Designation: B742 – 90 (Reapproved 2012)

Standard Specification for Fine Silver Electrical Contact Fabricated Material[1]

This standard is issued under the fixed designation B742; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers fine silver grade 99.9 % in fabricated form. The forms covered are tubing, rod, wire, strip, and sheet for electrical contact applications.

1.2 The electrical contact properties may vary dependent upon the method of manufacture (refer to 6.3).

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 standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to become familiar with all hazards, including those identified in the appropriate Material Safety Data Sheet (MSDS) for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B413 Specification for Refined Silver

B476 Specification for General Requirements for Wrought Precious Metal Electrical Contact Materials

3. Classification

3.1 This specification presently defines only one grade of fine silver, 99.90 % minimum silver. It differs from the Grade 99.90 referred to in Specification B413 in that the chemical limits are slightly different. The reason for this is that Specification B413 refers to "refined silver in cast bar form," whereas this Specification covers fabricated forms. The properties of silver are greatly dependent upon the amount and type of elements present, up to 0.10 %.

3.2 Other types of silver containing appreciably lesser amounts of impurities, and those with additives for special purposes, are not covered by this specification, because the mechanical properties can be appreciably different.

4. Ordering Information

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

4.1.1 Quantity (weight usually in troy ounces, or number of units).

4.1.2 Name of material (fine silver).

4.1.3 Temper.

4.1.4 Dimensions; thickness, width, length, diameter, coil size, or other pertinent sizes.

4.1.4.1 *Form of Material:* sheet, strip, disks, blanks, wire, shaped wire, or other.

4.1.4.2 *Form Furnished:* flat lengths, coils, rod, straight lengths, or other.

4.1.5 ASTM designation and date of issue.

4.1.6 Additions to the specification and supplementary requirements, if required.

5. General Requirements

5.1 The provisions of Specification B476 shall apply to all materials produced to this specification.

6. Manufacture

6.1 The materials used for making this product shall be of such quality and purity that the finished material will conform to the requirements and properties prescribed in this specification.

6.2 The material shall be produced by either hot or cold working operations. It should be finished by such cold working and annealing as may be necessary to meet the properties specified.

6.3 After the initial shipment and approval has been made, the supplier must notify the purchaser prior to making any significant changes in process techniques, basic formulation, or other factors that might affect the quality or the electrical

[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.

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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.

TABLE 1 Chemical Composition[A]

Element	Weight %
Silver	99.90 min (by difference)
Silver and copper	99.95 min
Copper	0.10 max
Nickel	0.002 max
Cadmium	0.005 max
Zinc	0.005 max
Lead	0.025 max
Iron	0.005 max
Aluminum	0.002 max
Bismuth	0.001 max
Total others	0.05 max
Total of all impurities	0.10 max

[A] Elements, such as phosphorus, sodium, and lithium are not natural impurities in this grade of silver and thus are not normally found in any appreciable quantities. However, since they may be detrimental for certain electrical contact applications, limits for these and other elements may be established by agreement between the purchaser and manufacturer. Refer to 7.2.

contact characteristics, such as weld resistance or erosion. Such changes in process shall be immediately brought to the attention of the purchaser for determination of the necessity for requalification.

7. Chemical Composition

7.1 Material produced under this specification shall meet the requirements of chemical composition prescribed in Table 1.

7.2 By agreement between the purchaser and the manufacturer, analysis may be required and limits established for elements or compounds not specified in the table of chemical composition.

8. Mechanical Properties

8.1 The material shall conform to the mechanical properties prescribed in Table 2 or Table 3.

8.2 Since it is not always possible to tension test some parts and shapes, the user and supplier should reach an agreement with respect to the type of hardness tests and the acceptable range that should be applicable.

8.3 All test specimens shall be full size when practical.

8.4 All tests shall be conducted at room temperature, 65 to 85°F (18 to 29°C).

9. Inspection and Testing

9.1 All material produced to this specification shall be inspected as detailed in the provisions of Specification B476.

10. Certification

10.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

11. Keywords

11.1 contact; electrical contact; fine silver; silver; wrought

TABLE 2 Mechanical Properties of Sheet and Strip

NOTE 1—These hardness values are listed as "Typical," because of the difficulty in establishing a range meaningful for all the thicknesses possible. If the purchaser desires hardness specifications, rather than tensile strengths, he shall reach agreement with the supplier as to the proper and suitable hardness scale and range for the particular size and form ordered.

Temper	Reduction in B & S Numbers (Reference)	Percent Reduction (Reference)	Ultimate Tensile Strength, psi (MPa)		Minimum Elongation in 2-in. (51 mm), %	Typical (see Note 1) Hardness Rockwell, 15 T
			Minimum	Maximum		
Annealed	0	0	24 000 (165)	30 000 (207)	25	59 max
½ H	2	21	30 000 (207)	37 000 (255)	8	72
Hard	4	37	37 000 (255)	44 000 (303)	3	76
Spring	8	60	44 000 (303)	51 000 (352)	1	80

TABLE 3 Mechanical Properties of Wire and Rod

Temper	Reduction in B & S Numbers (Reference)	Percent Reduction (Reference)	Ultimate Tensile Strength, psi (MPa)		Minimum Elongation in 2 in. (51 mm), %
			Minimum	Maximum	
Annealed	0	0	24 000 (165)	30 000 (207)	25
⅛ H	½	11	26 000 (179)	33 000 (228)	15
¼ H	1	21	30 000 (207)	37 000 (255)	4
½ H	2	37	39 000 (269)	46 000 (317)	4
Hard	4	60	42 000 (290)	49 000 (338)	2
Spring	8	84	46 000 (317)	54 000 (372)	1

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order, for agencies of the U.S. Government.

S1. Referenced Documents

S1.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

S1.1.1 *Federal Standards* [3]

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

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

S1.1.2 *Military Standards* [3]

MIL-STD-129 Marking for Shipment and Storage

S2. Quality Assurance

S2.1 *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or purchase order, the manufacturer may use his own or any other suitable facilities for the performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections and tests set forth when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

S3. Preparation for Delivery

S3.1 *Preservation, Packaging, Packing*

S3.1.1 *Civil Agencies*—The requirements of Fed. Std. No. 102 shall be referenced for definitions of the various levels of packaging protection.

S3.2 *Marking:*

S3.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

S3.2.2 *Civil Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. No. 123.

[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://dodssp.daps.dla.mil.

APPENDIX

(Nonmandatory Information)

X1. TYPICAL PROPERTY VALUES

X1.1 The following is a list of typical property values that are useful for engineering calculations in electrical contact design and application.

Electrical conductivity, % IACS (volume basis)	100 (Note X1.1)
Resistivity, μΩ·cm	1.72 (Note X1.1)
Freezing point	961.93°C (1763.5°F) (Note X1.2)
Density approximately 20°C	10.49 Mg/m ^{3} (g/cm ^{3})
Coefficient of thermal expansion, Linear at 0 to 20°C	19.68 μm/m·K (10.93 μin./in.°F)

NOTE X1.1—The typical values listed for conductivity and resistivity can vary. They depend upon the purity and the temper. For this reason, even ranges of 95 to 103 % IACS for electrical conductivity and 1.67 to 1.81 μΩ·cm for resistivity can be exceeded.

NOTE X1.2—The freezing point of silver is a defined fixed point, according to the International Practical Temperature Scale of 1968.[4]

[4] For further information, refer to *Symposium on Evolution of the International Practical Temperature Scale of 1968*, ASTM STP 565, ASTM, 1968.