

AEROSPACE MATERIAL SPECIFICATION

SAE

AMS 4771F

Submitted for recognition as an American National Standard

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Superseding AMS 4771E

BRAZING, FILLER METAL, SILVER
50Ag - 16Cd - 15.5Zn - 15.5Cu - 3.0Ni
1170° - 1270°F (632° - 688°C) Solidus-Liquidus Range

UNS P07501

1. SCOPE:

- 1.1 Form: This specification covers a silver alloy in the form of wire, rod, sheet, strip, foil, pig, powder, shot, and chips and a viscous mixture (paste) of powder in a suitable binder.
 - 1.2 Application: Primarily for joining ferrous metals, including austenitic steels and alloys, where high joint strength up to 400°F (204°C) is required, and for joining nonferrous metals except those having base of aluminum or magnesium.
 - 1.3 WARNING: Numerous scientific studies have determined that cadmium presents a health hazard to persons who are exposed to it.
 - 1.4 Safety - Hazardous Materials: While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.
- ## 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.

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2.1.1 Aerospace Material Specifications:

AMS 2222 - Tolerances, Copper and Copper Alloy Sheet, Strip, and Plate
 MAM 2222 - Tolerances, Metric, Copper and Copper Alloy Sheet, Strip, and Plate
 AMS 2224 - Tolerances, Copper and Copper Alloy Wire
 MAM 2224 - Tolerances, Metric, Copper and Copper Alloy Wire
 AMS 2825 - Material Safety Data Sheets

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 214 - Sieve Analysis of Granular Metal Powders
 ASTM E 56 - Chemical Analysis of Silver Brazing 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-2073-1 - DOD Materiel, Procedures for Development and Application of Packaging Requirements

2.4 AWS Publications: Available from American Welding Society, P.O. Box 351040, Miami, FL 33135-1040.

ANS Z49.1 - Safety in Welding and Cutting

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E 56, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Silver	49.0	51.0
Cadmium	15.0	17.0
Zinc	13.5	17.5
Copper	14.5	16.5
Nickel	2.5	3.5
Other Elements, total (3.1.1)	--	0.15

3.1.1 Determination not required for routine acceptance.

3.1.2 The requirements of 3.1 apply to paste after removal of the binder.

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Wire: Cold drawn or cold rolled, as ordered, annealed, and cleaned.

3.2.2 Rod: Cold drawn, cold rolled, or extruded, as ordered, in hard temper, and cleaned.

3.2.3 Sheet, Strip, and Foil: Cold rolled, in hard temper.

3.2.4 Pig, Powder, Shot, and Chips: As fabricated.

3.2.5 Paste: Shall consist of 84 - 90% by weight powder in a suitable binder and shall not contain flux.

3.3 Properties: Filler metal shall conform to the following requirements:

3.3.1 Color: Shall be yellow-white.

3.3.2 Flatness: When unrolled, strip and foil shall lie flat with no undue tendency to recoil.

3.3.3 Paste:

3.3.3.1 Paste shall have a shelf life of not less than six months from date of manufacture; not more than thorough mixing shall be required to restore paste for use during that time.

3.3.3.2 Paste shall leave no adherent residue when heated in a protective atmosphere to 1000°F (538°C) or higher.

3.4 Quality: The product as received by purchaser, shall be uniform in color, quality, and condition and free from foreign materials and from imperfections detrimental to its working qualities. Wire, rod, sheet, strip, and foil shall be clean, sound, bright, and free from slivers, splitting, ragged edges, damaged ends, and other injurious imperfections. Pig, powder, shot, and chips shall have a metallic luster.

3.5 Sizes and Tolerances: The product shall be supplied in the following standard sizes and to the tolerances shown:

3.5.1 Wire and Rod:

3.5.1.1 Nominal Diameters:

Inch		Millimeters	
0.005	0.062	0.13	1.57
0.007	0.094	0.18	2.39
0.010	0.125	0.25	3.18
0.015	0.175	0.38	4.44
0.025	0.188	0.64	4.78
0.031	0.225	0.79	5.72
0.040	0.250	1.02	6.35
0.047		1.19	

3.5.1.2 Diameter Tolerances for Drawn Wire and Rod: AMS 2224 or MAM 2224 as applicable to refractory alloys.

3.5.1.3 Diameter Tolerance for Rolled or Extruded Wire and Rod:

TABLE I

Nominal Diameter or Distance Between Parallel Sides Inch	Tolerance, Inch Plus and Minus	
	Rounds	Squares
0.031 to 0.062, incl	0.005	--
Over 0.062 to 0.125, incl	0.006	--
Over 0.125 to 0.188, incl	0.007	0.009
Over 0.188 to 0.250, incl	0.008	0.010

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimeters	Tolerance, Millimeter Plus and Minus	
	Rounds	Squares
0.79 to 1.57, incl	0.13	--
Over 1.57 to 3.18, incl	0.15	--
Over 3.18 to 4.78, incl	0.18	0.23
Over 4.78 to 6.35, incl	0.20	0.25

3.5.2 Sheet, Strip, and Foil:

3.5.2.1 Nominal Thicknesses:

Inch		Millimeter	
0.001	0.006	0.02	0.15
0.0015	0.008	0.038	0.20
0.002	0.010	0.05	0.25
0.003	0.014	0.08	0.36
0.004	0.020	0.10	0.51
0.005	0.030	0.13	0.76

3.5.2.2 Tolerances:

3.5.2.2.1 Thickness: Nominal thicknesses under 0.002 inch (0.05 mm) shall have a tolerance of ± 0.0002 inch ($\pm 5 \mu\text{m}$); nominal thicknesses 0.002 inch (0.05 mm) and over shall have tolerances conforming to AMS 2222 or MAM 2222 as applicable to refractory alloys.

3.5.2.2.2 Width of Individual Rolls: Nominal widths under 6 inches (152 mm) shall vary not more than ± 0.010 inch (± 0.25 mm) from the width ordered. Nominal widths 6 inches (152 mm) and over shall vary not more than ± 0.015 inch (± 0.38 mm) from the width ordered.

3.5.2.2.3 Length in Individual Roll: Shall not be limited except that no roll shall weigh more than 75 pounds (34 kg).

3.5.3 Powder shall be supplied in accordance with the following limits on particle size distribution unless some other distribution is specified. Tests shall be in accordance with ASTM B 214.

Nominal Size	U.S. Standard Sieve
-60 mesh	Through a No. 40 sieve - 100% Through a No. 60 sieve - 95% minimum Through a No. 325 sieve - 10% maximum
-100 mesh	Through a No. 60 sieve - 100% Through a No. 100 sieve - 95% minimum Through a No. 325 sieve - 15% maximum
-140C mesh	On a No. 100 sieve - 0.5% maximum On a No. 140 sieve - 10% maximum Through a No. 325 sieve - 20% maximum
-140F mesh	On a No. 100 sieve - 0.5% maximum On a No. 140 sieve - 10% maximum Through a No. 325 sieve - 55% maximum
-200 mesh	On a No. 140 sieve - 0.5% maximum On a No. 200 sieve - 10% maximum Through a No. 325 sieve - 65% maximum
-325 mesh	On a No. 200 sieve - 0.5% maximum On a No. 325 sieve - 10% maximum Through a No. 325 sieve - 90% minimum

3.5.3.1 When a nominal size is not specified, -140F mesh shall be supplied.

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 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: Tests for all technical requirements are acceptance tests and shall be performed on each lot.

4.3 Sampling and Testing: Shall be in accordance with the following:

4.3.1 Composition: One sample from each lot.

4.3.2 Properties: One sample from each lot.

4.3.3 Other Technical Requirements: As agreed upon by purchaser and vendor.

- 4.3.4 A lot shall be all product, other than powder or paste, which has been tested and found to conform to 3.1 and in the same temper and size and presented for vendor's inspection at one time.
- 4.3.5 A lot of powder shall be a uniform blend of powder produced from one or more furnace charges and presented for vendor's inspection at one time.
- 4.3.6 A lot of paste shall be that paste produced from a single lot of powder combined with binder from the same manufacturing batch and presented for vendor's inspection at one time.
- 4.4 Reports: The vendor of the product shall furnish with each shipment a report showing the results of tests to determine conformance to the composition requirements and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 4771F, form, size, and quantity.
- 4.4.1 A material safety data sheet conforming to AMS 2825, or equivalent, shall be supplied to each purchaser prior to or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of the product for production use. Each request for modification of product formulation shall be accompanied by a revised data sheet for the proposed formulation.
- 4.5 Resampling and Retesting: Not applicable.
5. PREPARATION FOR DELIVERY:
- 5.1 Identification:
- 5.1.1 The product shall be identified as agreed upon by purchaser and vendor.
- 5.1.2 Each exterior container or package shall be permanently and legibly marked with not less than the following information:
- BRAZING FILLER METAL
AMS 4771F
LOT NUMBER _____
MANUFACTURER'S IDENTIFICATION _____
NOMINAL DIMENSIONS _____
WEIGHT _____
- 5.1.2.1 Each container and package of paste shall also be marked with the date of manufacture.