~~Designation:B 853–02~~ Designation: B 853 – 07

Standard Specification for Powder Metallurgy ~~(P/M)~~(PM) Boron Stainless Steel Structural Components[1]

This standard is issued under the fixed designation B 853; 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

~~1.1This specification covers stainless steel powder metallurgy (P/M) structural components with a 7.7-g/cm^3~~*

1.1 This specification covers stainless steel powder metallurgy (PM) structural components with a 7.7-g/cm^3 minimum density that are fabricated from prealloyed powder consisting primarily of iron, chromium, nickel, molybdenum, and boron[2] and are intended for use in corrosive service.

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

1.2 With the exception of density values, for which g/cm3 is the industry standard, the values stated in inch-pound units are to be regarded as the standard. The SI values given in parentheses are converted in accordance with IEEE/ASTM SI 10 and are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

B 117 Practice for Operating Salt Spray (Fog) Apparatus

B 243 Terminology of Powder Metallurgy

B 311 Test Method for Density Determination for Powder Metallurgy (P/M) Materials Containing Less ~~than~~Than Two Percent Porosity

E 8 Test Methods for Tension Testing of Metallic Materials

E 354 Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

E 572~~Test Method for X-Ray Emission Spectrometric Analysis of Stainless Steel~~[7] Test Method for Analysis of Stainless and Alloy Steels by X-ray Fluorescence Spectrometry

E 1019 Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

E 1086 Test Method for Optical Emission Vacuum Spectrometric Analysis of Stainless Steel by ~~the~~ Point-to-Plane Excitation Technique

G 48~~Test Method for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution~~[4] Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution

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

3. Terminology

3.1 *Definitions*— Definitions of powder metallurgy terms can be found in Terminology B 243. Additional descriptive information is in the Related Material section of Volume 02.05 of the *Annual Book of ASTM Standards.*

4. Ordering Information

4.1 Orders for components under this specification shall include the following information:

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[1] This specification is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.11 on Near Full Density Powder Metallurgy Materials.

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[2] U.S. Patents 3980444, 4014680, 4032336.

~~[3] Annual Book of ASTM Standards, Vol 01.03.~~

[3] 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.**

4.1.1 Dimensions (see Section 9),
4.1.2 Chemical composition (see Section 6 and Table 1),
4.1.3 Density (see Section 7),
4.1.4 Mechanical properties (see Section 8 and Table 2),
4.1.5 Certification (see Section 13),
4.1.6 Reference to the standard.

5. Materials and Manufacture

5.1 Structural components shall be made by cold pressing and sintering prealloyed powder.
5.2 The sintering temperature is dependent on the chemical composition of the powder.

6. Chemical Composition

6.1 The material shall conform to the composition limits specified in Table 1.
6.2 Chemical analysis should be made in accordance with Test Methods E 354, E 572, E 1019, and E 1086.

7. Physical Properties

7.1 *Density*:
7.1.1 The sintered density shall be ~~7.7 g/cm~~7.7 g/cm^3 minimum.
7.1.2 Density shall be determined in accordance with Test Method B 311.

8. Mechanical Properties

8.1 The purchaser and manufacturer shall agree upon the method to be used to verify the typical yield or tensile strength in the finished parts. The preferred method for verifying the tensile or yield strength is for the manufacturer and purchaser to agree upon a qualification test to be performed on the actual part. The specific test should be determined after consideration of the function of the part. An example would be measuring the force needed to break teeth off a gear, using a prescribed fixture.

8.2 The tensile properties of the material may also be verified using specifically prepared bars, compacted from the same mixed powder lot as the purchased parts, and sintered along with the parts.

8.3 Typical tensile values for 0.2 % offset yield strength, ultimate strength, and percent elongation in 1-in. gage length for as-sintered standard flat unmachined tension test specimens for powder metallurgy ~~(P/M)~~(PM) products (see ~~Fig. 19 of~~ Test Methods E 8) are in Table 2.

9. Dimensions and Tolerances

9.1 Dimensions and tolerances of the structural components shall be indicated on drawings accompanying the purchase order or contract.

10. Sampling

~~10.1*Lot*—Unless otherwise specified, a lot shall consist of components of the same form and dimensions made from the same mixed powder lot, compacted, and processed under the same conditions, and submitted for inspection at one time.~~
~~10.2~~
10.1 *Chemical Analysis*—If required by purchase agreement, at least one sample for chemical analysis shall be taken from each lot. A representative sample of chips may be obtained by dry-milling, drilling, or crushing at least two pieces without lubrication using clean dry tools.
~~10.3~~
10.2 *Mechanical Testing*—If required by the purchase agreement, the manufacturer and purchaser shall mutually agree on the representative number of specimens for mechanical testing from each lot. This number shall be based on good practice of statistical quality control.

TABLE 1 Chemical Composition Requirements

Element	Composition Limits, Weight %
Carbon	0.05 max
Manganese	2.00 max
Phosphorus	0.03 max
Sulfur	0.03 max
Silicon	1.0 max
Chromium	22.0 to 24.0
Nickel	17.0 to 19.0
Molybdenum	3.0 to 4.0
Boron	0.20 to 0.50
Nitrogen	0.10 max
Iron[A]	balance

[A] Iron shall be determined arithmetically by difference.