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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5597E

Issued SEP 1965
Revised JAN 2001
Reaffirmed APR 2006

Superseding AMS 5597D

Nickel Alloy, Corrosion and Heat Resistant, Sheet, Strip, and Plate
52.5Ni - 19Cr - 3.0Mo - 5.1Cb - 0.90Ti - 0.50Al - 18Fe
Consumable Electrode or Vacuum Induction Melted
1950 °F (1066 °C) Solution Heat Treated

Composition similar to UNS N07718

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:

These products have been used typically for parts, such as cases and ducts, requiring high strength at cryogenic temperatures and for short-time use up to 1000 °F (538 °C), particularly those parts which are formed or welded and then heat treated to develop required properties, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2262	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate
MAM 2262	Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate
AMS 2269	Chemical Check Analysis Limits, Nickel, Nickel Alloys and Cobalt Alloys
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2807	Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 112	Determining Average Grain Size
ASTM E 290	Semi-Guided Bend Testing for Ductility of Metallic Materials
ASTM E 354	Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	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	4.75	5.50
Titanium	0.65	1.15
Aluminum	0.20	0.80
Cobalt	--	1.00
Tantalum	--	0.05
Boron	--	0.006
Copper	--	0.30
Iron	remainder	

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

3.2 Melting Practice:

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.

3.3 Condition:

The product shall be supplied in the following condition:

3.3.1 Sheet and Strip: Hot or cold rolled, solution heat treated, and, unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled having a surface appearance comparable to the following commercial corrosion-resistant steel finishes as applicable (See 8.2):

3.3.1.1 Sheet: No. 2D finish.

3.3.1.2 Strip: No. 1 strip finish.

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

3.4 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 (1066 °C ± 14) 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 an air cool or faster.

3.5 Properties:

The product shall conform to the following requirements:

3.5.1 As Solution Heat Treated:

3.5.1.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 2 - Tensile Properties

Property	Value
Tensile Strength, max	140 ksi (965 MPa)
Yield Strength at 0.2% Offset, max	75.0 ksi (517 MPa)
Elongation in 2 Inches (50.8 mm) or 4D, min	30%

3.5.1.2 Hardness: Should be not higher than 25 HRC, or equivalent (See 8.3), determined in accordance with ASTM E 18, but the product shall not be rejected on the basis of hardness if the tensile properties of 3.5.1.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.5.1.3 Bending: Product shall withstand, without cracking, bending in accordance with ASTM E 290 at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 3 times the nominal thickness of the product, with axis of bend parallel to the direction of rolling.

TABLE 3 - Bending Parameters

Nominal Thickness Inch	Nominal Thickness Millimeters	Bend Factor
Up to 0.050, incl	Up to 1.27, incl	1
Over 0.050 to 0.1874, incl	Over 1.27 to 4.760, incl	2

3.5.1.4 Average Grain Size: Shall be ASTM No. 3 or finer, determined in accordance with ASTM E 112.

3.5.1.5 Microstructure: Metallographic examination shall disclose no significant alloy depleted layer (See 8.4) or other undesirable surface condition. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.5.2 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 hours ± 0.5, furnace cooling to 1200 °F ± 15 (649 °C ± 8), holding at 1200 °F ± 15 (649 °C ± 8) until a total precipitation heat treatment time of 20 hours has been reached, and cooling in air. The product shall also meet the requirements of 3.5.2.1 and 3.5.2.2 after being re-solution heat treated by heating to 1950 °F ± 25 (1066 °C ± 14) in a suitable protective atmosphere, holding at heat for 60 minutes ± 5, and cooling at a rate equivalent to an air cool or faster and precipitation heat treated as above:

3.5.2.1 Tensile Properties: Shall be as shown in Table 4 for product 0.010 to 1.000 inch (0.25 to 25.40 mm), inclusive, in nominal thickness, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 4 - Minimum Tensile Properties

Property	Value
Tensile Strength	180 ksi (1241 MPa)
Yield Strength at 0.2% Offset	150 ksi (1034 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	15%

3.5.2.2 Hardness: Should be not lower than 38 HRC, or equivalent (See 8.3), determined in accordance with ASTM E 18, but the product shall not be rejected on the basis of hardness if the tensile properties of 3.5.2.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.6 Quality:

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.7 Tolerances:

Shall conform to all applicable requirements of AMS 2262 or MAM 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The following requirements are 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 (3.5.1.1), hardness (3.5.1.2), bending (3.5.1.3), average grain size (3.5.1.4), and microstructure (3.5.1.5) of each lot as solution heat treated.

4.2.1.3 Tensile properties (3.5.2.1) and hardness (3.5.2.2) of each lot after precipitation heat treatment.

4.2.1.4 Tolerances (3.7) of each lot.

4.2.2 Periodic Tests: Tensile properties (3.5.2.1) and hardness (3.5.2.2) of each lot after re-solution and precipitation heat treatment as in 3.5.2 are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2371.