ADOPTION NOTICE

SAE-AMS6520, "STEEL, MARAGING, SHEET, STRIP, AND PLATE 18NI - 7.8CO - 4.9MO - 0.40TI - 0.10AL CONSUMABLE ELECTRODE MELTED, SOLUTION HEAT TREATED", was adopted on 22-JUN-95 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: ASC/ENOI, Building 560, 2530 Loop Road West, Wright-Patterson AFB, OH 45433-7101. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001. http://www.sae.org/

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 6520C

Issued MAY 1969
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Superseding AMS 6520B

Submitted for recognition as an American National Standard

Steel, Maraging, Sheet, Strip, and Plate
18Ni - 7.8Co - 4.9Mo - 0.40Ti - 0.10Al
Consumable Electrode Melted, Solution Heat Treated

UNS K92890

1. SCOPE:

1.1 Form:

This specification covers a premium aircraft-quality, maraging steel in the form of sheet, strip, and plate.

1.2 Application:

These products have been used typically for large booster rocket applications, pressure vessels, and other components requiring through-hardening, without quenching, to a yield strength of 245 ksi (1689 MPa) or higher, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

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

AMS 2248	Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2252	Tolerances, Low-Alloy Steel Sheet, Strip, and Plate
MAM 2252	Tolerances, Metric, Low-Alloy Steel Sheet, Strip, and Plate
AMS 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
MAM 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurement

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7154 FAX: (724) 776-0243
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2.1 (Continued):

AMS 2370 Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steels, Wrought Products and Forging Stock
AMS 2750 Pyrometry
AMS 2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

2.2 ASTM Publications:

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

ASTM A 370 Mechanical Testing of Steel Products
ASTM A 604 Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets
ASTM E 45 Determining the Inclusion Content of Steel
ASTM E 112 Determining the Average Grain Size
ASTM E 338 Sharp-Notch Tension Testing of High-Strength Sheet Materials
ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E 399 Plane-Strain Fracture Toughness of Metallic Materials

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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

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 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.03
Manganese	--	0.10
Silicon	--	0.10
Phosphorus	--	0.010
Sulfur	--	0.010
Nickel	17.00	19.00
Cobalt	7.00	8.50
Molybdenum	4.60	5.20
Titanium	0.30	0.50
Aluminum	0.05	0.15

3.1.1 Prior to pouring, nominal additions of 0.05% calcium, 0.02% zirconium, and 0.003% boron shall be made to the melt but analysis for these elements need not be made.

3.1.2 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

3.2 Melting Practice:

Steel shall be produced by multiple melting using consumable electrode practice in the remelt cycle; at least one of the melting cycles shall be under vacuum.

3.3 Condition:

Hot rolled, solution heat treated, and descaled.

3.4 Heat Treatment:

The product shall be solution heat treated by heating in air to 1500 °F ± 25 (816 °C ± 14), holding at heat for a time commensurate with the thickness and the heating procedure, and cooling in air. Continuously-rolled product may be solution heat treated at temperatures higher than 1500 °F (816 °C) provided the product is re-solution heat treated at 1500 °F ± 25 (816 °C ± 14). Pyrometry shall be in accordance with AMS 2750.

3.5 Properties:

The product shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A 370:

3.5.1 As Solution Treated:

3.5.1.1 Macrostructure: Visual examination of transverse full cross-sections, etched in hot hydrochloric acid in accordance with ASTM A 604, shall show no pipe or cracks. Porosity, segregation, inclusions, and other imperfections shall be no worse than the macrographs of ASTM A 604 shown in Table 2.

TABLE 2 - Macrostructure Limits

Class	Condition	Severity
1	Freckles	A
2	White Spots	A
3	Radial Segregation	B
4	Ring Pattern	B

3.5.1.2 Micro-Inclusion Rating: No specimen shall exceed the limits shown in Table 3, determined in accordance with ASTM E 45, Method D.

TABLE 3 - Micro-Inclusion Rating Limits

Type	A	B	C	D	E
Thin	1.5	1.5	1.5	2.0	3.0
Heavy	1.0	1.0	1.0	1.5	2.0

3.5.1.2.1 Type E presents the limits for titanium nitrides and shall be rated in the same manner as Type B.

3.5.1.3 Average Grain Size: Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112 (See 8.2), for product 0.625 inch (15.88 mm) and under in nominal thickness.

3.5.1.4 Hardness: Shall be not higher than 34 HRC, or equivalent (See 8.3).

3.5.2 After Maraging: Product shall have the following properties after being maraged by heating to 900 °F ± 10 (482 °C ± 6), holding at heat for 3 to 5 hours, and cooling in air.

3.5.2.1 Tensile Properties: Shall be as specified in Table 4.

TABLE 4A - Minimum Room Temperature Tensile Requirements, Inch/Pound Units

Nominal Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation, % 2-Inch or 4D Gage Length	Elongation, % 1-Inch Gage Length	Elongation, % 0.5 Inch Gage Length
Up to 0.030, excl	255	245	--	--	1.0
0.030 to 0.045, incl	255	245	--	--	2.0
Over 0.045 to 0.065, incl	255	245	--	2.0	--
Over 0.065 to 0.090, incl	255	245	2.5	5.0	--
Over 0.090 to 0.125, incl	255	245	3.0	6.0	--
Over 0.125 to 0.250, incl	255	245	4.0	8.0	--
Over 0.250 to 0.375, incl	255	245	5.0	--	--
Over 0.375	255	245	6.0	--	--

TABLE 4B - Minimum Room Temperature Tensile Requirements, SI Units

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation, % 50.8-mm or 4D Gage Length	Elongation, % 25.4-mm Gage Length	Elongation, % 12.7-mm Gage Length
Up to 0.76, excl	1758	1689	--	--	1.0
0.76 to 1.14, incl	1758	1689	--	--	2.0
Over 1.14 to 1.65, incl	1758	1689	--	2.0	--
Over 1.65 to 2.29, incl	1758	1689	2.5	5.0	--
Over 2.29 to 3.18, incl	1758	1689	3.0	6.0	--
Over 3.18 to 6.35, incl	1758	1689	4.0	8.0	--
Over 6.35 to 9.52, incl	1758	1689	5.0	--	--
Over 9.52	1758	1689	6.0	--	--

3.5.2.2 Hardness: Shall be not lower than 48 HRC, or equivalent (See 8.3).

3.5.2.3 Fracture Toughness: When specified, product shall be subjected to fracture toughness testing. Method of test and standards for acceptance shall be as agreed upon by purchaser and vendor. ASTM E 338 is a suggested method of test for sheet. ASTM E 399 is a suggested method of test for plate.

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.

3.6.1 Steel shall be premium aircraft-quality conforming to AMS 2300 or MAM 2300.

3.7 Tolerances:

Shall conform to all applicable requirements of AMS 2252 or MAM 2252.

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. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2370.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report showing the results of tests for chemical composition, macrostructure, micro-inclusion rating, grain size, and frequency-severity cleanliness rating of each heat and the results of tests on each lot for tensile properties, hardness, and, when specified, fracture toughness after maraging. This report shall include the purchase order number, heat number, AMS 6520C, size, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2370.