



Designation: B595 – 21

Standard Specification for Materials for Aluminum Powder Metallurgy (PM) Structural Parts¹

This standard is issued under the fixed designation B595; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This specification covers aluminum powder metallurgy structural parts made using admixed materials.

1.2 This specification covers a material designation code that includes the chemical composition of the material, its guaranteed minimum 0.2 % offset yield strength or ultimate tensile strength, and the temper condition of the material.

1.3 *Units*—With the exception of density values for which the g/cm^3 unit is the industry standard, property values stated in inch-pound units are to be regarded as standard. Values in SI units result from conversion, are only for information, and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[B243 Terminology of Powder Metallurgy](#)

[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 Surface-Connected Porosity of Sintered](#)

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 B09.05 on Structural Parts.

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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.

[Powder Metallurgy \(PM\) Products Using Archimedes' Principle](#)

[E8/E8M Test Methods for Tension Testing of Metallic Materials](#)

[E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)

[E466 Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials](#)

[E606/E606M Test Method for Strain-Controlled Fatigue Testing](#)

[E1269 Test Method for Determining Specific Heat Capacity by Differential Scanning Calorimetry](#)

[E1416 Practice for Radioscopic Examination of Weldments](#)

2.2 *MPIF Standards:*³

[MPIF Standard 10, Method for Determination of the Tensile Properties of Powder Metallurgy \(PM\) Materials](#)

[MPIF Standard 35-SP, Materials Standards for PM Structural Parts](#)

[MPIF Standard 72, Guide to Sample Preparation of Aluminum Powder Metallurgy \(PM\) Materials for Cross-sectional Metallographic Evaluation](#)

3. Terminology

3.1 *Definitions*—Definitions of powder metallurgy terms can be found in Terminology [B243](#). Additional descriptive information is available under “General Information on PM” on the ASTM B09 web page.

4. Ordering Information

4.1 Materials for parts covered under this specification shall be ordered by material 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 Section 8, Table 2, Table 3, Table X1.1, and Table X1.2),

4.2.5 Density (see Section 7, Table X1.1, and Table X1.2),

³ Available from Metal Powder Industries Federation (MPIF), 105 College Rd. East, Princeton, NJ 08540, <http://www.mpif.org>.

TABLE 1 Chemical Composition Requirements (wt.%)^{A,B}

Material Designation Code	Al	Cu	Si	Mg	Element
	Balance	3.5	0.5	0.2	Minimum
AC-2014	Balance	3.5	0.5	0.2	Minimum
	Balance	5.5	1.2	1.0	Maximum

^A Other elements: 1.5 wt.% max.

^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 Tensile Strength Values (inch-pound)

NOTE 1—Processing parameters used to generate these data; other conditions may be used.

Material Designation Code ^C	Minimum Strength ^{A,B,D}	
	Yield	Ultimate
	10 ³ psi	
AC-2014-23-T2	23	
AC-2014-25-T2	25	
AC-2014-32-T8		32
AC-2014-38-T8		38

^A Suffix numbers represent minimum strength values in 10³ psi

^B Mechanical property data derived from laboratory prepared test specimens sintered under commercial manufacturing conditions

^C Thermal Treatment:

-T2: Cold worked (sized) and then naturally aged (room temperature)

-T8: Solution treated at 935 °F for 70 min at temperature, immediately water quenched, cold worked (sized), overall length (OAL) reduced by approximately 2 %, and artificially aged at 320 °F for 18 h and air cooled

^D Tensile properties determined on machined round specimens

TABLE 3 Minimum Tensile Strength Values (SI)

NOTE 1—Processing parameters used to generate these data; other conditions may be used.

Material Designation Code ^C	Minimum Strength ^{A,B,D}	
	Yield	Ultimate
	MPa	
AC-2014-23-T2	160	
AC-2014-25-T2	170	
AC-2014-32-T8		220
AC-2014-38-T8		265

^A Suffix numbers represent minimum strength values in 10³ psi

^B Mechanical property data derived from laboratory prepared test specimens sintered under commercial manufacturing conditions

^C Thermal Treatment:

-T2: Cold worked (sized) and then naturally aged (room temperature)

-T8: Solution treated at 502 °C for 70 min at temperature, immediately water quenched, cold worked (sized), overall length (OAL) reduced by approximately 2 %, and artificially aged at 160 °C for 18 h and air cooled

^D Tensile properties determined on machined round specimens

4.2.6 Special packaging, if required.

5. Materials and Manufacture

5.1 Structural parts shall be made by compacting, sintering, and sizing followed by either a T2 or T8 temper to produce finished parts in conformance with this specification.

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 between the producer and the purchaser.

7. Physical Properties

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

7.1.1 The producer and purchaser 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 and Table X1.2.

8. Mechanical Properties

8.1 For material in the T2 condition, the minimum guaranteed 0.2 % offset yield strength as shown in Table 2 and Table 3 is a numerical suffix to the material designation code and is read as 10³ psi. The code is adopted from MPIF Standard 35-SP. All tensile yield strengths are defined as the 0.2 % offset yield strengths.

8.2 For material in the T8 condition, the minimum guaranteed ultimate tensile strength as shown in Table 2 and Table 3 is a numerical suffix to the material designation code and is read as 10³ psi. The code is adopted from MPIF Standard 35-SP.

8.3 The producer and purchaser shall agree upon the method to be used to verify the minimum strength characteristics of the finished parts. Since it is generally impossible to machine tensile test specimens from these parts, alternative strength tests are advisable. An example would be measuring the force needed to break teeth off a gear with the gear properly fixtured.

8.4 The tensile properties shall be measured using machined round specimens prepared in accordance with MPIF Standard 10 and tested in accordance with Test Methods E8/E8M and MPIF Standard 10.

8.5 Typical mechanical property values may be found in Table X1.1 and Table X1.2.

9. Permissible Variations in Dimensions

9.1 Permissible variations in dimensions shall be within the limits specified in the drawings provided by the purchaser, which describe the structural parts that accompany the order, or variations shall be within the limits specified in the order.

10. Sampling

10.1 *Chemical Analysis*—When requested on the purchase order, at least one sample for chemical analysis shall be taken from each lot. A sample of chips may be obtained by dry-milling, or crushing at least two pieces with clean, dry tools without lubrication. In order to obtain oil-free chips, the parts selected for test shall have the oil extracted from them in accordance with Test Methods B963, if necessary.

10.2 *Mechanical Tests*—The producer and the purchaser shall agree upon a representative number of specimens for mechanical tests.

11. Inspection

11.1 Inspection of the material shall be agreed upon between the producer and purchaser as part of the purchase order or contract.