SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS7728 | REV. H

Issued 1963-07
Revised 2000-06
Noncurrent 2006-05
Reaf Nonc 2012-04

Superseding AMS7728G

Iron-Nickel-Cobalt Alloy, Sheet, Strip, and Plate
53Fe - 29Ni - 17Co
Low Expansion Glass Sealing, Annealed

K94610

RATIONALE

AMS7728H 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/AMS7728H

1. SCOPE:

1.1 Form:

This specification covers an iron-nickel-cobalt alloy in the form of sheet, strip, and plate.

1.2 Application:

These 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 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 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 112	Determining the Average Grain Size
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 impurities not exceeding the percentages by weight shown in Table 1; composition shall be determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Maximum Impurities

Element	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+A1+Mg+Zr	0.20

3.2 Condition:

Cold rolled and bright annealed, having a surface appearance comparable to the following commercial corrosion-resistant steel finishes as applicable (See 8.2).

3.2.1 Sheet: No. 2D finish

3.2.2 Strip: No. 1 strip finish

3.3 Properties:

The product shall conform to the following requirements:

3.3.1 As Received:

3.3.1.1 Average Grain Size: Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112.

3.3.1.2 Hardness: Shall be not higher than shown in Table 2, or equivalent (See 8.3), determined in accordance with ASTM E 18.

TABLE 2 - Maximum Hardness

Nominal Thickness Inch	Nominal Thickness Millimeters	Hardness HRB
0.100 and under	2.54 and under	82
Over 0.100	Over 2.54	85

3.3.2 After Reannealing: Specimens to determine conformance to the following requirements shall be reannealed by heating in a hydrogen atmosphere to 900 °C ± 15 (1652 °F ± 27), holding at heat for 60 minutes ± 5, further heating to 1100 °C ± 15 (2012 °F ± 27), holding at heat for 15 minutes ± 3, cooling from 1100 °C ± 15 (2012 °F ± 27) to 200 °C (392 °F) or below in the hydrogen atmosphere at a rate not greater than 5 °C (9 °F) per minute, and air cooling to room temperature; specimens may be cooled to room temperature between the 900 °C (1652 °F) and 1100 °C (2012 °F) heating periods.

3.3.2.1 Coefficient of Thermal Expansion: Shall be as shown in Table 3, determined in accordance with ASTM E 228.

TABLE 3A - 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}

TABLE 3B - 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}

3.3.2.2 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 after cold soaking for not less than four 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 Thickness: Product over 1 inch (25 mm) wide shall be measured at least 3/8 inch (9.5 mm) from the edge and shall be as shown in Table 4.

TABLE 4A - Thickness Tolerances, Inch/Pound Units

Nominal Thickness Inch	Tolerance, Inch Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges Up to 3.0 Inches, excl	Tolerance, Inch Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges 3.0 to 6.0 Inches, incl	Tolerance, Inch Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges Over 6.0 to 12.0 Inches, incl	Tolerance, Inch Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges Over 12.0 to 16.0 Inches, incl
Up to 0.006, excl	0.0005	0.005	--	--
0.006 to 0.009, incl	0.00075	0.00075	--	--
Over 0.009 to 0.010, incl	0.001	0.001	0.001	0.001
Over 0.010 to 0.011, incl	0.001	0.001	0.001	0.0015
Over 0.011 to 0.016, incl	0.001	0.001	0.0015	0.0015
Over 0.016 to 0.019, incl	0.001	0.001	0.0015	0.002
Over 0.019 to 0.025, incl	0.001	0.0015	0.002	0.002
Over 0.025 to 0.028, incl	0.0015	0.0015	0.002	0.002
Over 0.028 to 0.034, incl	0.0015	0.002	0.0025	0.0025
Over 0.034 to 0.049, incl	0.002	0.0025	0.003	0.003
Over 0.049 to 0.068, incl	0.0025	0.003	0.003	0.003
Over 0.068 to 0.099, incl	0.003	0.003	0.003	0.004
Over 0.099 to 0.160, incl	0.004	0.004	0.004	0.004
Over 0.160 to 0.189, incl	0.005	0.005	+0.020	+0.020
Over 0.189 to 0.250, incl	--	--	+0.046	+0.046
Over 0.250 to 0.375, incl	--	--	+0.046	+0.046
Over 0.375 to 0.500, incl	--	--	+0.054	+0.054
Over 0.500 to 0.750, incl	--	--	+0.054	+0.054
Over 0.750 to 1.000, incl	--	--	+0.060	+0.060

TABLE 4B - Thickness Tolerances, SI Units

Nominal Thickness mm	Tolerance, mm Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges Up to 7.6 mm, excl	Tolerance, mm Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges 76 to 152 mm, incl	Tolerance, mm Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges Over 152 to 305 mm, incl	Tolerance, mm Plus and Minus Except as Shown (See 3.5.1.1) Width Ranges Over 305 to 406 mm, incl
Up to 0.15, excl	0.013	0.013	--	--
0.15 to 0.23, incl	0.0190	0.0190	--	--
Over 0.23 to 0.25, incl	0.025	0.025	0.025	0.025
Over 0.25 to 0.28, incl	0.025	0.025	0.025	0.038
Over 0.28 to 0.41, incl	0.025	0.025	0.038	0.038
Over 0.41 to 0.48, incl	0.025	0.025	0.038	0.05
Over 0.48 to 0.64, incl	0.025	0.038	0.05	0.05
Over 0.64 to 0.71, incl	0.038	0.038	0.05	0.05
Over 0.71 to 0.86, incl	0.038	0.05	0.064	0.064
Over 0.86 to 1.24, incl	0.05	0.064	0.08	0.08
Over 1.24 to 1.73, incl	0.064	0.08	0.08	0.08
Over 1.73 to 2.51, incl	0.08	0.08	0.08	0.10
Over 2.51 to 4.06, incl	0.10	0.10	0.10	0.10
Over 4.06 to 4.80, incl	0.13	0.13	+0.51	+0.51
Over 4.80 to 6.35, incl	--	--	+1.17	+1.17
Over 6.35 to 9.52, incl	--	--	+1.17	+1.17
Over 9.52 to 12.70, incl	--	--	+1.37	+1.37
Over 12.70 to 19.05, incl	--	--	+1.37	+1.37
Over 19.05 to 25.40, incl	--	--	+1.52	+1.52

3.5.1.1 For widths over 6.00 to 16.00 inches (152 to 406 mm), inclusive, the minus tolerance for nominal thicknesses over 0.160 to 0.189 inch (4.06 to 4.80 mm), inclusive, shall be 0.000 and for nominal thicknesses over 0.189 inch (4.80 mm) shall be -0.010 inch (-0.25 mm).

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:

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