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SAE-AMS7907, "BARS, RODS, TUBING, AND SHAPES, BERYLLIUM, INSTRUMENT GRADE", was adopted on 20-DEC-91 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, Defense Supply Center Philadelphia, ATTN: DSCP-ITAA, 700 Robbins Avenue, Philadelphia, PA 19111-5096. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001. http://www.sae.org/

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 7907

Issued APR 1991
Reaffirmed MAY 1995

Beryllium Bars, Rods, Tubing, and Shapes
Instrument Grade

1. SCOPE:

1.1 Form:

This specification covers a beryllium in the form of bars, rods, tubing, and machined shapes from vacuum hot pressed powder.

1.2 Application:

Primarily for parts requiring a combination of high strength-to-weight ratio, high modulus of elasticity, excellent dimensional stability, and minimum guaranteed micro-yield strength.

1.3 Precaution:

WARNING: Beryllium Product. Inhalation of dust or fumes may cause serious chronic lung disease. Potential cancer hazard based principally on animal tests.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7154 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Material Specifications:

AMS 2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steel and Corrosion and Heat Resistant Steels and Alloys

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 8 Tension Testing of Metallic Materials
ASTM E 8M Tension Testing of Metallic Materials (Metric)
ASTM E 112 Determining Average Grain Size

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Military Standards:

MIL-STD-453 Inspection, Radiographic
MIL-STD-2073-1 DoD Material, Procedures for Development and Application of Packaging Requirements
MIL-STD-6866 Inspection, Liquid Penetrant

2.4 ANSI Publications:

Available from American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

ANSI B46.1 Surface Texture
ANSI Y14.5M Dimensioning and Tolerancing

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the following percentages by weight:

	min	max
Beryllium Oxide	--	2.2
Aluminum	--	0.10
Carbon	--	0.15
Iron	--	0.15
Magnesium	--	0.08
Silicon	--	0.08
Other Metallic Impurities, each	--	0.04
Beryllium (3.1.2)	98.0	--

3.1.1 Beryllium oxide shall be determined by gas fusion; aluminum, iron, magnesium and silicon determined by DC plasma emission spectrometry; carbon determined by combustion; and beryllium determined as the difference.

3.1.2 Beryllium content includes 36% of actual beryllium oxide content.

3.2 Condition:

Hot pressed with secondary options of heat treatment, stress relief, and/or hot isostatic pressing (HIP) after hot pressing.

3.2.1 Surface Finish: The product shall be furnished with a machined surface. Surface finish shall be no greater than 110 Ra [125 microinches (3.2 µm) rms], determined in accordance with ANSI B46.1.

3.3 Properties:

The product shall conform to the following requirements:

3.3.1 Tensile Properties: Shall be as follows, determined at room temperature in accordance with ASTM E 8 or ASTM E 8M:

Tensile Strength, minimum	55 ksi (379 MPa)
Yield Strength at 0.2% Offset, minimum	40 ksi (276 MPa)
Elongation in 4D, minimum	2%
Micro-Yield Strength, minimum	5 ksi (34 MPa)

3.3.1.1 Micro-Yield Strength: The stress required to produce a permanent strain of 1.0×10^{-6} inch/inch (cm/cm). The test procedure consists of repeated static loading and unloading the test specimen. The stresses are higher on each succeeding cycle and any permanent strain is recorded to the accuracy of 0.1×10^{-6} after each cycle. The procedure is repeated until the permanent strain is higher than 1.0×10^{-6}.

3.3.2 Grain Size: Shall average no larger than 20 microns (20 µm), determined in accordance with ASTM E 112, using the intercept method at 500X magnification.

3.4 Quality:

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.4.1 Soundness:

3.4.1.1 The product shall be free from cracks, determined as in 3.4.2.1 or 3.4.2.2.

3.4.1.2 Density: Shall be at least 99.0% of theoretical density, determined using the water displacement method. Density determination shall be accurate to the second decimal place or better.

3.4.1.2.1 Theoretical density shall be calculated using the following formula:

$$\text{Theoretical Density (gm/cm}^3\text{)} = \frac{100\%}{\frac{100 - \%\text{Be0}}{1.8477\ \text{gm/cm}^3} + \frac{\%\text{Be0}}{3.009\ \text{gm/cm}^3}}$$

3.4.1.3 Radiographic Inspection: Radiographic inspection, to a penetrameter sensitivity of 2%, shall be performed in accordance with MIL-STD-453, however, exceptions are taken to the penetrameter contrast requirement and applicable area of penetrameter density ranges of +30% or -15% from the density at penetrameter location(s).

3.4.1.3.1 Radiographic indications (voids or inclusions) shall conform to the following requirements:

3.4.1.3.1.1 Maximum Dimension of any Indication: Any dimension of any indication, measured in the plane of the radiograph, shall not exceed 0.050 inch (1.270 mm).

3.4.1.3.1.2 Maximum Average Dimension of any Indication: The average dimension of an indication shall be the arithmetic average of the maximum and minimum dimensions, measured in the plane of the radiograph, and shall not exceed 0.030 inch (0.76 mm) diameter.

3.4.1.3.1.3 Total Combined Volume Per Cubic Inch (16.4 cm^3) of all Indications: The total combined volume per cubic inch (16.4 cm^3) of all indications, with an average dimension larger than 0.001 inch (0.03 mm), shall not exceed the volume of a 0.050 inch (1.27 mm) diameter sphere.

3.4.1.3.1.4 The minimum detectable size of voids and inclusions will increase as the section thickness increases, (See 8.1).

3.4.1.3.1.5 Part Density Uniformity: The terms variable density areas, banding, or striations denote relatively large areas of a radiograph, which vary in density by more than 5% compared to the surrounding area of comparable section thickness. Suspect areas shall be re-radiographed and interpreted with the appropriate penetrameter or beryllium of 5% in thickness placed as follows:

a. Less dense (darker radiograph) areas shall be covered by the penetrameter. The radiograph of the covered area shall appear lighter than that of the adjacent area.

b. More dense (lighter radiograph) areas shall have the penetrameter placed immediately adjacent to them. The radiograph of the covered area shall appear lighter than that of the suspect more-dense area.

3.4.1.3.1.6 Discrete high density (light radiograph) indications, or areas in product 1.000 inch (25.40 mm) and under in nominal thickness, which are 5% or less in radiographic density variation compared to the surrounding material, are acceptable.

3.4.2 Surface Condition:

3.4.2.1 Visual: No restrictions to size or number of visual imperfections if they do not hold fluorescent penetrant dye.

3.4.2.2 Surface Indications: Penetrant inspection shall be performed in accordance with MIL-STD-6866, Type 1, Level 2, Method B, Form A.

3.4.2.2.1 Individual Indications: Shall not exceed 0.050 inch (1.27 mm) in major dimension.

3.4.2.2.2 Frequency: Any one square inch (6.45 cm^2) shall contain no more than three indications measuring 0.003 to 0.050 inch (0.08 mm to 1.27 mm) in major dimension.

3.5 Tolerances:

Product shall conform to the dimensions and dimensional tolerances specified in the purchase order and applicable drawings. If tolerances are not specified, the following standard tolerances in accordance with ANSI Y14.5M shall apply.

	Inches	Tolerance Inch plus	Tolerance Inch minus
Diameter, Width or Thickness	Up to 3, incl	0.016	0.000
Diameter, Width or Thickness	Over 3 to 20, incl	0.062	0.000
Diameter, Width or Thickness	Over 20	0.250	0.000
Length	Up to 20, incl	0.125	0.000
Length	Over 20	0.250	0.000

	Millimeters	Tolerance Millimeters plus	Tolerance Millimeters minus
Diameter, Width or Thickness	Up to 76, incl	0.41	0.00
Diameter, Width or Thickness	Over 76 to 508, incl	1.57	0.00
Diameter, Width or Thickness	Over 508	6.35	0.00
Length	Up to 508, incl	3.18	0.00
Length	Over 508	6.35	0.00

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

Tests for all technical requirements are acceptance tests and shall be performed on each lot as applicable.

4.3 Sampling and Testing:

Shall be in accordance with the following; a lot shall consist of all product manufactured from a single hot-pressed billet and in the same condition as defined in 3.2.

4.3.1 Composition: Not less than one sample from each lot.