SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE MAM 4778D

Issued JUL 1989
Revised FEB 1995
Reaffirmed SEP 2000
Cancelled MAR 2003

Superseding MAM 4778C

Nickel Alloy, Brazing Filler Metal
92Ni - 4.5Si - 3.1B
980 to 1040 °C Solidus-Liquidus Range

UNS N99630

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of March, 2003. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications.

AMS 4778 covers the same material.

"CANCELLED" specifications are available from SAE.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

1. SCOPE:

1.1 Form:

This specification covers a nickel alloy in the form of wire, rod, strip, foil, and powder and a viscous mixture (paste) of the powder in a suitable binder and procured in metric units.

1.1.1 AMS 4778 is the inch/pound version of this MAM.

1.2 Application:

This filter metal has been used typically for joining corrosion and heat resistant steels and alloys requiring corrosion and oxidation resistant joints with good strength at elevated temperatures, but usage is not limited to such applications. Also may be used as a corrosion and oxidation resistant hard coating.

1.3 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 applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

2.1 ASTM Publications:

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

ASTM B 214	Sieve Analysis of Granular Metal Powders
ASTM D 638M	Tensile Properties of Plastics (Metric)
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 354	Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-2073-1	DOD Material, Procedures for Development and Application of Packaging Requirements

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 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	- -	0.06
Silicon	4.00	5.00
Phosphorus	- -	0.02
Sulfur	- -	0.02
Boron	2.75	3.50
Cobalt (3.1.1)	- -	0.10
Titanium	- -	0.05
Aluminum	- -	0.05
Iron (3.1.2)	- -	0.50
Zirconium	- -	0.05
Selenium (3.1.1)	- -	0.005 (50 ppm)
Nickel	remainder	

3.1.1 Determination not required for routine acceptance.

3.1.2 Iron to 1.50% by weight maximum is permissible in strip and foil products (tape form).

3.2 Condition:

The product shall be supplied in the following condition:

3.2.1 Wire and Strip: Powder bonded in a suitable plastic.

3.2.2 Rod: As cast, with fins and projections removed.

3.2.3 Foil and Powder: As fabricated.

3.2.4 Paste: Shall consist of 84 to 90% by weight powder in a suitable binder and, unless otherwise ordered, shall not contain flux.

3.3 Properties:

Filler metal shall conform to the following requirements:

3.3.1 Wire and Strip:

3.3.1.1 Burn-Off of Plastic: The plastic used for bonding powder to form wire and strip shall burn off, leaving no adherent residue, when the product is heated to a temperature not higher than 980 °C.

3.3.1.2 Tensile Strength: Shall be not lower than 2.5 MPa, determined in accordance with ASTM D 638M, Speed B.

3.3.1.3 Metallic Content: The ratio of volume of powder to volume of plastic binder shall be the largest possible consistent with the requirements of 3.3.1.1 and 3.3.1.2.

3.3.2 Rod, Foil, and Powder: When specified, properties shall be as agreed upon by purchaser and vendor.

3.3.3 Paste:

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

3.3.3.2 Paste, without flux, shall leave no adherent residue when heated in a protective atmosphere to a temperature higher than 540 °C.

3.3.4 When used as a hard coating, alloy shall melt quickly and shall flow freely under neutral oxy-acetylene flame, without bubbling or boiling, to produce an adherent deposit free from porosity due to blow-holes, gas cavities, or slag inclusions.

3.3.4.1 Alloy, deposited as in 3.3.4, shall have hardness not lower than 25 HRC, or equivalent (See 8.3), determined in accordance with ASTM E 18.

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. Rod and powder shall have a metallic luster. Wire, strip, and foil shall be clean, sound, smooth, and free from ragged edges, splitting, damaged ends, and other imperfections detrimental to usage of the product.

3.5 Sizes and Tolerances:

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

3.5.1 Wire:

3.5.1.1 Diameter Standard Sizes: Shall be 0.8, 1.6, 3.2, and 4.8 millimeters.

3.5.1.2 Diameter Tolerances: Shall be ±0.10 millimeter.

3.5.2 Rod:

3.5.2.1 Nominal Dimensions: Shall be as ordered.

3.5.2.2 Diameter Tolerances: Shall be as shown in Table 2.

TABLE 2 - Diameter Tolerances

Diameter Millimeters	Tolerance, % of Diameter
0.8	±20
1.6	±15
3.2	±10
4.8	±10

3.5.2.3 Concentricity: When long lengths are supplied as welded composites of cast lengths, diameters of the adjacent sections shall be concentric within ±0.8 millimeter.

3.5.3 Strip and Foil: When specified, properties shall be as agreed upon by purchaser and vendor.

3.5.4 Powder:

3.5.4.1 Mesh Designations: Shall be 60, 100, 140, 200, and 325.

3.5.4.2 Powder shall be supplied in accordance with the limits on particle size distribution shown in Table 3, unless another distribution is specified. Tests shall be in accordance with ASTM B 214.

TABLE 3 - Particle Size Distribution

Mesh Designation	U.S. Standard Sieve
60	Through a No. 40 sieve - 100% Through a No. 60 sieve - 95% min Through a No. 325 sieve - 10% max
100	Through a No. 60 sieve - 100% Through a No. 100 sieve - 95% min Through a No. 325 sieve - 15% max
140C	On a No. 100 sieve - 0.5% max On a No. 140 sieve - 10% max Through a No. 325 sieve - 20% max
140F	On a No. 100 sieve - 0.5% max On a No. 140 sieve - 10% max Through a No. 325 sieve - 55% max

TABLE 3 - Particle Size Distribution (Continued)

Mesh Designation	U.S. Standard Sieve
200	On a No. 140 sieve - 0.5% max On a No. 200 sieve - 10% max Through a No. 325 sieve - 65% max
325	On a No. 200 sieve - 0.5% max On a No. 325 sieve - 10% max Through a No. 325 sieve - 90% min

3.5.4.2.1 When a mesh designation 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:

4.2.1 Acceptance Tests: 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 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 is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with the following:

4.3.1 Composition: One sample shall be taken from each furnace charge except that powder produced from consecutive furnace charges and collected together, without teardown of the atomizing equipment, shall constitute a batch, from which one sample shall be taken.

4.3.2 Properties Except Shelf Life of Paste: One sample from each lot.

4.3.2.1 A lot shall be all product, other than powder or paste, which has been tested and found to conform to Table 1, in the same temper and size, and presented for vendor's inspection at one time.

4.3.2.2 A lot of powder shall be a uniform blend of powder produced from one or more furnace charges, each meeting the requirements of Table 1, as modified by 4.3.1, and presented for vendor's inspection at one time.