



Standard Specification for Silver-Nickel Electrical Contact Materials¹

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1. Scope

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

1.2 This specification covers compositions within the silver-nickel system normally specified by users of electrical contacts.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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

B328 Test Method for Density, Oil Content, and Interconnected Porosity of Sintered Metal Structural Parts and Oil-Impregnated Bearings (Withdrawn 2009)³

E18 Test Methods for Rockwell Hardness of Metallic Materials

E384 Test Method for Knoop and Vickers Hardness of Materials

3. Ordering Information

3.1 Orders for this material under this specification shall include the following information.

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 The last approved version of this historical standard is referenced on www.astm.org.

3.1.1 Dimensions (see Section 6).

3.1.2 Chemical composition (see reference table in [Appendix X1](#)).

3.1.3 Physical properties (see Section 5 and reference table in [Appendix X1](#)).

3.1.4 Certification (see Section 13).

3.1.5 Other features as agreed upon between the seller and the user.

4. Chemical Composition

4.1 The material shall conform to composition limits as agreed upon between the manufacturer and user.

4.2 The chemical analysis shall be made in accordance with the methods described in the newest edition of *Annual Book of ASTM Standards*, Vol 03.05 and 03.06, or by any other approved method agreed upon between manufacturer and purchaser.

5. Physical Requirements

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

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

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

5.4 The typical properties of the most common types of silver-nickel electrical contact materials are given in the appendix.

6. Dimensions, Mass, and Permissible Variations

6.1 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.

7. Workmanship, Finish, and Appearance

7.1 The parts shall be free of defects in material or processing, which would seriously affect their performance.

8. Sampling

8.1 *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.

9. Number of Tests and Retests

9.1 *Chemical Analysis*—The manufacturer and purchaser shall agree on a representative number of specimens for chemical analysis. A representative sample of chips may be obtained by milling, drilling, or crushing with dry tools, (without lubrication). In order to obtain free chips, the parts selected for test shall have the oil extracted in accordance with Test Method B328, if necessary.

9.2 *Physical Tests*—The manufacturer and purchaser shall agree on a representative number of specimens, for physical tests including microstructure.

10. Significance and Use

10.1 Proprietary methods for 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 test the materials electrically 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 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 contact supplied.

11. Inspection

11.1 Inspection of the material shall be agreed upon between the purchaser and the supplier as part of the purchase contract.

12. Rejection and Rehearing

12.1 Unless otherwise specified, rejections based on tests made in accordance with the specification shall be reported to the manufacturer within 30 days of the receipt of shipment.

13. Certification

13.1 When a request is made at the time of cost quotation and 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.

14. Keywords

14.1 contacts; electrical contacts; electrical contact materials; impurities; silver-nickel

APPENDIX

(Nonmandatory Information)

X1. Typical Property Values

X1.1 The following information provides guidelines for users and manufacturers of silver-nickel contact materials (Table X1.1). These properties are influenced by particle size, homogeneity, impurities or additives, and other manufacturing process variables. For example, the specific gravity and hardness of fabricated wire or strip, in general, are higher than for press-sinter-repress materials. Tensile strength values versus the amount of cold work for wire varies considerably depending

upon the annealing temperature used and the microstructure. The best choice for a given application should be mutually decided between the purchaser and the supplier, using their mutual experience and application knowledge.

X1.2 With the knowledge that many manufacturing process variables are available, if a vendor change is made, noticeable property or performance variations are possible.

TABLE X1.1 Typical Property Ranges or Values

| Classification | 90 Silver- 10 Nickel | 85 Silver- 15 Nickel | 80 Silver- 20 Nickel | 70 Silver- 30 Nickel | 60 Silver- 40 Nickel | 50 Silver- 50 Nickel |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Silver, % | 89.0–91.0 | 84.0–86.0 | 79.0–81.0 | 69.0–71.0 | 59.0–61.0 | 49.0–51.0 |
| Nickel, % | balance | balance | balance | balance | balance | balance |
| Total impurities, % | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Theoretical density, g/cm ³ ^A | 10.31 | 10.22 | 10.13 | 9.96 | 9.79 | 9.63 |
| Density theoretical, min, %: | | | | | | |
| Press-sinter-repress | 97 | 96 | 96 | ... | 93 | 93 |
| Fabricated | 99 | 99 | 99 | 99 | 99 | ... |
| Specific gravity for fabricated product, min. g/cm ³ | 10.2 | ... | 10.0 | 9.8 | 9.7 | ... |
| Electrical conductivity: | | | | | | |
| % IACS | 75–94 | 65–88 | 62–83 | 53–73 | 45–68 | 30–50 |
| m/Ω·mm ² | 44–55 | 38–51 | 36–48 | 31–42 | 26–39 | 17–29 |
| Hardness: | | | | | | |
| Press-sinter-repress R15T ^B | 48–62 | 48–68 | 54–68 | ... | 58–68 | 60–77 |
| Fabricated-HV ₅₀₀ ^A | 50–90 | ... | 60–90 | 65–105 | 70–115 | ... |
| Tensile strength of fabricated wire, ksi (MPa): | | | | | | |
| Temper: | | | | | | |
| Annealed | 36.0 (248) | 38.0 (262) | ... | 46.0 (317) | ... | ... |
| 21 % reduction | 45.0 (310) | 54.0 (372) | ... | 61.0 (421) | ... | ... |
| 60 % reduction | 56.5 (390) | 65.0 (448) | ... | 71.0 (490) | ... | ... |
| 84 % reduction | 61.0 (421) | 68.0 (469) | ... | 77.0 (531) | ... | ... |

^A See Test Method **E384**.

^B See Test Methods **E18**.

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