SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS7727 | REV. E

Issued 1964-01
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Noncurrent 2006-05
Reaf Nonc 2012-04

Superseding AMS7727D

Iron-Nickel-Cobalt Alloy, Bars and Forgings
53Fe - 29Ni - 17Co
Low Expansion, Glass Sealing
K94610

RATIONALE

AMS7727E has been reaffirmed to comply with the SAE five-year review policy.

NONCURRENT NOTICE

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of May, 2006. It is recommended, therefore, that this specification not be specified for new designs.

"NONCURRENT" refers to those specifications which have previously been widely used and which may be required for production or processing of existing designs in the future. The Aerospace Materials Division, however, does not recommend these specifications for future use in new designs. "NONCURRENT" specifications are available from SAE upon request.

Similar but not necessarily identical products are covered in the following specifications. However, this listing is provided for information only and does not constitute authority to substitute these specifications for the "NONCURRENT" specification.

ASTM F 15, Iron-Nickel-Cobalt Sealing Alloy

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
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS7727E

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 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 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, 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 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

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

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) 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 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:

The vendor of the product 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 product conforms to specified requirements.

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:

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 one sample for each lot.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and for coefficient of thermal expansion and temperature of transformation of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS 7727D, size, and quantity. If forgings are supplied, the part number and the size and melt source of stock used to make the forgings shall also be included.

4.5 Resampling and Retesting:

Shall be as follows:

4.5.1 Bars: In accordance with AMS 2371.

4.5.2 Forgings: In accordance AMS 2374.