



Designation: B 853 – 07

Standard Specification for Powder Metallurgy (PM) Boron Stainless Steel Structural Components¹

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*

1.1 This specification covers stainless steel powder metallurgy (PM) structural components with a 7.7-g/cm³ minimum density that are fabricated from prealloyed powder consisting primarily of iron, chromium, nickel, molybdenum, and boron² and are intended for use in corrosive service.

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 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 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 Point-to-Plane Excitation Technique

G 48 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:

- 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/cm³ minimum.

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 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 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.

TABLE 2 Typical Mechanical Properties^A

0.2 % Offset yield strength	33 000 psi (228 MPa)
Ultimate tensile strength	76 000 psi (520 MPa)
Elongation in one inch	23 %
Apparent Hardness	75 HRB

^A Determined on a cold-pressed and vacuum-sintered standard flat unmachined test specimen for powder metallurgy (PM) products (see Test Methods E 8).

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 (PM) products (see 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 *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.

10.2 *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.

11. Inspection

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

12. Rejection and Rehearing

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

13. Certification

13.1 When specified in the purchase order or contract, a producer's certification of compliance document shall be reported to the purchaser, verifying that the components manufactured were sampled, tested, and inspected in accordance with this specification and have met the requirements. When specified in the purchase order or contract, a report of test results shall be furnished.

13.2 Certification by an independent third party indicating conformance to the requirements of this specification may be considered upon the request of the purchaser.

13.3 The purchase order or contract shall specify whether or not the certification includes a report of chemical analysis.

14. Keywords

14.1 cold pressing; density; powder metallurgy (PM); pre-alloyed powder; sintering; stainless steel; structural (PM) components

**SUPPLEMENTARY REQUIREMENTS**

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order. The supplier and the purchaser should agree upon a minimum number of hours survival for the requested corrosion test.

S1. Intergranular Corrosion Test

S1.1 When specified, material shall pass intergranular corrosion tests conducted by the manufacturer in accordance with Practices **A 262**.

S2. Salt Spray (Fog) Testing

S2.1 When specified, material shall pass the salt spray corrosion test conducted by the manufacturer in accordance with Practice **B 117**.

S3. Pitting and Crevice Corrosion Test

S3.1 When specified, material shall pass pitting and crevice corrosion tests conducted by the manufacturer in accordance with Test Methods **G 48**.

SUMMARY OF CHANGES

Committee B09 has identified the location of selected changes to this standard since the last issue (B 853-02) that may impact the use of this standard.

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| (1) Corrected the title of Test Method E 572 in Section 2.1 . | (3) Deleted the definition of “lot” in Section 10.1 as we currently have an approved definition in Terminology B 243 . |
| (2) Deleted the reference to a specific figure number in Test Methods E 8 in Section 8.3 . | |

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