Designation: B823 – 09

Standard Specification for Materials for Copper Base Powder Metallurgy (PM) Structural Parts[1]

This standard is issued under the fixed designation B823; 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.

1. Scope*

1.1 This specification covers a variety of copper base powder metallurgy (PM) structural materials, including those used in applications where high electrical conductivity is required. It includes a classification system, or material designation code. With the classification system, this specification includes chemical composition and minimum tensile yield strength.

NOTE 1—Paragraphs 6.1 and 8.1 govern material classification by the designation code. The classification system is explained in the Appendix.

NOTE 2—Materials classified as C-0000 are expected to be used in applications where high electrical conductivity is required.

1.2 With the exception of density values, for which the g/cm^3 unit is the industry standard, the values stated in inch-pound units are to be regarded as the standard. The stated SI values are converted in accordance with IEEE/ASTM SI 10 and are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B243 Terminology of Powder Metallurgy

B715 Specification for Sintered Copper Structural Parts for Electrical Conductivity Applications[3]

B925 Practices for Production and Preparation of Powder Metallurgy (PM) Test Specimens

B962 Test Methods for Density of Compacted or Sintered Powder Metallurgy (PM) Products Using Archimedes' Principle

B963 Test Methods for Oil Content, Oil-Impregnation Efficiency, and Interconnected Porosity of Sintered Powder Metallurgy (PM) Products Using Archimedes' Principle

E8 Test Methods for Tension Testing of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *IEEE/ASTM Standard:*

SI 10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

2.3 *MPIF Standard:*

MPIF Standard 35, Materials Standards for PM Structural Parts[4]

3. Terminology

3.1 *Definitions*—Definitions of powder metallurgy terms can be found in Terminology B243. Additional descriptive information is available in the Related Materials section of Vol 02.05 of the *Annual Book of ASTM Standards*.

4. Ordering Information

4.1 Materials for parts covered by this specification shall be ordered by materials designation code.

4.2 Orders for parts under this specification may include the following information:

4.2.1 Certification, if required (see Section 13),

4.2.2 Dimensions (see Section 9),

4.2.3 Chemical composition (see 6.1, 10.1, and Table 1),

4.2.4 Test methods and mechanical properties (see 8.2 , 8.3, Table 2, and Table X1.1),

4.2.5 Density (see 7.1 and Table 3),

4.2.6 Porosity and oil content (see 7.3),

4.2.7 Electrical properties (see 7.3 and Table Table X2.1), and

4.2.8 Special packaging, if required.

5. Materials and Manufacture

5.1 Structural parts shall be made by compacting and sintering metal powders. Parts may also be made by repressing and resintering sintered parts, if necessary, to produce finished parts in conformance with the requirements of this specification.

[1] This test method is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.05 on Structural Parts.

Current edition approved Oct. 1, 2009. Published February 2010. Originally approved in 1992. Last previous edition approved in 2001 as B823 – 01. DOI: 10.1520/B0823-09.

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

[4] Available from Metal Powder Industries Federation (MPIF), 105 College Rd. East, Princeton, NJ 08540, http://www.mpif.org.

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

TABLE 1 Chemical Requirements

Material Designation	Chemical Composition, %[A,B]					
	Cu	Zn	Pb	Sn	Ni	
C-0000	99.8					min
	100					max
CZ-1000	88.0	Bal.	. . .	. . .	. . .	min
	91.0	Bal.	. . .	. . .	. . .	max
CZP-1002	88.0	Bal.	1.0	. . .	. . .	min
	91.0	Bal.	2.0	. . .	. . .	max
CZ-2000	77.0	Bal.	. . .	. . .	. . .	min
	80.0	Bal.	. . .	. . .	. . .	max
CZP-2002	77.0	Bal.	1.0	. . .	. . .	min
	80.0	Bal.	2.0	. . .	. . .	max
CZ-3000	68.5	Bal.	. . .	. . .	. . .	min
	71.5	Bal.	. . .	. . .	. . .	max
CZP-3002	68.5	Bal.	1.0	. . .	. . .	min
	71.5	Bal.	2.0	. . .	. . .	max
CNZ-1818	62.5	Bal.	. . .	. . .	16.5	min
	65.5	Bal.	. . .	. . .	19.5	max
CNZP-1816	62.5	Bal.	1.0	. . .	16.5	min
	65.5	Bal.	2.0	. . .	19.5	max
CT-1000	87.5	Bal.	. . .	9.5	. . .	min
	90.5	Bal.	. . .	10.5	. . .	max

[A] Other elements: For the C-0000 material, the total by difference equals 0.2 % maximum; for all others, the total by difference equals 2.0% maximum; these may include other minor elements added for specific purposes.

[B] For the purpose of determining conformance with this specification, measured values shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding-off method of Practice E29

TABLE 2 Minimum Yield Strength for Copper Base Alloys

Material Designation Code	Minimum Yield Strength, 10^3 psi[A]
C-0000–5	5
C-0000–7	7
CZ-1000-9	9
-10	10
-11	11
CZP-1002-7	7
CZ-2000-11	11
-12	12
CZP-2002-11	11
-12	12
CZ-3000-14	14
-16	16
CZP-3002-13	13
-14	14
CNZ-1818-17	17
CNZP-1816-13	13
CT-1000-13 (repressed)	13

[A] For the purpose of determining conformance with this specification, measured values shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding-off method of Practice E29.

6. Chemical Composition

6.1 The material shall conform to the requirements provided in Table 1.

6.2 Chemical analysis shall be performed in accordance with the methods prescribed in Vol 03.05 of the Annual Book of ASTM Standards, or by any other approved method agreed upon between the manufacturer and the purchaser.

NOTE 3—Iron contamination should be avoided. Iron in solid solution in copper has a deleterious effect on both electrical and thermal conductivity. Iron not in solid solution (admixed) has a much lesser effect on conductivity. An example of the effect of iron on conductivity is shown in Fig. X2.1.

TABLE 3 Density Requirements for High Electrical Conductivity Applications

Material Designation Code	Dry Density, g/cm^3[A]
C-0000–5	7.8 to 8.3
C-0000–7	8.3 min

[A] For the purpose of determining conformance with this specification, measured values shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding-off method of Practice E29.

7. Physical Properties

7.1 *Density*:

7.1.1 *High Electrical Conductivity Application*:

In applications where high electrical conductivity is required, if the density does not vary more than 0.3 g/cm^3 from one section of the structural part to any other section, the overall density shall fall within the limits prescribed in Table 3. If the density varies more than 0.3 g/cm^3 from one section of the part to another, the manufacturer and the purchaser shall agree upon a critical section of the part where the stresses are highest. The density of this critical section, rather than the average density, shall fall within the limits prescribed in Table 3.

7.1.2 *Other Applications*:

The buyer and the seller may agree upon a minimum average density for the part and minimum densities for specific regions of the part. Typical density values may be found in Table X1.1.

7.1.3 Density shall be determined in accordance with Test Method B962.

7.2 *Porosity*:

7.2.1 The buyer and the seller may agree upon a minimum volume oil content for parts that are to be self-lubricating. The oil content shall be determined in accordance with Test Methods B963.

7.2.2 The buyer and the seller may agree upon a functional test for porosity in parts that are to be self-lubricating, or for permeability where fluid flow must be restricted.

7.3 *Electrical Conductivity*:

7.3.1 The manufacturer and the purchaser shall agree on qualification tests to determine the electrical conductivity. The test shall be made on sample parts or specimens compacted to a given density using an apparatus based on the eddy-current principle.

7.3.1.1 Conductivity is determined with an instrument that indicates the resistance of a material to the flow of eddy currents. Prior to making the tests, the instrument is allowed to warm up for a period of time recommended by the manufacturer. The instrument is adjusted using three standards of known conductivity supplied by the manufacturer. Test specimens shall be at the same temperature as the reference materials used in adjusting the instrument. Several readings at different locations are taken on each test specimen to obtain an average value.

7.3.1.2 No specimen preparation is required providing the surface is flat in the probe area.