo - 5.1(Cb + Ta) - 0.90Ti - 0.60Al - 18Fe
Vacuum Melted

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant nickel alloy in the form of investment castings.

1.2 Application: Primarily for structural parts requiring strength to 1300° F (705° C) and oxidation resistance to 1800° F (980° 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 2362 - Stress-Rupture Properties of Castings
AMS 2635 - Radiographic 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 E8 - Tension Testing of Metallic Materials
ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E192 - Reference Radiographs of Investment Steel Castings for Aerospace Applications
ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt-Base 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 methods in accordance with ASTM E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	--	0.10
Manganese	--	0.35
Silicon	--	0.35
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	17.00	21.00
Nickel	50.00	55.00
Molybdenum	2.80	3.30
Columbium + Tantalum	4.75	5.50
Titanium	0.65	1.15
Aluminum	0.40	0.80
Titanium + Aluminum	--	1.75
Cobalt	--	1.00
Boron	--	0.006
Copper	--	0.30
Iron	remainder	

3.2 Condition: Homogenization and solution heat treated.

3.3 Casting:

3.3.1 The metal for castings shall be melted and poured under vacuum without loss of vacuum between melting and pouring. When permitted by purchaser, protective atmosphere may be used in lieu of vacuum for pouring of castings.

3.3.2 Castings shall be poured either 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.

3.3.2.1 A master heat is refined metal of a single furnace charge or metal blended as in 3.3.2.2 and melted and cast into ingot or pig under vacuum. 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.

3.3.2.2 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 within the limits of 3.1 and that the total weight of metal blended does not exceed 10,000 lb (4540 kg). 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 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 tests.

Ø 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 castings are poured directly from a master heat, in which case the specimens shall also be poured

Ø directly from the master heat. Specimens shall be of standard proportions in accordance with ASTM E8 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 representative tensile test specimens shall be heat treated as follows:

3.5.1 Homogenization Heat Treatment: Heat in a suitable protective atmosphere to 2000°F ± 25 (1093°C ± 15), hold at heat for 1 - 2 hr, and cool as required to below 90°F (32°C).

3.5.2 Solution Heat Treatment: Heat in a suitable protective atmosphere within the range 1750° - 1800° F (954° - 982° C), hold at the selected temperature within ±25° F (± 15° C) for not less than 1 hr, and cool at a rate equivalent to air cool or faster.

3.6 Properties: Castings and representative tensile test specimens produced in accordance with 3.4.2 shall conform to the following requirements:

3.6.1 As Solution Heat Treated:

3.6.1.1 Hardness: Shall be not higher than 25 HRC or equivalent, determined in accordance with

Ø ASTM E18.

3.6.2 After Precipitation Heat Treatment: Tensile test specimens and castings, heat treated as in 3.5, shall have the following properties after being precipitation heat treated by heating to 1325° F ± 15 (718° C ± 8), holding at heat for 8 hr ± 0.5, furnace cooling to 1150° F ± 15 (621° C ± 8), holding at 1150° F ± 15 (621° C ± 8) for a total precipitation time of 18 hr, and cooling at a rate equivalent to an air cool or faster:

3.6.2.1 Separately-Cast Test Specimens:

3.6.2.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:

	Tensile Strength, min	125,000 psi (862 MPa)
Ø	Yield Strength at 0.2% Offset, min	110,000 psi (758 MPa)
	Elongation in 1 in. (25.4 mm) or 4D, min	5%
	Reduction of Area, min	10%

3.6.2.1.2 Stress-Rupture Properties at 1300° F (704° C): Shall be as follows, determined in accordance

Ø with ASTM E139:

3.6.2.1.2.1 Test specimens, maintained at 1300° F ± 3 (704° C ± 2) while a load sufficient to produce an initial axial stress of 65,000 psi (448 MPa) is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 3% in 4D.

3.6.2.1.2.2 The test of 3.6.2.1.2.1 may be conducted using a load higher than required to produce an initial axial stress of 65,000 psi (448 MPa) but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.6.2.1.2.1.

3.6.2.1.2.3 When permitted by purchaser, the test of 3.6.2.1.2.1 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 65,000 psi Ø (448 MPa) shall be used to rupture or for 23 hr, whichever occurs first. After the 23 hr and at intervals of 8 - 16 hr, preferably 8 - 10 hr, thereafter, the stress shall be increased in increments of 5,000 psi (34.5 MPa). Time to rupture and elongation requirements shall be as specified in 3.6.2.1.2.1.

3.6.2.2 Castings:

Ø 3.6.2.2.1 Hardness: Shall be 34 - 44 HRC or equivalent, determined in accordance with ASTM E18.

3.6.2.2.2 Tensile and Stress-Rupture Properties: When specified on the drawing or when agreed upon by purchaser and vendor, tensile test specimens conforming to ASTM E8 shall be machined from Ø castings selected at random from each master heat. Property requirements for such specimens shall be as shown on the drawing or as agreed upon by purchaser and vendor and may be defined as specified in AMS 2360 and/or AMS 2362.

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 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 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 and acceptance standards required of the casting. 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.