AEROSPACE
MATERIAL SPECIFICATIONS

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York, N.Y. 10017

AMS 5598

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Revised

ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT
Nickel Base - 15.5Cr - 0.95(Cb + Ta) - 2.6Ti - 0.70Al - 7.0Fe
Consumable Electrode or Vacuum Induction Melted

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. APPLICATION: Primarily for parts requiring high strength up to 1500 F (816 C) and oxidation resistance up to 1800 F (982 C), and for bellows and flat springs requiring optimum resistance to relaxation up to 1000 F (538 C) with moderate or relatively low stresses, particularly where welding is involved. Parts may be formed, welded if required, and then heat treated to improve strength at elevated temperatures.

3. COMPOSITION:

	min	max
Carbon	--	0.08
Manganese	--	0.35
Silicon	--	0.35
Phosphorus (1)	--	0.015
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel + Cobalt	70.00	--
Cobalt (1)	--	1.00
Columbium + Tantalum	0.70	1.20
Titanium	2.25	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Copper	--	0.50

(1) Determination not required for routine acceptance.

3.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2269.

4. CONDITION:

4.1 Sheet: Cold rolled, solution heat treated as in 5.1, descaled, and leveled as flat as possible.

4.2 Strip: Cold rolled and solution heat treated as in 5.1. Strip need not be bright and may have an oxidized surface.

4.3 Plate: Hot rolled, solution heat treated as in 5.1, and descaled, unless otherwise specified.

5. TECHNICAL REQUIREMENTS:

5.1 Heat Treatment: The product shall be solution heat treated by heating to approximately 1800 F (982 C), holding at heat for a time commensurate with the thickness, and cooling at a rate equivalent to air cool or faster.

5.2 Tensile Properties:

5.2.1 Strip:

Nominal Thickness Inch	Tensile Strength psi, max	Elongation % in 2 in., min
Up to 0.010, excl	140,000	--
0.010 to 0.025, excl	135,000	18
0.025 and over	As agreed upon by purchaser and vendor	

5.2.2 Sheet:

Nominal Thickness Inch	Tensile Strength psi, max	Yield Strength at 0.2% Offset or at Extension Indicated (E = 31,000,000)		Elongation % in 2 in., min
		psi, max	Extension Under Load in. in 2 in.	
0.010 to 0.024, incl	135,000	75,000	0.0088	30
Over 0.024 to 0.250, incl	135,000	75,000	0.0088	35

5.2.3 For sheet in widths 9 in. and over, tensile test specimens shall be taken with the axis perpendicular to the direction of rolling. For all strip and for sheet in widths less than 9 in., tensile test specimens shall be taken with the axis parallel to the direction of rolling.

5.3 Bending: Sheet shall withstand, without cracking, bending at room temperature through an angle of 180 deg around a diameter equal to the bend factor times the nominal thickness of the material, with axis of bend parallel to the direction of rolling.

Nominal Thickness Inch	Bend Factor
Up to 0.050, incl	1
Over 0.050 to 0.250, incl	2

5.4 Grain Size: Grain size of sheet and strip 0.010 in. and over in thickness shall average not over 0.0025 in. in diameter (Grain Size No. 5) when determined in accordance with the issue of ASTM E112 listed in the latest issue of AMS 2350.

5.5 Properties After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to 1350 F ± 15 (732.2 C ± 8.3), holding at heat for 8 hr, cooling at a rate of 100 F ± 15 (55.6 C ± 8.3) per hr to 1150 F ± 15 (621.1 C ± 8.3), holding at 1150 F ± 15 (621.1 C ± 8.3) for 8 hr, and air cooling.

Note. Instead of the 100 F (55.6 C) per hr cooling rate to 1150 F ± 15 (621.1 C ± 8.3), material may be furnace cooled at any rate provided the time at 1150 F ± 15 (621.1 C ± 8.3) is adjusted to give a total precipitation heat treatment time of 18 hours.

5.5.1 Tensile Properties:

Product	Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 31,000,000) psi, min	Extension Under Load in. in 2 in.	Elongation % in 2 in. or 4D, min
Strip	Up to 0.010, excl	155,000	--	--	--
	0.010 and over	160,000	--	--	12
Sheet	0.010 to 0.250, incl	170,000	115,000	0.0114	18
Plate	0.187 to 4.000, excl	160,000	105,000	0.0108	18

5.5.1.1 Elongation requirements do not apply to strip under 0.020 in. in thickness.

5.5.1.2 For sheet and plate in widths 9 in. and over, tensile test specimens shall be taken with the axis perpendicular to the direction of rolling. For all strip and for sheet and plate in widths less than 9 in., tensile test specimens shall be taken with the axis parallel to the direction of rolling.

5.5.2 Hardness: Strip 0.005 in. and over in thickness and plate shall have hardness not lower than Rockwell C 30 or equivalent; sheet shall have hardness not lower than Rockwell C 32 or equivalent.

6. QUALITY: Material shall be produced by multiple melting using consumable electrode practice in the remelt cycle or shall be induction melted under vacuum, unless otherwise permitted. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used. The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

7. TOLERANCES: Unless otherwise specified, tolerances for sheet in widths 44 in. and under and thicknesses 0.010 in. and over; for strip, other than thickness; and for plate shall conform to all applicable requirements of the latest issue of AMS 2262. Thickness tolerances for strip shall be ± 10% of the nominal thickness.

8. REPORTS:

8.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition of each heat in the shipment, and the results of tests on each thickness from each heat to determine conformance to the technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number, thickness, size, and quantity from each heat.

8.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, 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.

9. IDENTIFICATION: Unless otherwise specified, each sheet, strip, and plate shall be marked, in the respective location indicated below, with AMS 5598, heat number, manufacturer's identification, and nominal thickness in inches. The characters shall be not less than 3/8 in. in height, shall be applied using a suitable marking fluid, and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effects on the material or its performance. The characters shall be sufficiently stable to withstand normal handling and shall not interfere with welding procedures.