



Designation: **B662 – 94 (Reapproved 2012) B662/B662M – 20**

## Standard Specification for Silver-Molybdenum Electrical Contact Material<sup>1</sup>

This standard is issued under the fixed designation ~~B662~~B662/B662M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope Scope\*

1.1 This specification covers electrical contact components made from silver-molybdenum by powder metallurgical procedures.

1.2 This specification covers compositions within the silver-molybdenum system ~~normally specified by users of contacts for electrical contact applications.~~

1.3 The values stated in either SI units or inch-pound units are to be regarded as standard. ~~No other units of measurement are included in this standard.~~ separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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~~ safety, health, and ~~health~~ environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.5 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:<sup>2</sup>

[B328 Test Method for Density, Oil Content, and Interconnected Porosity of Sintered Metal Structural Parts and Oil-Impregnated Bearings \(Withdrawn 2009\)](#)<sup>3</sup>

[B542 Terminology Relating to Electrical Contacts and Their Use](#)

### 3. Terminology

3.1 For terms related to electrical contacts and their use, refer to Terminology [B542](#).

### 4. Ordering Information

4.1 ~~Orders for this material under this specification shall include the following information:~~ Include the following information when placing orders for product under this specification:

4.1.1 ~~Dimensions (see Section and tolerances, 10);~~

4.1.2 ~~Chemical composition (see tables in the appendix as a guideline);~~ Alloy composition,

4.1.3 ~~Physical properties (see Section properties, 5 and the appendix as a guideline);~~

4.1.4 ~~Certification (see Section Certification, 13);~~ and

4.1.5 ~~Other features~~ requirements as agreed upon between the manufacturer and purchaser.

### 5. Materials and Manufacture

5.1 The materials shall be of such purity and soundness so as to be suitable for the intended application.

NOTE 1—Proprietary methods for the manufacture of these materials vary significantly among suppliers, and these methods influence such properties

<sup>1</sup> 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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<sup>2</sup> 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.

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

\*A Summary of Changes section appears at the end of this standard



as arc erosion, contact resistance, and the tendency to weld in service. Since the performance of contacts in a device depends on numerous factors outside the contact itself (opening speed, closing speed, contact pressure, contact bounce, environmental variations, assembly technique and variations, etc.), it is recommended that, as part of the qualification on initial samples, the user should functionally and electrically test the materials for all devices applicable to the material's use. This specification provides a means for the contact manufacturer and contact user to reach agreement on the details of the material to be supplied for a specific use, and reasonable assurance that future lots will be similar in properties and microstructure to the initial test or sample contacts supplied.

## 6. Chemical Composition

6.1 The material shall conform to chemical composition and impurity limits as agreed upon between the manufacturer and the purchaser.

6.2 The compositional requirements are affected by processing. [Table 1](#) covers infiltrated silver-molybdenum contact alloys, and [Table 2](#) covers pressed, sintered, and re-pressed silver-molybdenum contact alloys.

6.3 The chemical analysis of the alloy shall be made in accordance with the methods prescribed in the newest edition of Volume 01.02 of the *Annual Book of ASTM Standards* or by any other approved method agreed upon between the manufacturer and the purchaser.

6.4 These specification limits do not preclude the presence of other unnamed elements, impurities, or additives. Analysis shall be regularly made only for the minor elements listed in the table. However, if a user knows of elements that might be detrimental to their application or has other reasons for requiring analysis for specific elements, then agreement between manufacturer and purchaser for both limits and methods of analysis should be required for elements not specified.

## 7. Physical Properties-Property Requirements

7.1 The manufacturer and the purchaser shall agree on qualification tests for determination of physical properties.

**TABLE X1.1 Typical Chemical Ranges-1 Chemical Composition of Infiltrated Silver-Molybdenum Contacts-Contact Alloys**

Alloy	Composition, <sup>A</sup> weight, %		
	Class A1	Class A	Class B
Silver	33 to 37	38 to 42	48 to 52
Molybdenum	balance	balance	balance
Copper, max	0.5	0.5	0.5
Cobalt or nickel, max	0.5	0.5	0.5
Total impurities, max	1	1	1
Typical Properties			
	Class A1	Class A	Class B
Hardness, Rockwell B	80 to 100	72 to 92	60 to 85
Density, Mg/m <sup>3</sup>	10.3	10.3	10.3
Electrical conductivity, % IACS	35 to 45	45 to 50	50 to 55
Theoretical density, min, %	96	96	96
Properties			
	Class A	Class B	
Modulus of rupture: <sup>B</sup>			
—psi	135 000	110 000	
—MPa	931	758	
Young's modulus: <sup>B</sup>			
—psi	36.4 × 10 <sup>6</sup>	32 × 10 <sup>6</sup>	
—GPa	250	220	
Tensile strength: <sup>B</sup>			
—psi	55 000	45 000	
—MPa	379	310	
Coefficient of expansion: <sup>B</sup>			
—in./in.-°F	7.75 × 10 <sup>-6</sup>	6.9 × 10 <sup>-6</sup>	
—m/m-K	13.95 × 10 <sup>-6</sup>	12.4 × 10 <sup>-6</sup>	
Thermal conductivity: <sup>B</sup>			
—Btu-in./h-ft <sup>2</sup> -°F	2664	2988	
—W/m-K	384	431	

<sup>A</sup> Analysis is regularly made for the elements for which specific limits are listed. If, however, the presence of "other" elements is suspected or indicated in the course of routine analysis, further analysis shall be made to determine that the total of these "other" elements and the listed impurities are not in excess of the total impurities limit.

<sup>B</sup> Items that are normally useful for engineering calculations in contact design but are not specified.



**TABLE X1.2 Typical Chemical Ranges Press, 2 Chemical Composition of Pressed, Sintered, and Repressed Silver-Molybdenum Contacts Re-pressed Silver-Molybdenum Contact Alloys**

Alloy	Composition, <sup>A</sup> weight, %	
	Class A	Class B
	Class A	Class B
Silver	38 to 42	48 to 52
Molybdenum	balance	balance
Nickel, cobalt, or copper, max	0.5	0.5
Total impurities, max	1	1
Typical Properties		
	Class A	Class B
Rockwell B:	60 to 75	60 to 75
—Hardness of repressed part	50 to 70	40 to 70
—Hardness after annealing	10.3	10.3
Density, Mg/m <sup>3</sup>	40 to 50	45 to 55
Electrical conductivity, % IACS		
Modulus of rupture: <sup>B</sup>		
—psi	9800	8300
—MPa	68	57
Theoretical density, min, %	95	95

7.2 The tests shall be performed on production parts, wherever practical or applicable. (Small size contacts do not lend themselves to accurate conductivity measurement.)

7.3 The tests shall be determined after consideration of the function of the part.

7.4 The typical properties of two most common types of silver-molybdenum contacts are given in the appendix.

## 6. Finishing of Contacts

6.1 The material shall be finished by such operations as necessary to meet requirements agreed upon between the manufacturer and the purchaser of the contacts (brazing alloy backing, tumbling to polish surfaces, special surface finish, silver-rich surface layer, cleaning, etc.):

## 8. Workmanship, Finish, and Appearance

8.1 The material shall be finished by such operations as necessary to meet requirements agreed upon between the manufacturer and the purchaser of the contacts (brazing alloy backing, tumbling to polish surfaces, special surface finish, silver-rich surface layer, cleaning, etc.).

8.2 The parts shall be free of defects in material or processing that would seriously affect their performance.

## 9. Dimensions, Mass, and Permissible Variations

9.1 Permissible variations in dimensions shall be within the limits specified on drawings describing the contacts and accompanying the order; or shall be within the limits specified in the purchase order.

## 8. Workmanship, Finish, and Appearance

8.1 The parts shall be free of defects in material or processing that would seriously affect their performance.

## 9. Significance and Use

9.1 Proprietary methods for the manufacture of these materials vary significantly among suppliers, and these methods influence such properties as arc erosion, contact resistance, and the tendency to weld in service. Since the performance of contacts in a device depends on numerous factors outside the contact itself (opening speed, closing speed, contact pressure, contact bounce, environmental variations, assembly technique and variations, etc.), this specification cannot ensure performance control in the application. As part of the qualification on initial samples, it is recommended that the user functionally and electrically test the materials for all devices applicable to the material's use. This specification will provide a means for the contact manufacturer and contact user to reach agreement on the details of the material to be supplied for a specific use, and reasonable assurance that future lots will be similar in properties and microstructure to the initial test or sample contacts supplied.

## 10. Sampling

10.1 Lot—Unless otherwise specified, a lot shall consist of parts of the same form and dimensions, made of powders of the same particle size range and composition, processed under the same conditions, and submitted for inspection at one time.