Designation: B541 – 24

Standard Specification for Gold Electrical Contact Alloy[1]

This standard is issued under the fixed designation B541; 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 a gold-rich, age-hardenable alloy in rod, wire, and strip form applicable to 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 The following precautionary statement pertains to the test method portion only, Section 8, of this specification. *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

B542 Terminology Relating to Electrical Contacts and Their Use

B899 Terminology Relating to Non-ferrous Metals and Alloys

E8/E8M Test Methods for Tension Testing of Metallic Materials

E384 Test Method for Microindentation Hardness of Materials

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms pertaining to this standard, reference shall be made to Terminology B542 and B899.

4. Materials and Manufacture

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

4.2 The material shall be finished by such operations (cold working, annealing, turning, grinding, age hardening, etc.) as are required to produce the prescribed properties.

5. Chemical Composition

5.1 Material produced under this specification shall meet the requirements of Table 1 for chemical composition.

6. Condition

6.1 This specification covers the conditions and forms listed in Table 2.

7. Mechanical Properties

7.1 Mechanical properties shall conform to Table 3, Table 4, Table 5, and Table 6 as appropriate.

7.2 The contract or order may specify ultimate tensile strength, 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.

7.3 Mechanical properties of flattened wire, less than 0.012 in. (0.305 mm) thick shall conform to Table 5.

8. Test Methods

8.1 Test methods are in accordance with Specification B476.

[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.

TABLE 1 Chemical Requirements

Element	Composition, Weight %	
	Nominal	Range
Gold	71.5	70.5–72.5
Platinum	8.5	8.0–9.0
Silver	4.5	4.0–5.0
Copper	14.5	14.0–15.0
Zinc	1.0	0.8–1.2
Cadmium	...	0.01 max
Total base metal impurities	...	0.2 max
Total platinum group metal impurities	...	0.2 max

TABLE 2 Conditions and Forms

Process	Symbol	Form		
		Wire	Strip	Rod
Annealed	A	X	X	X
Stress relieved	S-R	X	X	
Age hardened from solution annealed condition	HT-A	X	X	X
Age hardened from solution annealed and cold-worked condition	HT-CW	X	X	X

TABLE 3 Mechanical Properties of Wire (0.004 in. to 0.020 in. (0.101 mm to 0.508 mm) diameter)[A]

Property	Condition			
	A	S-R	HT-A	HT-CW
Tensile strength, ksi	85–110	130–170	130–165	150–210
Tensile strength, MPa	590–760	900–1170	900–1140	1030–1450
Elongation, % in 2 in. [51 mm]	20 min	5–12	7–14	2–10
Hardness, Knoop, HK[B]	200–240	270–340	300–350	325–400

[A] See 7.2.
[B] See 8.3.

TABLE 4 Mechanical Properties of Wire (0.021 in. to 0.080 in. (0.509 mm to 2.03 mm) diameter)[A]

Property	Condition			
	A	S-R	HT-A	HT-CW
Tensile strength, ksi	80–110	130–170	130–160	145–200
Tensile strength, MPa	550–760	900–1170	900–1100	1000–1380
Elongation, % in 2 in. [51 mm]	16 min	4–14	5–14	2–13
Hardness, Knoop HK_{100}[B]	180–240	270–340	270–340	290–370

[A] See 7.2.
[B] See 8.3.

TABLE 5 Mechanical Properties of Strip (0.003 in. to 0.020 in. (0.076 mm to 0.508 mm) thick)[A]

Property	Condition			
	A	S-R	HT-A	HT-CW
Tensile strength, ksi	85–115	125–160	130–160	150–190
Tensile strength, MPa	590–790	860–1100	900–1100	1030–1310
Elongation, % in 2 in. [51 mm]	12 min	3–13	3–15	2 min
Hardness, Knoop, HK[B]	200–250	270–340	300–375	315–385

[A] See 7.2.
[B] See 8.3.

8.2 All tension tests are in accordance with Test Methods E8/E8M and tensile specimens are full cross-section size when practical.

8.3 Hardness is in accordance with Test Method E384. Test material 0.005 in. (0.13 mm) in thickness (diameter) and larger using a 100-gf indenter load. Test material less than 0.005 in. in thickness (diameter) using a 50-gf indenter load. Make a minimum of five hardness indentions on each specimen. Make all indentions so that the long axis of the Knoop indenter is parallel to the rolling or drawing direction of the material. In the case Vickers hardness is required, a mutually agreeable hardness range should be determined by the producer and the user. The same load requirements as Knoop microhardness