AEROSPACE MATERIAL SPECIFICATION

AMS5225	REV. F

Issued 1955-08
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Reaffirmed 2014-06

Superseding AMS5225E

Iron-Nickel Alloy, Strip
49Fe - 5.3Cr - 42Ni - 2.5Ti - 0.55Al
Solution Heat Treated, Cold Rolled, 50% Reduction
(Composition similar to UNS N09902)

RATIONALE

This document has been reaffirmed to comply with the SAE five-year review policy.

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 temperature 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 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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2242	Tolerances, Corrosion and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
AMS2248	Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS2750	Pyrometry
AMS2807	Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS5225F

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E 8/E 8M Tension Testing of Metallic Materials
ASTM E 18 Rockwell Hardness of Metallic Materials
ASTM E 112 Determining Average Grain Size
ASTM E 354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys
ASTM E 384 Microindentation Hardness 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	41.00	43.50
Titanium	2.20	2.75
Aluminum	0.30	0.80
Chromium + (Titanium - 4x Carbon)	7.10	8.10
Iron	remainder	

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248.

3.2 Condition

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

3.3 Solution Heat Treatment

Except as specified in 3.3.1, 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 AMS2750.

3.3.1 Continuous Heat Treating: Process parameters (e.g., furnace temperature set points, heat input, travel rate, etc.) for continuous heat treating lines shall be established by the material producer and validated by testing of product to the other requirements of this specification.

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.

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/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 to 140 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 8.2), 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 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness..

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/E 8M:

TABLE 3 - Minimum Tensile Properties After Precipitation Heat Treatment

Property	Value
Tensile Strength	190 ksi (1310 MPa)
Yield Strength at 0.2% Offset	165 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 8.2), 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 are acceptable., determined on specimens taken from the same sample as that with the nonconforming hardness or from another sample with similar nonconforming hardness.

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 AMS2242.

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

4.3 Sampling and Testing

Shall be in accordance with AMS2371.

4.4 Reports

The vendor of strip shall furnish with each shipment a report showing the results of tests for composition of each heat and for average grain size solution heat treated, tensile properties after solution treated and cold rolled, tensile properties and hardness after precipitation heat treatment, and stating that the product conforms to the other technical requirements. This report shall include the purchase order, heat and lot numbers, AMS5225F, size, and quantity.

4.5 Resampling and Retesting

Shall be in accordance with AMS2371.

5. PREPARATION FOR DELIVERY

5.1 Identification

Shall be in accordance with AMS2807.

5.2 Packaging

Strip shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the strip to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT

A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Strip not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.