



Designation: B477 – 21

Standard Specification for Gold-Silver-Nickel Electrical Contact Alloy¹

This standard is issued under the fixed designation B477; 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 U.S. Department of Defense.

1. Scope

1.1 This specification covers 75 % gold-22 % silver-3 % nickel alloy tubing, rod, wire, strip, and sheet material for sliding electrical contacts.

1.2 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.

1.3 *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 Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate safety, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

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

B476 Specification for General Requirements for Wrought Precious Metal Electrical Contact Materials
E384 Test Method for Microindentation Hardness of Materials

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.

3. Manufacture

3.1 Raw materials shall be of such quality and purity that the finished product will have the properties and characteristics prescribed in this specification.

3.2 The material shall be finished by such operations (cold working, heat treating, annealing, turning, grinding, or pickling) as are required to produce the prescribed properties.

4. Chemical Composition

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

5. Mechanical and Electrical Requirements

5.1 The contract or order may specify ultimate tensile strength and elongation, microhardness (Knoop or Vickers), or a combination of these mechanical properties as temper criterion. If the contract or order does not specify a temper criterion, then the criterion for temper designation will be ultimate tensile strength and elongation.

5.2 Mechanical properties shall conform to the listings of **Table 2**.

5.3 All test specimens shall be full size when practical.

5.4 All tests are to be conducted at room temperature, about 68°F (20°C).

6. General Requirements

6.1 Specification **B476** shall apply to all materials produced to this specification.

6.2 *Microhardness*, when performed, shall be in accordance with Test Method **E384**.

7. Inspection and Testing

7.1 Material furnished under this specification shall be inspected by the manufacturer as listed below:

7.1.1 Visual inspection at 10 \times ,

7.1.2 Temper test (hardness or tensile),

7.1.3 Dimensional tests, and

7.1.4 Spectrographic or chemical analysis when indicated by the purchase order.

7.2 The purchaser shall perform such tests as are required to verify the quality of material procured under this specification.

TABLE 1 Chemical Composition

Element	Weight Percent
Gold	74.2–75.8
Silver	21.4–22.6
Nickel	2.6–3.4
Selected base metals (lead, antimony, bismuth, tin, arsenic, cadmium, germanium, thallium, gallium, sulfur)	0.01 max, total
Total all base metal impurities (including above selected base metals)	0.2 max
Total noble metal impurities	0.1 max

TABLE 2 Mechanical Properties
Wire 0.004 to 0.060 in. (0.1 to 1.5 mm) Diameter and Strip 0.003 to 0.030 in. (0.08 to 0.8 mm) Thick Except as Noted

Properties	Annealed	Stress-Relieved	Work-Hardened (maximum)	Work-Hardened (standard)
Ultimate tensile strength, ksi	40 - 55	50 - 75	85 - 120	65 - 100
Elongation in 2 in. (51 mm), %	10 min	8 min	1 - 10	1 - 13
Knoop hardness ^A	85 - 115	120 - 160	175 - 220	150 - 200
Vickers hardness ^A	75 - 110	110 - 150	165 - 210	140 - 190

^A 100-g load (50 g under 0.005 in. (0.13 mm) thick).

8. Keywords

8.1 contacts; electrical contact alloy; gold alloy

APPENDIX

(Nonmandatory Information)

X1. TYPICAL PROPERTY VALUES

X1.1 **Table X1.1** contains a list of typical property values which are useful for engineering calculations in electrical contact design and application.

TABLE X1.1 Typical Property Values

	Temper			
	A	B	C	D
Resistivity, Ω-cmil/ft	...	73	...	73
μΩ-cm	...	12.1	...	12.1
Density, g/cm ³	15.8	15.8	15.8	15.8
Solidus temperature, °C	927	927	927	927
Linear coefficient of thermal expansion per °C (23–100 C)	...	14.8 × 10 ⁻⁶	...	14.8 × 10 ⁻⁶
Thermal EMF vs platinum (0–100 C) μV/°C	...	–3	...	–3
Softening voltage, mV	...	100	...	100
Melting voltage, mV	...	340	...	340
Fatigue strength (rotating-bending) at 10 ⁸ stress reversals				
psi	...	35 000	...	35 000
MPa	...	240	...	240
Modulus of elasticity in tension:				
psi	...	12 × 10 ⁶	...	12 × 10 ⁶
MPa	...	82 700	...	82 700
Proportional limit				
ksi	...	35	50	45
MPa	...	240	345	310
Brinell hardness (15 kg load):				
Wire or rod 0.061 to 0.187 in. (1.53 to 4.8 mm) dia				120–165