NOTICE OF
ADOPTION

ADOPTION NOTICE
20 December 1991
AMS 5221D
1 July 1990
SUPERSEDING
AMS 5221C
20 March 1985

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Title of Document: Alloy Strip
49Fe - 5.3Cr - 42Ni - 2.5Ti - 0.55Al
Solution Heat Treated

Date of Specific Issue Adopted: 1 July 1990

Releasing Non-Government Standards Body: SAE

Custodians:
Air Force - 11
Army - MR
Navy - AS

Military Coordinating Activity
Air Force - 11

(Project No: 9515-0894)

FSC 9515

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G-45-05

The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-5221 REV D

Issued 1955-08-15
Revised 1990-07-01
Superseding AMS-5221C

Submitted for recognition as an American National Standard

ALLOY STRIP
49Fe - 5.3Cr - 42Ni - 2.5Ti - 0.55Al
Solution Heat Treated

UNS N09902

1. SCOPE:

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

1.2 Application: Primarily 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.

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.

2.1.1 Aerospace Material Specifications:

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 of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock

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 Average Grain Size
ASTM E 354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, Ø determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	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 - 4 x 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 requirements of AMS-2248.

3.2 Condition: Solution heat treated.

3.3 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 but not more than 30 minutes, and cooling as required.

3.4 Properties: Strip shall conform to the following requirements:

3.4.1 As Solution Heat Treated:

3.4.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E 8 or ASTM E 8M, on specimens as in 4.3.1 from strip 0.020 to 0.250 inch (0.51 to 6.35 mm), incl, in nominal thickness:

Tensile Strength, maximum	95,000 psi (655 MPa)
Elongation in 2 Inches (50.8 mm), minimum	35%

3.4.1.1.1 Properties of strip under 0.020 inch (0.51 mm) or over 0.250 inch (6.35 mm) in nominal thickness shall be as agreed upon by purchaser and vendor:

3.4.1.2 Hardness: Should be not higher than 80 HRB, or equivalent, determined in accordance with ASTM E 18 but strip shall not be rejected on the basis of hardness if the tensile properties requirement of 3.4.1.1 are met.

3.4.1.3 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, determined in accordance with ASTM E 112.

3.4.2 After Precipitation Heat Treatment: Specimens as in 4.3.1 from strip 0.020 to 0.250 inch (0.51 to 6.35 mm), incl, 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; properties of strip under 0.020 inch (0.51 mm) or over 0.250 inch (6.35 mm) in nominal thickness shall be as agreed upon by purchaser and vendor:

3.4.2.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E 8 or ASTM E 8M:

Tensile Strength, minimum	150,000 psi (1034 MPa)
Yield Strength at 0.2% Offset, minimum	90,000 psi (621 MPa)
Elongation in 2 Inches (50.8 mm), minimum	5%

3.4.2.2 Hardness: Should be 27 - 35 HRC, or equivalent, determined in accordance with ASTM E 18 but strip shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.2.1 are met.

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 be as follows:

3.6.1 Thickness:

TABLE I

Nominal Thickness (T) Inch	Thickness Tolerance, Inch plus and minus Width Ranges, Inches	
	Up to 4.0, incl	Over 4.0 to 5.0, incl
Up to 0.015, incl	0.0005	0.0006
Over 0.015 to 0.025, incl	0.00075	0.0008
Over 0.025 to 0.040, incl	0.001	0.001
Over 0.040	0.025T	0.025T

TABLE I (SI)

Nominal Thickness (T) Millimetres	Thickness Tolerance, Millimetre plus and minus Width Ranges, Millimetres	
	Up to 102, incl	Over 102 to 127, incl
Up to 0.38, incl	0.013	0.015
Over 0.38 to 0.64, incl	0.0190	0.020
Over 0.64 to 1.02, incl	0.025	0.025
Over 1.02	0.025T	0.025T

3.6.1.1 When premium tolerances for thickness are specified, product shall conform to Table II.

TABLE II

Nominal Thickness (T) Inch	Thickness Tolerance, Inch plus and minus Width Ranges, Inches	
	Up to 4.0, incl	Over 4.0 to 5.0, incl
Up to 0.005, incl	0.0002	0.0003
Over 0.005 to 0.010, incl	0.0003	0.0004
Over 0.010 to 0.015, incl	0.0004	0.0005
Over 0.015 to 0.025, incl	0.0005	0.0005
Over 0.025	0.02T	0.02T

TABLE II (SI)

Nominal Thickness (T) Millimetres	Thickness Tolerance, Millimetre plus and minus Width Ranges, Millimetres: Up to 102, incl	Over 102 to 127, incl
Up to 0.13, incl	0.005	0.008
Over 0.13 to 0.25, incl	0.008	0.010
Over 0.25 to 0.38, incl	0.010	0.013
Over 0.38 to 0.64, incl	0.013	0.013
Over 0.64	0.02T	0.02T

3.6.2 Width:

TABLE III

Nominal Width Inches	Width Tolerances, Inch Thickness Ranges, Inch: Up to 0.010, incl	Over 0.010 to 0.040, incl	Over 0.040 to 0.075, incl	Over 0.075
Up to 3.00, incl	+0.010 -0.000	+0.010 -0.000	+0.015 -0.000	+0.015 -0.000
Over 3.00 to 4.00, incl	+0.010 -0.000	+0.012 -0.000	+0.015 -0.000	+0.015 -0.000
Over 4.00 to 5.00, incl	+0.010 -0.000	+0.015 -0.000	+0.015 -0.005	+0.015 -0.015

TABLE III (SI)

Nominal Width Millimetres	Width Tolerance, Millimetre Thickness Range, Millimetres: Up to 0.25, incl	Over 0.25 to 1.02, incl	Over 1.02 to 1.90, incl	Over 1.90
Up to 76.2, incl	+0.25 -0.00	+0.25 -0.00	+0.38 -0.00	+0.38 -0.00
Over 76.2 to 101.6, incl	+0.25 -0.00	+0.30 -0.00	+0.38 -0.00	+0.38 -0.00
Over 101.6 to 127.0, incl	+0.25 -0.00	+0.38 -0.00	+0.38 -0.13	+0.38 -0.38