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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4769E

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Superseding AMS 4769D

Submitted for recognition as an American National Standard

SILVER ALLOY BRAZING FILLER METAL
45Ag - 24Cd - 16Zn - 15Cu
1125 to 1145 °F (607 to 618 °C) Solidus-Liquidus Range

UNS P07450

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 (207 °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.

Printed in U.S.A.
91-0942/ EG

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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.

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.

ANSI Z49.1 Safety in Welding and Cutting

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 56, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Silver	44.0	46.0
Cadmium	23.0	25.0
Zinc	14.0	18.0
Copper	14.0	16.0
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 (R) Rod: Cold drawn, cold rolled, or extruded, as ordered, in as-fabricated 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 (R) Paste: Paste not containing flux (3.2.5.1) shall be supplied unless paste containing flux (3.2.5.2) is specified.

3.2.5.1 Paste Without Flux: Shall consist of 84 to 90% by weight powder in a suitable binder.

3.2.5.2 (R) Paste Containing Flux: Shall consist of 55 to 80% by weight powder in a suitable binder and flux combination.

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 (R) Paste without flux 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, condition, 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:

TABLE 2 - Standard Diameter Sizes

Inch		Millimeters	
0.001	0.062	0.025	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 Tolerance: AMS 2224 or MAM 2224 as applicable to refractory alloys.

3.5.1.3 Diameter Tolerance for Rolled or Extruded Wire and Rod:

TABLE 3A - Diameter Tolerances, Inch/Pound Units

Nominal Diameter or Distance Between Parallel Sides Inch	Tolerance, Inch Plus and Minus Rounds	Tolerance, Inch Plus and Minus 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 3B - Diameter Tolerances, SI Units

Nominal Diameter or Distance Between Parallel Sides Millimeters	Tolerance, Millimeter Plus and Minus Rounds	Tolerance, Millimeter Plus and Minus 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:

TABLE 4 - Standard Thicknesses

Inch		Millimeter	
0.001	0.006	0.025	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 (±5 µm); 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 Sizes:

3.5.3.1 Mesh Designations: 60, 100, 140, 200, and 325.

3.5.3.2 Powder shall be supplied in accordance with the limits on particle size distribution shown in Table 5, unless some other distribution is specified. Tests shall be in accordance with ASTM B 214.

TABLE 5 - Particle Size Distribution

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

3.5.3.2.1 When mesh designation is not specified, 140F 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:

4.2.1 (R) Acceptance Tests: Tests for all technical requirements other than shelf life of paste (3.3.3.1) are acceptance tests and shall be performed on each lot.

4.2.2 (R) Periodic Tests: Tests for shelf life of paste (3.3.3.1) 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 in accordance with the following:

4.3.1 (R) Composition: For all product except powder, one sample from each lot; for powder, one sample from each furnace charge.

4.3.2 (R) Properties Except Shelf Life of Paste: 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, in the same temper and size, and presented for vendor's inspection at one time.

4.3.5 (R) A lot of powder shall be a uniform blend of powder produced from one or more furnace charges, each meeting the requirements of 3.1, 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 or numbers, AMS 4769E, 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.