



Designation: F106 – 24

Standard Specification for Brazing Filler Metals for Electron Devices¹

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1. Scope

1.1 This specification covers requirements for filler metals suitable for brazing internal parts and other critical areas of electron devices in a nonoxidizing atmosphere (**Note 1**).

1.2 These materials are available in strip or wire or preforms made by blanking the strip or bending the wire. Powders are also available.

NOTE 1—Brazing filler metals for general applications are specified in AWS Specification A 5.8.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards*:²

B214 Test Method for Sieve Analysis of Metal Powders

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

F19 Test Method for Tension and Vacuum Testing Metalized Ceramic Seals (Withdrawn 2023)³

2.2 *American Welding Society*:⁴

A 5.8 Specification for Brazing Filler Metals

C 3.2 Method for Evaluating the Strength of Brazed Joints

¹ This specification is under the jurisdiction of ASTM Committee **B02** on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee **B02.05** on Precious Metals and Electrical Contact Materials and Test Methods.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126.

C 3.3 Recommended Practices for Design, Manufacture and Inspection of Critical Brazed Components

3. Classification

3.1 Brazing filler metals which are vacuum grade and are classified on the basis of chemical composition shown in **Table 1**. The difference between Grade 1 and 2 is the allowable impurity content. Grade 1 requires generally lower levels of impurities.

4. Ordering Information

4.1 Orders for material to this specification shall include the following information:

4.1.1 Quantity,

4.1.2 Dimensions and tolerances (**Table 2**),

4.1.3 Form (rod, bar, wire, etc.),

4.1.4 AWS classification (**Table 1**),

4.1.5 Grade 1,

4.1.6 Special requirements or exceptions, and

4.1.7 *Certification*—State if certification is required.

5. Materials and Manufacture

5.1 The brazing filler metals shall be vacuum grade and fabricated by any method that yields a product conforming to the requirements of this specification.

6. Chemical Composition

6.1 The finished brazing filler metal shall conform to the chemical composition shown in **Table 1** for Grade 1 material.

7. Mechanical Properties

7.1 Unless otherwise specified, wire shall be furnished in soft temper most suitable for hand feeding or ring winding on mandrels. A minimum elongation of 10 % in 2 in. (50.8 mm) indicates that the wire is annealed.

7.2 Unless otherwise specified, strip shall be furnished in hard as-rolled temper to facilitate clean blanking of thin shims or preforms. A maximum elongation of 5 % in 2 in. (50.8 mm) designates the strip as hard.

8. Dimensions and Permissible Variations

8.1 These materials must conform to the dimensional limitations listed in **Table 2** for strip, wire, and preforms or to **Table 3** for the size distribution of powdered brazing filler metals.

TABLE 1 Chemical Composition Requirements (in Wt. %) for Vacuum Grade Filler Metals for Electron Devices^{A,B,C}

NOTE 1—All finished material shall be reasonably smooth and bright and free from dirt, oil, grease, or other foreign material.

NOTE 2— A complete designation of specified material must include the grade designation number (for example, BVAg-6b, Grade 1).

NOTE 3—Single values shown are maximum percentages, except where otherwise specified.

AWS Classification	UNS Designation	Ag	Au	Cu	Ni	Co	Sn	Pd	In	Zn	Cd	Pb	P	C
Grade 1 – Vacuum grade filler metals														
BVAg-0	P07017	99.95 min.	...	0.05	...	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAg-6b	P07507	49.0–51.0	...	Remainder	...	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAg-8	P07727	71.0–73.0	...	Remainder	...	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAg-8b	P07728	70.5–72.5	...	Remainder	0.3–0.7	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAg-18	P07607	59.0–61.0	...	Remainder	...	...	9.5–10.5	...	...	0.001	0.001	0.002	0.002	0.005
BVAg-29	P07627	60.5–62.5	...	Remainder	...	...	...	...	14.0–15.0	0.001	0.001	0.002	0.002	0.005
BVAg-30	P07687	67.0–69.0	...	Remainder	...	...	...	4.5–5.5	...	0.001	0.001	0.002	0.002	0.005
BVAg-31	P07587	57.0–59.0	...	31.0–33.0	...	...	...	Remainder	...	0.001	0.001	0.002	0.002	0.005
BVAg-32	P07547	53.0–55.0	...	20.0–22.0	...	...	...	Remainder	...	0.001	0.001	0.002	0.002	0.005
BVAu-2	P00807	...	79.5–80.5	Remainder	...	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAu-3	P00351	...	34.5–35.5	Remainder	2.5–3.5	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAu-4	P00827	...	81.5–82.5	...	Remainder	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAu-7	P00507	...	49.5–50.5	...	24.5–25.5	0.06	...	Remainder	...	0.001	0.001	0.002	0.002	0.005
BVAu-8	P00927	...	91.0–93.0	...	...	...	...	Remainder	...	0.001	0.001	0.002	0.002	0.005
BVAu-9	P00354	...	34.5–35.5	Remainder	...	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVAu-10	P00503	...	49.5–50.5	Remainder	...	...	...	...	...	0.001	0.001	0.002	0.002	0.005
BVPd-1	P03657	...	...	...	0.06	Remainder	...	64.0–66.0	...	0.001	0.001	0.002	0.002	0.005
Grade 2 – Vacuum grade filler metals														
BVCu-1x	C14181	...	...	99.99 min.	...	...	...	...	...	0.002	0.002	0.002	0.002	0.005

^AAll vacuum grade filler metals are considered to be spatter free (refer to Melting Test, Section 10).

^BAll other elements in addition to those listed in the table above, with a vapor pressure higher than 10^{-7} Torr at 932 °F (500 °C) (such as Mg, Sb, K, Na, Li, Ti, S, Cs, Rb, Sc, Hg, Tc, Sr, and Ca) are limited to 0.001 % max each for Grade 1 vacuum grade filler metals and 0.002 % max each for Grade 2 vacuum grade filler metals. The accumulative total of all these high vapor pressure elements including zinc, cadmium, and lead is limited to 0.010 % max. The total of other impurities not included in the preceding list is limited to 0.05 % max, except for BVCu-1x, which shall be 0.01 max.

^C For the braze alloys shown, analysis shall regularly be made only for the major alloying elements specified and the elements Zn, Cd, Pb, P, C (by Melting Test), Hg, Mg, and Sb. However, the presence of the other elements (listed above in Footnote B), with a vapor pressure higher than 10^{-7} Torr at 932 °F (500 °C), outside the limits specified shall constitute cause for rejection of the material.

TABLE 2 Dimensional Tolerances (All Plus or Minus)

Width Tolerances, in. (mm)		
Thickness	8 in. (200 mm) wide and under	Over 8 in. (200 mm) wide
Less than 0.020 (0.5)	0.005 (0.125)	0.015 (0.38)
0.020 to 0.050 (0.5 to 1.25), incl	0.010 (0.250)	0.015 (0.38)
Thickness Tolerances—Strip		
Thickness, in. (mm)	8 in. (200 mm) wide and under	Over 8 in. (200 mm) wide
Up to 0.002 (0.05), incl	0.0002 (0.005)	0.0005 (0.0125)
Over 0.002 to 0.003 (0.05 to 0.075), incl	0.0003 (0.0075)	0.0006 (0.015)
Over 0.003 to 0.004 (0.075 to 0.10), incl	0.0004 (0.010)	0.0007 (0.018)
Over 0.004 to 0.006 (0.10 to 0.15), incl	0.0005 (0.0125)	0.0008 (0.02)
Over 0.006 to 0.013 (0.15 to 0.33), incl	0.0010 (0.025)	0.0013 (0.033)
Over 0.013 to 0.021 (0.33 to 0.53), incl	0.0015 (0.038)	0.0018 (0.046)
Over 0.021 to 0.026 (0.53 to 0.66), incl	0.0020 (0.05)	0.0020 (0.05)
Over 0.026 to 0.050 (0.66 to 0.125), incl	0.0020 (0.05)	0.0050 (0.125)
Camber Tolerances—Strip (Edgewise Bowl)		
0.5 in. (12.5 mm) max in 6 ft (1.8 m)		
Diameter Tolerances—Wire		
Diameter, in. (mm)	Tolerance, in. (mm)	
0.010 to 0.020 (0.250 to 0.5)	0.0003 (0.0075)	
Over 0.020 to 0.030 (0.5 to 0.75)	0.0005 (0.0125)	
Over 0.030 to 0.040 (0.75 to 1.0)	0.0007 (0.018)	
Over 0.040 to 0.050 (1.0 to 1.25)	0.0008 (0.02)	
Over 0.050 to 0.060 (1.25 to 1.5)	0.0010 (0.025)	
Over 0.060 to 0.080 (1.5 to 2.0)	0.0015 (0.038)	
Over 0.080 to 0.250 (2.0 to 6.3)	0.0020 (0.05)	