Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 7726C
Superseding AMS 7726B
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ALLOY WIRE, LOW EXPANSION, GLASS SEALING
53Fe - 29Ni - 17Co

1. SCOPE:

1.1 Form: This specification covers a low-expansion iron-nickel-cobalt alloy in the form of wire.

1.2 Application: Primarily for the fabrication of lead wires and other electronic elements to be sealed to hard glasses during the assembly of electronic components.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock
AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B95 - Linear Expansion of Metals
ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E112 - Estimating the Average Grain Size of Metals
ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall be approximately 53% iron, 29% nickel, and 17% cobalt by weight with residual elements not exceeding the following percentages by weight; composition shall be determined by wet ø chemical methods in accordance with ASTM E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	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

3.2 Condition: Cold drawn and bright annealed.

3.3 Properties: Wire shall conform to the following requirements:

3.3.1 Grain Size: Shall be predominantly 5 or finer with occasional grains as large as 3 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

ø 3.3.2 Hardness: Shall be not higher than 82 HRB or equivalent, determined in accordance with ASTM E18.

3.3.3 Coefficient of Thermal Expansion: Shall be as specified in Table I, determined in accordance with ASTM B95 on specimens reannealed by heating in a hydrogen atmosphere to 900°C ± 15 (1650°F ± 25), holding at heat for 60 min. ± 5, followed by heating in a hydrogen atmosphere to 1100°C ± 15 (2010°F ± 25), holding at heat for not less than 15 min., and cooling in the hydrogen atmosphere to 200°C (390°F) or lower at a rate not exceeding 5 C (9 F) deg per minute. The specimens may be cooled to room temperature between the 900°C (1650°F) and the 1100°C (2010°F) heating periods.

TABLE I

Temperature Range	Average Linear Coefficient of Thermal Expansion (mm/mm)/Deg Celsius
30°C to 400°C	$4.60 \text{ to } 5.20 \times 10^{-6}$
30°C to 450°C	$5.10 \text{ to } 5.50 \times 10^{-6}$

TABLE I (IP)

Temperature Range	Average Linear Coefficient of Thermal Expansion In. per In. per Deg Fahrenheit
86°F to 752°F	$2.56 \text{ to } 2.89 \times 10^{-6}$
86°F to 842°F	$2.83 \text{ to } 3.06 \times 10^{-6}$

3.3.4 Temperature of Transformation: The temperature of transformation from gamma to alpha phase shall be not higher than -78°C (-109°F), determined on specimens annealed as in 3.3.3 by expansion measurements in accordance with ASTM B95 or by metallographic examination.

3.3.5 Glass Seal Test: Wire shall produce, with Corning Glass 7052 or equivalent, a glass-to-metal seal free from bubbles. The seal shall be free from cracks after immersion in a mixture of dry ice and acetone maintained at -80°C ± 2 (-112°F ± 4). Annealing after the sealing operation to relieve stresses in the glass is permissible. When specified by purchaser, the seal produced in this test shall meet additional requirements of standards supplied to the manufacturer by the purchaser.

3.4 Quality: Wire, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the wire.

3.5 Tolerances: Unless otherwise specified, tolerances shall conform to the following:

3.5.1 Diameter or Thickness: Shall be as specified in Table II.

TABLE II

Nominal Diameter or Distance Between Parallel Sides Inch	Tolerance, Inch plus and minus
0.002 to 0.0043, incl	0.0002
Over 0.0043 to 0.0079, incl	0.00025
Over 0.0079 to 0.0149, incl	0.0003
Over 0.0149 to 0.0199, incl	0.0004
Over 0.0199 to 0.0309, incl	0.0005
Over 0.0309 to 0.0409, incl	0.0006
Over 0.0409 to 0.0609, incl	0.0007
Over 0.0609 to 0.0809, incl	0.0008
Over 0.0809 to 0.1259, incl	0.0010
Over 0.1259 to 0.1569, incl	0.0015
Over 0.1569 to 0.250, incl	0.0020

TABLE II (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tolerance, Millimetre plus and minus
0.05 to 0.109, incl	0.005
Over 0.109 to 0.201, incl	0.0065
Over 0.201 to 0.378, incl	0.008
Over 0.378 to 0.505, incl	0.010
Over 0.505 to 0.785, incl	0.013
Over 0.785 to 1.039, incl	0.015
Over 1.039 to 1.547, incl	0.018
Over 1.547 to 2.055, incl	0.020
Over 2.055 to 3.198, incl	0.030
Over 3.198 to 3.985, incl	0.038
Over 3.985 to 6.35, incl	0.050

3.5.2 Roundness: Round wire shall not be out-of-round by more than one-half the total tolerance specified in Table II for the nominal diameter.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of wire shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to Ø the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform such confirmatory testing as he deems necessary to ensure that the wire conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), grain Ø size (3.3.1), hardness (3.3.2), coefficient of thermal expansion (3.3.3), temperature of transformation (3.3.4), quality (3.4), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for glass sealing (3.3.5) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless Ø frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2371 and the following; a lot shall be all wire of the same Ø nominal size from the same heat of alloy processed at the same time:

4.3.1 Sampling for coefficient of thermal expansion (3.3.3), temperature of transformation (3.3.4), and Ø glass sealing tests shall be as agreed upon by purchaser and vendor.

4.4 Reports:

4.4.1 The vendor of wire shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat and the results of tests on each lot to determine conformance to the other acceptance test requirements of this specification. This report shall include the purchase order number, lot number, AMS 7726C, nominal size, and quantity from each lot.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 7726C, contractor or other direct supplier of wire, part number, and quantity. When wire for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of wire to determine conformance to the requirements of this specification, and shall include in the report a statement that the wire conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

Ø 4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.

5. PREPARATION FOR DELIVERY:

Ø 5.1 Identification: Wire shall be identified in accordance with AMS 2806.

5.2 Packaging:

5.2.1 Coils and bundles of straight lengths of wire shall be wrapped in burlap or other suitable wrapping and tightly bound or shall be suitably packaged in boxes to prevent damage during shipment.