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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for Sintered Bronze Structural Parts[1]

This standard is issued under the fixed designation B 255; 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.

ε[1] NOTE—Keywords were added editorially in October 1995.

1. Scope

1.1 This specification covers sintered metal powder structural parts made from one copper–tin composition of two types depending on density.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

NOTE 1—Definitions of powder metallurgy terms can be found in Terminology B 243 and additional useful information is available in the Related Material section of Vol 02.05 of the *Annual Book of ASTM Standards*.

2. Referenced Documents

2.1 *ASTM Standards:*

B 243 Terminology of Powder Metallurgy[2]

B 328 Test Method for Density, Oil Content, and Interconnected Porosity of Sintered Powder Metal Structural Parts and Oil–Impregnated Bearings[2]

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes[3]

3. Ordering Information

3.1 Orders for parts under this specification shall include the following information:

3.1.1 Dimensions (see Section 8),

3.1.2 Chemical composition (see Section 5 and Table 1),

3.1.3 Density, Type (see 6.1 and Table 2),

3.1.4 Porosity (see 6.2),

3.1.5 Mechanical requirements (see Section 7), and

3.1.6 Certification (see Section 13).

4. Materials and Manufacture

4.1 Structural parts shall be made by molding and sintering metal powders followed by repressing and resintering, if necessary, to produce finished parts conforming to the requirements of this specification.

TABLE 1 Chemical Requirements

Element	Composition, %
Copper	87.5 to 90.5
Tin	9.5 to 10.5
Carbon, max	1.75
Iron, max	1.0
Total other elements, max	0.5

5. Chemical Composition

5.1 Orders for parts shall conform to the requirements prescribed in Table 1.

5.2 The chemical analysis shall be made in accordance with Test Methods E 54 or any other standard method agreed upon between the manufacturer and the purchaser.

6. Physical Properties

6.1 *Density*:

6.1.1 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 2.

6.1.2 If the density varies more than 0.3 g/cm^3 from one section of the part to any other, the manufacturer and the purchaser shall agree upon the 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 2.

6.1.3 Density shall be determined in accordance with Test Method B 328.

6.2 *Porosity*:

6.2.1 When specified, the interconnecting porosity by volume shall not be less than the values prescribed in Table 3.

6.2.2 The porosity shall be determined in accordance with Test Method B 328.

7. Mechanical Properties

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

TABLE 2 Density Requirements

Type	Dry Density, g/cm^3
I	6.4 to 6.8
II	6.8 to 7.2

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[2] *Annual Book of ASTM Standards*, Vol 02.05.

[3] *Annual Book of ASTM Standards*, Vol 03.05.

TABLE 3 Porosity

Type	Porosity, min, Volume %
I	18
II	7

7.2 These tests shall be performed on production parts.

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

7.4 The limits shall be agreed upon between the manufacturer and purchaser.

7.5 All shipments of parts subsequent to the establishment of testing conditions shall conform to the limits agreed upon.

NOTE 2—The mechanical properties in tension and compression that may be expected from standard specimens molded to size are given in the Appendix to this specification.

8. Permissible Variations in Dimension

8.1 Permissible variations in dimensions shall be within the limits specified on the drawings describing the structural parts accompanying the order, or shall be within the limits specified in the order.

9. Workmanship, Finish, and Appearance

9.1 Structural parts shall be uniform in composition.

9.2 When parts are cut or fractured, the exposed surface shall be of uniform appearance.

10. Sampling

10.1 *Lot*—Unless otherwise specified, a lot shall consist of parts of the same form and dimensions, made from powders of the same composition, molded and sintered under the same conditions, and submitted for inspection at one time.

10.2 *Chemical Analysis*—If required by purchase agreement, at least one sample for chemical analysis shall be taken from each lot. A sample shall consist of chips, obtained by dry-milling, drilling, or crushing of at least two pieces.

10.3 *Mechanical Tests*—The manufacturer and purchaser shall agree upon a representative number of specimens for mechanical tests.

11. Inspection

11.1 Unless otherwise specified, inspection of parts supplied on contract shall be made by the purchaser.

12. Rejection and Rehearing

12.1 Parts that fail to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly, and in writing. In case of dissatisfaction with test results, the producer or supplier may make claim for a rehearing.

13. Certification

13.1 When specified in the purchase order or contract, a producer's certification shall be furnished to the purchaser that the parts were manufactured, sampled, tested, and inspected in accordance with this specification and have been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

13.2 The purchase order must specify whether or not the certification includes chemistry.

13.3 Upon request of the purchaser in the contract or order, the certification of an independent third party indicating conformance to the requirements of this specification may be considered.

14. Keywords

14.1 bronze structural parts; copper alloy; copper/tin alloy; sintered bronze

APPENDIX

(Nonmandatory Information)

X1. MECHANICAL PROPERTIES AND HARDNESS DATA

X1.1 Data for tensile and compressive properties of molded and sintered bronze specimens are given in Table X1.1. The data do not constitute a part of the specification. They merely indicate to the purchaser the mechanical properties that may be expected from tension and compression specimens conforming to the density and chemical composition requirements specified. It should be thoroughly understood that the values represent specimens molded to size and not specimens cut from commercial parts or specimens machined from sample blanks. The tension tests are run on flat specimens approximately ¼ by ¼ in. (6.35 by 6.35 mm) in cross section with a gage length of 1 in. (25.4 mm). The compression tests are run on specimens with a diameter of ½ in. (12.7 mm) and a length of ¾ in. (19.1 mm).

TABLE X1.1 Typical Properties

Density g/cm^3	Ultimate Tensile Strength		Elongation in 1 in. (25.4 mm), %	Yield Strength in Compression		Hardness, HRH
	ksi	MPa		ksi	MPa	
6.4	13.5	93.1	1	11.0	75.8	45
6.8	16.0	110.3	2	15.0	104.3	55
7.2	20.0	137.9	3	20.0	137.9	65

X1.2 Hardness values are given as apparent values, as described in the General Description of Production, Properties and Uses of Metal Powder Sintered Bearings, and Sintered Metal Powder Structural Parts.[2]