

ADOPTION NOTICE

SAE-AMS5223, "IRON-NICKEL ALLOY, STRIP 49FE - 5.3CR - 42NI - 2.5TI - 0.55A1 SOLUTION HEAT TREATED, COLD ROLLED, 10% REDUCTION", was adopted on 17-MAR-89 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, Defense Supply Center Philadelphia, ATTN: DSCP-ILEA, 700 Robbins Avenue, Philadelphia, PA 19111-5096. 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

Submitted for recognition as an American National Standard



AMS 5223E

Issued NOV 1952
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Superseding AMS 5223D

Iron-Nickel Alloy, Strip
49Fe - 5.3Cr - 42Ni - 2.5Ti - 0.55Al
Solution Heat Treated, Cold Rolled, 10% Reduction

UNS N09902

1. SCOPE:

1.1 Form:

This specification covers an iron-nickel alloy in the form of strip.

1.2 Application:

This strip has been used typically for diaphragms, leaf springs, and helical springs, requiring a precipitation-hardenable alloy with a coefficient of modulus of elasticity of -20 to $+20 \times 10^{-6}$ per degree Fahrenheit from -50 to $+150$ °F (-36 to $+36 \times 10^{-6}$ per degree Celsius from -46 to $+66$ °C) after suitable heat treatment, 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 2242	Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
MAM 2242	Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
AMS 2248	Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2750	Pyrometry

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2.1 (Continued):

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, 1916 Race Street, Philadelphia, PA 19103-1187.

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 the Average Grain Size
ASTM E 354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys
ASTM E 384 Microhardness of 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 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.06
Manganese	--	0.80
Silicon	--	1.00
Phosphorus	--	0.04
Sulfur	--	0.04
Chromium	4.90	5.75
Nickel	41.00	43.50
Titanium	2.20	2.75
Aluminum	0.30	0.80
Chromium + (Titanium - 4x Carbon)	7.10	8.10
Cobalt	--	1.00
Iron	remainder	

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

3.2 Condition:

Solution heat treated, descaled, cold rolled with approximately 10% reduction in thickness, and having a surface appearance comparable to a commercial corrosion-resistant steel No. 1 strip finish (See 8.2).

3.3 Heat Treatment:

Strip shall be solution heat treated by heating to $1750^{\circ}\text{F} \pm 25$ ($954^{\circ}\text{C} \pm 14$), holding at heat for a time commensurate with thickness, and cooling as required. Pyrometry shall be in accordance with AMS 2750.

3.4 Properties:

Strip shall conform to the following requirements:

3.4.1 As Solution Heat Treated:

3.4.1.1 Average Grain Size: Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112 (See 8.3).

3.4.2 As Solution Heat Treated and Cold Rolled:

3.4.2.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M; these requirements apply to strip 0.020 to 0.1874 inch (0.51 to 4.760 mm), inclusive, in nominal thickness:

TABLE 2 - Tensile Properties

Properties	Value
Tensile Strength	90.0 to 110 ksi (621 to 758 MPa)
Elongation in 2 inches (50.8 mm), min	15%

- 3.4.2.2 Hardness: Shall be 83 to 98 HRB, or equivalent (See 8.4), determined in accordance with ASTM E 18. For thin gages where superficial hardness testing is impractical, microhardness testing in accordance with ASTM E 384 may be used. Strip shall not be rejected on the basis of hardness if the tensile properties of 3.4.2.1, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness, are acceptable.
- 3.4.3 After Precipitation Heat Treatment: Strip 0.020 to 0.1874 inch (0.51 to 4.760 mm), inclusive, in nominal thickness shall conform to the following requirements after being precipitation heat treated by heating to 1300 °F ± 15 (704 °C ± 8), holding at heat for 180 minutes ± 5, and cooling in air:
- 3.4.3.1 Tensile Properties: Shall be as shown in Table 3, determined in accordance with ASTM E 8 or ASTM E 8M:

TABLE 3 - Minimum Tensile Properties

Property	Value
Tensile Strength	165 ksi (1138 MPa)
Yield Strength at 0.2% Offset	120 ksi (827 MPa)
Elongation in 2 Inches (50.8 mm)	10%

- 3.4.3.2 Hardness: Shall be 34 to 41 HRC, or equivalent (See 8.4), determined in accordance with ASTM E 18. For thin gages where superficial hardness testing is impractical, microhardness testing in accordance with ASTM E 384 may be used. Strip shall not be rejected on the basis of hardness if the tensile properties of 3.4.3.1, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness, are acceptable.

3.5 Quality:

Strip, 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 strip.

3.6 Tolerances:

Shall conform to all applicable requirements of AMS 2242 or MAM 2242.