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SUPERSEDING
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FEDERAL SPECIFICATION

BRAZING ALLOY, GOLD

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope—This specification covers two types of gold brazing alloy; one for brazing wrought and cast gold appliances as in dental prosthetic procedures, and the other primarily for brazing component parts in electron tube assemblies.

1.2 Classification.

1.2.1 *Types and classes.* — Brazing alloys shall be furnished in the following types and classes, as specified (see 6.2).

Type I. — Gold-silver alloy for use with golds of the following classes:

Class 1—16-carat gold.

Class 2—18-carat gold.

Class 3—20-carat gold

Class 4—22-carat gold.

Type II.—Gold-copper alloy for use in brazing parts in electron tube assemblies:

Class 1—FS-BCuAu-1.

Class 2—FS-BCuAu-2.

2. APPLICABLE SPECIFICATIONS, STANDARDS, AND OTHER PUBLICATIONS

2.1 Specifications and standards.—The following specifications and standards, of the issues in effect on date of invitation for bids, form a part of this specification:

Federal Specifications:

PPP-B-566 — Boxes, Folding, Paperboard.

PPP-B-585—Boxes; Wood, Wirebound.

PPP-B-601 — Boxes, Wood, Cleated, Plywood.

PPP-B-621 — Boxes, Wood, Nailed and Lock-Corner.

PPP-B-676—Boxes, Set-Up, Paperboard.

Federal Standards:

Fed. Std. No. 102—Preservation, Packaging and Packing Levels.

Fed. Std. No. 123—Marking for Shipment and Storage (Civilian Agencies).

Fed. Test Method Std. No. 151—Metals; Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications, Standards, and Handbooks and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, Seattle, and Washington, D. C.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks

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and the Index of Federal Specifications, Standards, and Handbooks from established distribution points in their agencies.)

Military Specifications:

MIL–B–10377—Box, Wood, Cleated, Veneer, Paper Overlaid.

MIL–L–10547 — Liners, Case, Waterproof.

Military Standards:

MIL–STD–105 — Sampling Procedures and Tables for Inspection by Attributes.

MIL–STD–129—Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publication.—The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply:

National Bureau of Standards Publication:

Journal of Research Volume 20, RP 1103 —New Procedure for the Analysis of Dental Gold Alloys. Raleigh Gilchrist.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Price may be obtained from the Superintendent of Documents.)

3. REQUIREMENTS

3.1 Material. — Gold brazing alloys shall have the chemical composition shown in table I for the type and class specified. Material shall meet the requirements for chemical composition, when tested as specified in 4.4.1.1 and 4.4.1.2.

3.2 Forms and dimensions.

3.2.1 *Type I.*—Type I alloy shall be in the form of strips and of the dimensions and tolerances shown in table II.

3.2.2 *Type II.*—Type II alloy shall be of the forms shown in table II. Wire and strip forms shall be of the dimensions and tolerances specified. Preformed rings, washers, punchings, etc. shall be furnished in the dimensions and tolerances as agreed upon between the procuring agency and supplier at the time of purchase. (See 6.2.)

3.3 Weight (for type I).—Weight for type I alloy shall be one-pennyweight (dwt.) or two-pennyweight strips as specified (see 6.2). Weight tolerance for type I alloy shall be not greater than minus 1.0 percent on individual strips. Random lots of ten strips each may

TABLE I.—*Chemical composition*

Type	Class	Fineness of gold parts/1000	Gold percent		Silver percent		Copper percent	Other elements total (percent)
			Min.	Max.	Min.	Max.		
I	1	580	53.0	---	23.0	27.0	---	---
	2	650	65.0	---	12.0	16.0	---	---
	3	730	73.0	---	6.0	10.0	---	---
	4	800	80.0	---	4.0	8.0	---	---
II	1	375	37.25	37.75	---	---	Remainder	0.005[1]
	2	800	79.75	80.25	---	---	Remainder	0.005[1]

[1] Alloy shall contain not more than 0.005 percent volatile impurities such as zinc or cadmium, and shall be oxygen-free when specified (see 6.2). When vacuum tube applications are specified, FS–BCuAu–1 alloy shall contain not more than 0.002 percent zinc, 0.002 percent cadmium, 0.3 percent silver, 0.020 percent phosphorus, 0.010 percent carbon, 0.002 percent chromium, and not more than 0.005 percent other elements (each). (See 6.2.)

TABLE II.—*Dimensions and tolerances*

Type	Form	Dimensions (inch)	Tolerances plus and minus (inch)	
			Round	Square or Rectangular
I	Strip	⅛ width	-----	1/64
		0.0125 thickness	-----	0.0013
II	Drawn Wire	Diameter (round) or width (square)		
		0.010 to 0.020, incl.	0.0003	-----
		Over 0.020 to 0.030, incl.	0.0005	-----
		Over 0.030 to 0.040, incl.	0.0007	-----
		Over 0.040 to 0.050, incl.	0.0008	-----
		Over 0.050 to 0.060, incl.	0.0010	-----
		Over 0.060 to 0.080, incl.	0.0015	-----
		Over 0.080 to 0.250, incl.	0.0020	0.004
	Rolled or extruded wire	Diameter (round) or width (square)		
		1/32 to 1/16, incl.	0.005	-----
		Over 1/16 to ⅛, incl.	0.006	-----
		Over ⅛ to 5/16, incl.	0.007	0.009
		Over 5/16 to ¼, incl.	0.008	0.010
	Strip	Thickness[1]		
		0.006 and under	-----	[2]
		Over 0.006 to 0.013, incl.	-----	0.0010
		Over 0.013 to 0.021, incl.	-----	0.0015
		Over 0.021 to 0.026, incl.	-----	0.0020

[1] Tolerance specified for thickness is for strips under 8 inches in width. Standard sheet and strip tolerance shall apply for strips over 8 inches in width.

[2] Plus or minus 5 percent but not less than ± 0.0001 inch.

have a weight tolerance not greater than minus 0.1 percent. Weight of strips shall be tested in accordance with the method as specified in 4.4.2.3.

3.4 Fusion characteristics for type I alloy.—Gold brazing alloy shall exhibit the characteristics listed in table III, when tested for 30 seconds at the temperatures given, by the disk fusion test described in 4.4.2.1. The gold brazing alloy shall flow quickly and form a strong, smooth, close union when tested as specified in 4.4.2.2.

3.5 Identification marking.

3.5.1 *Type I.*—Each strip of gold brazing alloy shall be permanently marked or stamped with the fineness (parts per 1000) of the alloy and the carat of the alloy upon which it is to be used, at intervals averaging not more than 2⅜ inches, and with the manufacturer's identification in at least two places.

TABLE III.

Class	Attaches to plate but retains shape	Flows and loses all trace of original shape
	°/F	°/F
1 ----------	1,380	1,470
2 ----------	1,430	1,510
3 ----------	1,440	1,540
4 ----------	1,440	1,550

3.5.2 *Type II.*—The classification number or commercial alloy designation shall be clear-

ly marked on the outside and inside ends of wire and strip coils.

3.6 **Workmanship.**—Workmanship shall be first class throughout. Gold brazing alloy shall be uniform in all respects, free from ragged edges, damaged ends, dirt or other foreign elements which may affect the working qualities of the material.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 **Supplier responsibilities for inspection.**—Unless otherwise specified herein, the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.1.1 Inspection, as used in this specification, is defined as both examination (such as visual, auditory, etc., investigation without the use of special laboratory appliances or procedures) and testing (determination by technical means of physical and chemical properties) of the item.

4.1.2 *Certificates of quality.*—When available, certificates of quality, supplied by the manufacturer of the component or material, listing the specified test method and test results obtained, may be furnished in lieu of actual performance of such testing by the contractor.

4.2 **Sampling.**

4.2.1 *For examination.*—Sampling for examination shall be conducted in accordance with Military Standard MIL–STD–105.

4.2.2 *For tests.*—Sampling for tests shall be conducted in accordance with Military Standard MIL–STD–105, except that the acceptance number shall be zero (0) for all sample sizes.

	Inspection level	*Minimum sample size*
For disk fusion and brazing tests	L1	1
For weight of ten strip lots (type I only)	L3[1]	5
For weight of individual strips (type I only)	L4	10

For chemical composition.—Unless otherwise specified, not less than two pennyweights (3.10 g.) from each lot (control) number shall be selected for test (see 4.4.1).

[1] The unit of product for inspection shall be the ten strip lot.

4.2.3 Where possible, the same sample unit shall be used for the determination of two or more test characteristics.

4.3 **Examination.**—The alloy shall be examined to determine compliance with all requirements contained in this specification.

4.4 **Tests.**—Tests shall be conducted, as necessary, to determine compliance with specification requirements.

4.4.1 *Chemical composition.*

4.4.1.1 *Type I.*—The gold and siver content of the type I brazing alloy shall be determined by the method of Gilchrist, J. Research NBS 20: 745–771, (1938), or other methods demonstrated to be of equal accuracy. The determined values for metallic constituents shall be recorded to the nearest 0.5 percent. When a determined value falls midway between a half and a whole number, the whole number shall be recorded. In the event of dispute, analysis shall be by the Gilchrist method.

4.4.1.2 *Type II.*—Tests for chemical analysis of the type II brazing alloy shall be conducted in accordance with method 111 or 112, as specified in Federal Test Method Standard No. 151. Retests shall be permitted in accordance with Federal Test Method Standard No. 151.

4.4.2 *Physical tests (for type I).*

4.4.2.1 *Disk fusion test.*—Fusion tests shall be made in a recess in a solid silver block cast to fit the muffle of a platinum-wound porcelain fusing furnace and provided with suitable openings for a thermocouple. A refractory clay door block shall be used to minimize radiation losses. Fusion characteristics of gold brazing alloy shall be determined by noting the ability of $\frac{1}{16}$-inch disks punched from the test specimens: (a) To attach themselves to fluxed 24-carat gold plate at specified temperatures without losing their original shape; and (b) to fuse at specified temperatures, losing all trace of their original shape, and without peaks or unmelted cores.

4.4.2.2 *Brazing test.*—The suitability of the gold brazing alloy shall be tested by soldering a lap joint of gold plate of the carat for which the alloy is recommended. A strip of the gold shall be heated to redness, pickled in 50 percent sulfuric acid, washed with water, and bent into a tube approximately 25 millimeters long and 10 millimeters in diameter with a lapped seam. Borax may be applied to the lap. A small piece (approximately 1 millimeter square) of gold brazing alloy shall be placed at one end of the lap, and the band held over a flame until at red heat. The gold brazing alloy shall flow quickly along the lap at fusion temperature and form a strong, smooth, close union, and the soldered joint shall not open when the tube is placed in a vise, with the joint midway between the jaws, and flattened.

4.4.2.3 *Weight test.*—The weight shall be determined on an analytical or assay balance of suitable capacity, accuracy, and precision.

5. PREPARATION FOR DELIVERY

(For civil agency procurement Federal Standard No. 102 should be referred to for definitions and applications of the various levels of packaging and packing protection for supplies and equipment.)

5.1 Packaging.

5.1.1 *Unit of issue.*

5.1.1.1 *Type I.*—One strip of brazing alloy, as specified, constitutes one unit.

5.1.1.2 *Type II.*—As agreed upon between the procuring activity and supplier at the time of purchase.

5.1.2 *Quantities.*—Packaging and packing quantities shall be as specified in table IV.

5.1.2.1 *Packing variation permitted.* — If the required number of units to be shipped is less than the number of units specified to be overpacked in an exterior container, such units shall be packed in an exterior container of suitable size and design acceptable to a common carrier, which will insure safe delivery to destination.

5.1.3 *Level A.*

5.1.3.1 *Unit package.*—Each unit shall be packaged in an envelope of suitable size and design. Envelope shall be adequately secured to prevent accidental opening.

5.1.3.2 *Intermediate package.*—The number of units specified in table IV shall be wrapped with kraft paper or banded together with a kraft band. Wrapping or band shall

TABLE IV.—*Packaging and packing quantities*

Type	Unit package	Intermediate package	Protective package	Exterior container	Packaging and packing level
I	1 unit	20 units	100 units	1,000 units	A, B, or C
II	[1]	[1]	[1]	[1]	C

[1] As specified (see 6.2).

5.1.3.3 Unit package. Each unit package label shall bear the

be adequately secured to prevent accidental opening.

5.1.3.3 *Protective package.* — Protective package shall be a carton of appropriate size constructed in accordance with Federal Specification PPP–B–566 or PPP–B–676. Each carton shall be adequately secured to prevent accidental opening.

5.1.4 *Level C.*—Each unit shall be packaged in a standard commercial container of the size and kind commonly used, which will afford the degree of protection required for shipment and use of the product for its intended purpose within the continental limits of the United States of America.

5.2 **Packing.**

5.2.1 *Level A.*

5.2.1.1 *Exterior container.*—Exterior container shall be designed for type 2 load and constructed in accordance with Federal Specification PPP–B–585, style 3, for class 3 use; PPP–B–601, table II, using type III, class 1 plywood; PPP–B–621, table III; or Military Specification MIL–B–10377, table II.

5.2.1.2 *Case liner.*—Each level A box shall be lined with a waterproof case liner conforming to Military Specification MIL–L–10547. Closure and sealing shall conform to applicable paragraphs of appendix thereto.

5.2.1.3 *Strapping.* — Strapping (when required) shall be in accordance with applicable box specifications.

Note.—Strapping will not be required for shipment forwarded to a receiving activity within the continental limits of the United States for storage and redistribution.

5.2.2 *Level B.*

5.2.2.1 *Exterior container.*—Exterior container shall conform to Federal Specification PPP–B–601, table I, using type III, class 1 plywood, or shall be designed for type 2 load and constructed in accordance with Federal Specification PPP–B–585, style 3, for class 2 use; PPP–B–621, table I; or Military Specification MIL–B–10377, table I.

5.2.3 *Level C.*—Unless otherwise specified, brazing alloy shall be packed in substantial commercial containers of the type, size, and kind commonly used for the purpose, so constructed as to insure acceptance and safe delivery by common or other carriers, at the lowest rate, to the point of delivery called for in the contract or purchase order. Only one type and class of brazing alloy shall be packed in any one exterior container.

5.3 **Marking.**

5.3.1 *Civil agencies.*

5.3.1.1 *Unit, intermediate, and exterior containers.*—In addition to any special marking specified in the contract or order, containers shall be marked in accordance with Federal Standard No. 123.

5.3.2 *Military agencies.*

5.3.2.1 *Unit package.*—Each unit package shall be marked with stock number, item identification, unit, quantity, lot (control) number, and name of contractor, and shall also have printed thereon, or on a card inclosed therein, adequate instructions for use.

5.3.2.2 *Intermediate package.*—Each intermediate package shall be marked with stock number, item identification, unit, quantity, contract number, and name of contractor.

5.3.2.3 *Protective package.*—Each protective package shall be marked in accordance with section 5 of Military Standard MIL–STD–129.

5.3.2.4 *Exterior container.*—Exterior container shall be marked in accordance with Military Standard MIL–STD–129, except that no reference to item identification nor the word "gold" shall appear on the shipping

container. Service color and service symbol markings are required only on direct shipments from the contractor's plant to overseas activities.

6. NOTES

6.1 Intended use.

6.1.1 *Gold-silver alloys (type I).*—Type I alloys are used in prosthetic dentistry for joining gold alloy wires and similar wrought structures, and for brazing cast gold dental appliances, such as pontics and abutments in crown and bridgework.

6.1.2 *Gold-copper alloys (type II).*—Type II alloys employ the principle of capillary distribution to join together two or more members with closely fitted surfaces and at temperatures below the melting point of the metal of either member.

Brazing alloys of the FS–BCuAu classes are primarily used for joining parts in electron tube assemblies where gaseous inclusions are particularly undesirable. Their low vapor pressure make them particularly suited for this work. In electron tube applications these filler metals are usually applied by induction, furnace or resistance brazing in a reducing atmosphere or in a vacuum and with no flux. For other applications, a borax-boric acid flux is used. The two FS–BCuAu filler metals permit variation in brazing temperatures so that step brazing can be used.

6.2 Ordering data.—Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

(*a*) Title, number and date of this specification.
(*b*) Type and class required (see 1.2).
(*c*) When oxygen-free alloy is required for type II (see footnote [1] of table I).
(*d*) When vacuum tube application is required for type II (see footnote [1] of table I).
(*e*) Form and dimensions required for type II wire and strip (see 3.2.2).
(*f*) Form, dimensions, and tolerances required for preformed rings, washers, punchings, etc. (see 3.2.2).
(*g*) Weight required for type I (see 3.3).
(*h*) Quantities for packaging and packing for type II (see 5.1.2).
(*i*) Selection of applicable levels of packaging and packing (see 5.1 and 5.2).

6.3 Temperatures (for type II).—The solidus, liquidus, and the recommended brazing temperature ranges for the type II alloy are listed in table V.

TABLE V.

Alloy	Solidus °/F.	Liquidus °/F.	Brazing temperature range °/F.
BCuAu–1	1755	1815	1815 to 2000
BCuAu–2	1620	1630	1630 to 1850

Note.—Solidus and liquidus shown are for the nominal compositions in each classification.

The terms solidus and liquidus are well established in metallurgical usage. Their definitions are as follows:

Solidus: The highest temperature at which the metal is completely solid; in other words, the temperature at which melting starts.

Liquidus: The lowest temperature at which the metal is completely liquid; in other words, the temperature at which freezing starts.

6.4 Cleaning (for type II).—When brazing with any of the various processes, prebraze cleaning of the base metal is essential. The surface should be free from grease, oxides, scale, and dirt of any kind. Cleaning can be done chemically or mechanically. Grease or oil can be removed by a reliable degreasing solution such as trichloroethylene or trisodium phosphate. Oxide should be removed by a chemical bath or mechanically with a fine emery after degreasing. Steel grit, blasting, or sanding with a fine wheel can be used to remove surface scale.

6.5 **Selection of symbols (for type II).**—The basic classes of brazing filler metals adopted by the American Welding Society and the American Society for Testing Materials for similar brazing filler materials are identified by principal elements in their chemical compositions, as follows:

FS is for Federal Specification

B is for brazing filler metals (like the E for electrodes and the R for welding rods)

CuAu is for copper-gold, the principal elements of type II alloy.

The numbers following the letters indicate the particular composition within a group.

6.6 This specification does not include all types, classes, grades, sizes, etc., of the commodity indicated by the title of the specification, or which are commercially available, but is intended to cover the type, etc., normally procured to meet Federal Government requirements.

6.7 **Transportation description.**—Classified as precious metals. Not taken by freight. Ship via parcel post or express.

MILITARY INTERESTS:
Army—M
Navy—Md
Air Force.

PREPARING ACTIVITY:
Navy—Bureau of Medicine and Surgery (MMSA)

Copies of this specification may be purchased for 5 cents each.