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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 7727C

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Superseding AMS 7727B

Submitted for recognition as an American National Standard

IRON-NICKEL-COBALT ALLOY, BARS AND FORGINGS
53Fe - 29Ni - 17Co
Low Expansion, Glass Sealing

UNS K94610

1. SCOPE:

1.1 Form:

This specification covers an iron-nickel-cobalt alloy in the form of bars and forgings.

1.2 Application:

Those products have been used typically for electronic elements to be sealed to hard glasses during assembly, 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 2371 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2374 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steel and Alloy Forgings
AMS 2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys
AMS 2808 Identification, Forgings

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 228 Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer
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 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:
(R)

Shall be approximately 53% iron, 29% nickel, and 17% cobalt by weight with residual elements not exceeding 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, Residual Elements

Element	min	max
Carbon	--	0.04
Manganese	--	0.50
Silicon	--	0.20
Chromium	--	0.20
Molybdenum	--	0.20
Copper	--	0.20
Titanium	--	0.10
Aluminum	--	0.10
Magnesium	--	0.10
Zirconium	--	0.10
Sum of Ti+Al+Mg+Zr	--	0.20

3.2 Condition:

The product shall be supplied in the following condition:

3.2.1 Bars: Centerless ground.

3.2.2 Forgings: As ordered.

3.3 Properties:

The product, as supplied, shall conform to the following requirements:

3.3.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	70.0 ksi (483 MPa)
Yield Strength at 0.2% Offset	55.0 ksi (379 MPa)
Elongation in 4D	30%

3.3.2 Coefficient of Thermal Expansion: Shall be as shown in Table 3, determined in accordance with ASTM E 228 on specimens annealed by heating in a hydrogen atmosphere to 900 °C ± 15 (1652 °F ± 27), holding at heat for 60 minutes ± 5, followed by heating in a hydrogen atmosphere to 1100 °C ± 15 (2012 °F ± 27), holding at heat for not less than 15 minutes, and cooling in the hydrogen atmosphere to 200 °C (392 °F) or lower at a rate not exceeding 5 C (9 F) degrees per minute. The specimens may be cooled to room temperature between the 900 °C (1652 °F) and the 1100 °C (2012 °F) heat treatment cycles.

TABLE 3A - Coefficient of Thermal Expansion, Inch/Pound Units

Temperature Range	Average Linear Coefficient of Thermal Expansion Inch/Inch per Degree Fahrenheit
86 to 752 °F	2.56 to 2.89 x 10^{-6}
86 to 842 °F	2.83 to 3.06 x 10^{-6}

TABLE 3B - Coefficient of Thermal Expansion, SI Units

Temperature Range	Average Linear Coefficient of Thermal Expansion mm/mm per Degree Celsius
30 to 400 °C	4.60 to 5.20 x 10^{-6}
30 to 450 °C	5.10 to 5.50 x 10^{-6}

3.3.3 (R) Temperature of Transformation: The temperature of transformation from gamma to alpha phase shall be not higher than -78 °C (-108 °F), determined by metallographic examination of specimens annealed as in 3.3.2 and cold soaked for not less than 4 hours. Product over 7/8 inch (22.2 mm) in nominal section thickness may contain some localized transformation acceptable to standards agreed upon by purchaser and vendor.

3.4 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.

3.5 Tolerances:

Shall conform to the following:

3.5.1 Diameter of Centerless-Ground Bars: Shall be as shown in Table 4.

TABLE 4A - Diameter Tolerances, Inch/Pound Units

Nominal Diameter Inches	Tolerance, Inch Plus and Minus
0.030 to 0.055, incl	0.0005
Over 0.055 to 0.125, incl	0.001
Over 0.125 to 0.500, incl	0.0015
Over 0.500 to 1.000, incl	0.002
Over 1.000 to 1.625, incl	0.0025
Over 1.625 to 1.750, incl	0.003
Over 1.750 to 2.000, incl	0.004
Over 2.000 to 4.000, incl	0.005

TABLE 4B - Diameter Tolerances, SI Units

Nominal Diameter Millimeters	Tolerance, Millimeter Plus and Minus
0.76 to 1.40, incl	0.013
Over 1.40 to 3.18, incl	0.025
Over 3.18 to 12.70, incl	0.038
Over 12.70 to 25.40, incl	0.05
Over 25.40 to 41.28, incl	0.064
Over 41.28 to 44.45, incl	0.08
Over 44.45 to 50.80, incl	0.10
Over 50.80 to 101.60, incl	0.13

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

(R)

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:

4.2.1 Acceptance Tests: Composition (3.1), coefficient of thermal expansion (3.3.2), temperature of transformation (3.3.3), quality (3.4), and tolerances for bars (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tensile properties (3.3.1) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

(R)

Shall be as follows; a lot shall be all product of the same nominal size, configuration, or part number from the same heat of alloy processed at the same time:

4.3.1 Bars: In accordance with AMS 2371.

4.3.2 Forgings: In accordance with AMS 2374.

4.3.3 Sampling for coefficient of thermal expansion (3.3.2) and temperature of transformation (3.3.3) shall be as agreed upon by purchaser and vendor.