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400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5597B
Superseding AMS 5597A
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ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT UNS N07718
52.5Ni - 19Cr - 3.0Mo - 5.1 (Cb + Ta) - 0.90Ti - 0.50Al - 18Fe
Consumable Electrode or Vacuum Induction Melted
1950° F (1065° C) Solution Heat Treated

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant nickel alloy in the form of sheet, strip, and plate.

1.2 Application: Primarily for parts, such as cases and ducts, requiring high strength at cryogenic temperatures and for short-time use up to 1000° F (540° C), particularly those parts which are formed or welded and then heat treated to develop required properties.

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 2262 - Tolerances, Nickel, Nickel-Base, and Cobalt-Base Alloy Sheet, Strip, and Plate
AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock

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 E112 - Estimating the Average Grain Size of Metals
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials
ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt 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 Federal Standards:

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

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

Printed in U.S.A.

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 analytical methods approved by purchaser:

	min	max
Carbon	--	0.08
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	0.20	0.80
Cobalt	--	1.00
Boron	--	0.006
Copper	--	0.30
Iron	remainder	

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

3.2 Condition: The product shall be supplied in the following condition; standards for acceptance shall be as agreed upon by purchaser and vendor:

3.2.1 Sheet and Strip: Hot rolled or cold rolled, solution heat treated, and descaled unless solution heat treatment is performed in an atmosphere yielding a bright finish, having a surface appearance comparable to a commercial corrosion-resistant steel No. 2D Finish.

3.2.2 Plate: Hot rolled, solution heat treated, and descaled unless solution heat treatment is performed in an atmosphere yielding a bright finish.

3.3 Solution Heat Treatment: No specific heat treating instructions are specified but it is recommended that the product be solution heat treated by heating in a suitable protective atmosphere to 1950° F ± 25 (1065° C ± 15) but in no case lower than 1850° F (1010° C), holding at heat for a time commensurate with product thickness, and cooling at a rate equivalent to air cool or faster.

3.4 Properties: The product shall conform to the following requirements:

3.4.1 As Solution Heat Treated:

Ø 3.4.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:

Tensile Strength, max	140,000 psi (965 MPa)
Yield Strength at 0.2% Offset, max	75,000 psi (517 MPa)
Elongation in 2 in. (50 mm) or 4D, min	30%

3.4.1.2 Hardness: Should be not higher than 25 HRC or equivalent, determined in accordance with Ø ASTM E18, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.1.1 are met.

3.4.1.3 Bending: Product 0.187 in. (4.75 mm) and under in nominal thickness shall withstand, without cracking, bending in accordance with ASTM E290 at room temperature through an angle of 180 deg around a diameter equal to the bend factor times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

Nominal Thickness		Bend Factor
Inch	(Millimetres)	
Up to 0.050, incl	(Up to 1.25, incl)	1
Over 0.050 to 0.187, incl	(Over 1.25 to 4.75, incl)	2

3.4.1.3.1 Bending requirements for product over 0.187 in. (4.75 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.1.4 Grain Size: Shall be predominantly 3 or finer with occasional grains as large as 2 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

3.4.1.5 Microstructure: Metallographic examination shall disclose no significant alloy depleted layer or other undesirable surface condition. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.4.2 After Precipitation Heat Treatment: The product shall have the following properties after being precipitation heat treated by heating to 1400° F ± 15 (760° C ± 8), holding at heat for 10 hr ± 0.5, furnace cooling to 1200° F ± 15 (650° C ± 8), holding at 1200° F ± 15 (650° C ± 8) until a total precipitation heat treatment time of 20 hr has been reached, and cooling in air. The product shall also meet the requirements of 3.4.2.1 and 3.4.2.2 after being resolution heat treated by heating to 1950° F ± 25 (1065° C ± 15) in a suitable protective atmosphere, holding at heat for 60 min. ± 5, and cooling at a rate equivalent to air cool or faster and precipitation heat treated as above.

3.4.2.1 Tensile Properties: Shall be as follows for product 0.010 - 1.000 in. (0.25 - 25.00 mm), incl, in nominal thickness, determined in accordance with ASTM E8; tensile property requirements for product less than 0.010 in. (0.25 mm) or over 1.000 in. (25.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor:

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 mm) or 4D, min	15%

3.4.2.2 Hardness: Should be not lower than 38 HRC or equivalent, determined in accordance with ASTM E18, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.2.1 are met.

3.5 Quality:

3.5.1 Alloy shall be multiple melted using consumable electrode practice in the remelt cycle or shall be induction melted under vacuum. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used for remelting.

3.5.2 The product, as received by 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 product.

3.6 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2262.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product 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 4.4. Purchaser reserves the right to sample and to perform such confirmatory testing as deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each heat or lot as applicable.

4.2.1.1 Composition (3.1) of each heat.

4.2.1.2 Tensile properties (3.4.1.1), hardness (3.4.1.2), bending (3.4.1.3), grain size (3.4.1.4), and microstructure (3.4.1.5) of each lot as solution heat treated.

4.2.1.3 Tensile properties (3.4.2.1) and hardness (3.4.2.2) of each lot after precipitation heat treatment.

4.2.1.4 Tolerances (3.6) of each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for tensile properties (3.4.2.1) and hardness (3.4.2.2) of each lot after resolution and precipitation heat treatment as in 3.4.2 are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2371; a heat shall be the consumable electrode remelted ingots produced from alloy originally melted as a single furnace charge or the ingots produced from a single vacuum induction melt.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests for chemical composition and grain size of each heat and the results of tests on each lot to determine conformance to the other acceptance test requirements and, when performed, to the periodic test requirements. This report shall include the purchase order number, heat number, AMS 5597B, size, and quantity from each heat.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 5597B, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.