



Designation: B684/B684M – 22

Standard Specification for Platinum-Iridium Electrical Contact Materials¹

This standard is issued under the fixed designation B684/B684M; 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 an 80 % platinum—20 % iridium alloy, an 85 % platinum—15 % iridium alloy, and a 90 % platinum—10 % iridium alloy, in the form of rod, wire, strip, and sheet material for electrical contacts.

1.2 The values stated in either SI units or inch-pound units are to be regarded 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.

1.3 *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

B277 Test Method for Hardness of Electrical Contact Materials

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

B542 Terminology Relating to Electrical Contacts and Their Use

E8/E8M Test Methods for Tension Testing of Metallic Materials

E384 Test Method for Microindentation Hardness of Materials

3. Terminology

3.1 For definitions of terms related to electrical contact materials, refer to Terminology B542.

4. General Requirements

4.1 The requirements of Specification B476 shall apply to all materials produced to this specification.

4.2 In addition, when a section with a title identical to that referenced in 4.1 appears in this specification, it contains additional requirements which supplement those appearing in Specification B476.

5. Ordering Information

5.1 Include the following information when placing orders for product under this specification, as applicable:

5.1.1 ASTM designation and year of issue,

5.1.2 Grade of material (see Table 1),

5.1.3 Temper (annealed or work hardened, see Table 2 and Table 3),

5.1.4 Form (rod, wire, sheet, or strip),

5.1.5 Dimensions and tolerances,

5.1.6 Quantity, total weight or total length or number of pieces of each size,

5.1.7 Heat identification or traceability details, if required,

5.1.8 Certification or test report, or both, if required.

6. Materials and Manufacture

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

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

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.

Current edition approved April 1, 2022. Published April 2022. Originally approved in 1981. Last previous edition approved in 2016 as B684/B684M – 16. DOI: 10.1520/B0684_B0684M-22.

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.

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

TABLE 1 Chemical Requirements

Element	80 Pt/20 Ir	85 Pt/15 Ir	90 Pt/10 Ir
	Weight %	Weight %	Weight %
Pt	balance	balance	balance
Ir	19.50 – 20.50	14.50 – 15.50	9.50 – 10.50
Total Impurities	0.2 max	0.2 max	0.2 max
Total Platinum Group (Pd, Rh, Os, Ru), Au	0.1 max	0.1 max	0.1 max
Total Other Impurities (including the elements below)	0.1 max	0.1 max	0.1 max
Pb, Sb, Bi, Sn, As, Cd, Zn, Hg, Fe	0.01 max each	0.01 max each	0.01 max each
Ni	0.007 max	0.007 max	0.007 max
Other elements	0.02 max each	0.02 max each	0.02 max each

TABLE 2 Mechanical Properties of Wire and Rod

Property	80 Pt/20 Ir		85 Pt/15 Ir		90 Pt/10 Ir	
	Annealed	Work Hardened	Annealed	Work Hardened	Annealed	Work Hardened
Ultimate Tensile Strength, ksi [MPa]	85 – 120 [590 – 830]	130 min [900 min]	75 – 85 [520 – 590]	90 min [620 min]	40 – 60 [275 – 415]	70 min [480 min]
Elongation, % in 2 in. gauge length [51 mm]	10 min	1 min	10 min	1 min	10 min	1 min
Microhardness, HK	190 – 260	290 min	130 – 190	200 min	120 – 180	190 min

TABLE 3 Mechanical Properties of Strip and Sheet

Property	80 Pt/20 Ir		85 Pt/15 Ir		90 Pt/10 Ir	
	Annealed	Work Hardened	Annealed	Work Hardened	Annealed	Work Hardened
Ultimate Tensile Strength, ksi [MPa]	85 – 120 [590 – 830]	130 min [900 min]	75 – 85 [520 – 590]	90 min [620 min]	40 – 60 [275 – 415]	70 min [480 min]
Elongation, % in 2 in. gauge length [51 mm]	10 min	1 – 10	10 min	1 – 10	10 min	1 – 10
Microhardness, HK	190 – 260	290 min	130 – 190	200 min	120 – 180	190 min

7. Chemical Composition

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

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

NOTE 1—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 is not in excess of the total impurities limit.

8. Mechanical Property Requirements

8.1 The contract or purchase 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.

8.2 The mechanical properties shall conform to those properties listed in **Table 2** and **Table 3**.

8.3 All test specimens shall be full size when practical.

8.4 All tests are to be conducted at room temperature, 65 to 85 °F [18 to 29 °C].

9. Test Methods

9.1 Test methods shall be in accordance with Specification **B476**.

9.1.1 Knoop hardness tests shall be in accordance with Test Method **E384**. Material 0.005 in. [0.13 mm] in thickness (diameter) and larger shall be tested using a 100-g indenter load. Material less than 0.005 in. [0.13 mm] in thickness (diameter) shall be tested using a 50-g indenter load. Material less than 0.002 in. [0.05 mm] in thickness (diameter) shall be tested using a 25-g indenter load. A minimum of five hardness indentations shall be made on each specimen. All indentations shall be made so that the long axis of the indenter is parallel to the rolling or drawing direction of the material. The hardness value reported shall be the average of the five indentations.

9.1.2 All tension test specimens shall be full cross-section size when practical (see Test Methods **E8/E8M**).

9.1.3 All tests shall be conducted in room temperature, 65 to 85 °F [18.3 to 29.4 °C].

9.2 Chemical analysis shall be performed by spectrochemical or wet analysis methods.

10. Inspection and Testing

10.1 Material furnished under this specification shall be inspected and tested by the manufacturer as listed below:

10.1.1 Visual inspection per Specification **B476**,