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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5225E

Issued AUG 1955
Revised JUN 2000
Reaffirmed APR 2006
Superseding AMS 5225D

Iron-Nickel Alloy, Strip
49Fe - 5.3Cr - 42Ni - 2.5Ti - 0.55Al
Solution Heat Treated, Cold Rolled, 50% 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 x 10^{-6} per degree Fahrenheit from -50 to +150 °F (-36 to +36 x 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 issue of the following documents in effect on the date of the purchase order form 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 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, Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys

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

2.1 (Continued):

AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, 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 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

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 + Cobalt	41.00	43.50
Titanium	2.20	2.75
Aluminum	0.30	0.80
Chromium + (Titanium - 4x Carbon)	7.10	8.10
Cobalt (3.1.1)	--	1.00
Iron	remainder	

3.1.1 Determination not required for routine acceptance.

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

3.2 Condition:

Solution heat treated, cold rolled with approximately 50% reduction in thickness, and descaled.

3.3 Solution Heat Treatment:

Strip shall be solution heat treated by heating to 1750 °F ± 25 (954 °C ± 14), holding at heat for a time commensurate with section 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 8.2).

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 0.250 inch (0.51 to 6.35 mm), inclusive, in nominal thickness:

TABLE 2 - Tensile Properties

Properties	Value
Tensile Strength	125.0 to 140.0 ksi (862 to 965 MPa)
Elongation in 2 inches (50.8 mm), minimum	3%

3.4.2.2 Hardness: Shall be 24 to 32 HRC, or equivalent (See 8.3), 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 property requirements 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 0.250 inch (0.51 to 6.35 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 3 hours ± 0.10, 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 After Precipitation Heat Treatment

Property	Value
Tensile Strength	190.0 ksi (1310 MPa)
Yield Strength at 0.2% Offset	165.0 ksi (1138 MPa)
Elongation in 2 Inches (50.8 mm)	5%

3.4.3.2 Hardness: Shall be 39 to 46 HRC, or equivalent (See 8.3), 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 the 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.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of strip 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 strip conforms to specified requirements.

4.2 Classification of Tests:

All technical requirements except for cobalt analysis (See 3.1.1) 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 2371.