Designation: ~~B853 – 12~~ B853 – 16

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

This standard is issued under the fixed designation B853; 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/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.

1.2 With the exception of the values for density and the mass used to determine density, for which the use of the gram per cubic centimetre (g/cm^3) and gram (g) units is the longstanding industry practice, the values in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
B117 Practice for Operating Salt Spray (Fog) Apparatus
B243 Terminology of Powder Metallurgy
B311 Test Method for Density of Powder Metallurgy (PM) Materials Containing Less Than Two Percent Porosity
E8 Test Methods for Tension Testing of Metallic Materials
E354 Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys
E572 Test Method for Analysis of Stainless and Alloy Steels by Wavelength Dispersive X-Ray Fluorescence Spectrometry
E1019 Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques
E1086 Test Method for Analysis of Austenitic Stainless Steel by Spark Atomic Emission Spectrometry
G48 Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution

3. Terminology

3.1 *Definitions*—Definitions of powder metallurgy terms can be found in Terminology B243. 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, 10.1, and Table 1),
4.1.3 Density (see Section 7),
4.1.4 Mechanical properties (see Section 8, 10.2, and Table 2),
4.1.5 Certification (see Section 13),

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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] 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, Mass %
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 E8).

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 E354, E572, E1019, and E1086.

7. Physical Properties

7.1 *Density:*

7.1.1 The sintered density shall be 7.7 g/cm^3 minimum.

7.1.2 Density shall be determined in accordance with Test Method B311.

8. Mechanical Properties

8.1 The purchaser and ~~manufacturer~~producer 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~~producer 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 E8) 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.