Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 3865A
Superseding AMS 3865

Issued 11-1-69
Revised 3-1-74

FILAMENTS, BORON
Tungsten Substrate, Continuous

1. SCOPE:

1.1 Form: This specification covers filaments consisting of boron deposited on a tungsten substrate in continuous lengths.

1.2 Application: Primarily for reinforcement of structural plastic and metallic composites.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.2.1 Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

3. TECHNICAL REQUIREMENTS:

3.1 Material:

3.1.1 Construction: Filaments shall be formed by deposition of boron on a tungsten substrate to form continuous filaments of the diameter ordered.

3.1.2 Finish: Unless otherwise specified, there shall be no finish compound or treatment applied to the boron filaments.

3.1.3 Splices: The distance between splices is not controlled, unless filament with a minimum distance between splices or unspliced filament is ordered. The type and method of splicing and the method of identifying splice locations shall be as agreed upon by purchaser and vendor.

3.1.4 Bending: Boron filaments shall withstand, without breaking, bending through an angle of 180 deg (3.14 rad) around a mandrel of the size noted below with the filament direction perpendicular to the axis of the bend.

Filament Diameter nominal	Mandrel Diameter min
0.0040 in. (0.102 mm)	0.625 in. (15.88 mm)
0.0056 in. (0.142 mm)	0.875 in. (22.22 mm)
0.0080 in. (0.203 mm)	1.25 in. (31.8 mm)

Printed in U.S.A.

3.1.5 Resin Coupling: When specified, boron filaments shall couple with an impregnating resin to meet the property requirements of an applicable resin-impregnated-product specification.

3.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods:

3.2.1 Tensile Strength, min avg	400,000 psi	(2760 MPa)	4.5.1
3.2.2 Modulus of Elasticity			
min avg	55,000,000 psi	(379,200 MPa)	4.5.2
individual min	49,500,000 psi	(341,300 MPa)	
3.2.3 Filament Density, max	0.098 lb/in.^{3}	(2.71 Mg/m^3)	4.5.3

3.3 Quality: The product shall be uniform in quality and condition, clean, smooth, and free from foreign material and from imperfections detrimental to fabrication, appearance, or performance of parts.

3.4 Sizes and Tolerances:

3.4.1 Filament Diameter: Unless otherwise specified, filament shall be supplied in one of the following diameters, as ordered:

0.0040 in. + 0.0001, - 0.0003 (0.102 mm +0.003, -0.008)
0.0056 in. ± 0.0001 (0.142 mm ± 0.003)
0.0080 in. ± 0.0002 (0.203 mm ± 0.005)

3.4.2 Length: Shall be not less than the net length ordered. Defective filament, identified but not removed from a length, shall not be counted as net length for purchase.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to tensile strength (3.2.1) and filament diameter (3.4.1) requirements are classified as acceptance or routine control tests:

4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification or periodic control tests and may be the basis for approval of the product (See 4.4.1).

4.3 Sampling:

4.3.1 Sampling Schedule: Shall be in accordance with Single Sampling for Normal Inspection, General Inspection Level II, with an Acceptable Quality Level (AQL) of 1.5 specified in MIL-STD-105 as shown in Table I. Test specimens shall be taken at random throughout the lot.

TABLE I

SAMPLING SCHEDULES

Number of Inspection Units in the Lot	Number of Inspection Units from Which Samples are to be Taken	Number of Nonconforming Samples to Accept	Number of Nonconforming Samples to Reject
1 - 90	8 (4.3.1.1)	0	1
91 - 280	32	1	2
281 - 500	50	2	3

4.3.1.1 If number of inspection units to be sampled equals or exceeds lot size, inspect each unit.

4.3.2 Lot: A lot is defined as all material made from the same batch of raw materials under the same fixed conditions.

4.3.3 Inspection Unit: Unless otherwise specified, an inspection unit is defined as each spool of continuous length filament, but shall not exceed 5.0 lb (2.27 kg) of material.

4.4 Approval:

4.4.1 Sample material shall be approved by purchaser before material for production use is supplied, unless such approval be waived. Results of tests on production material shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production material which are essentially the same as those used on the approved sample material. If any change is necessary in ingredients, in type of equipment for processing, or in manufacturing procedures which could affect quality or properties of the material, vendor shall submit samples for reapproval unless purchaser grants written approval after review of a detailed statement of materials and processing used on the approved sample and those proposed. No production material made by the revised procedure shall be shipped prior to receipt of approval of such procedure.

4.5 Test Methods:

4.5.1 Tensile Strength: Shall be determined by testing not less than 10 individual filament specimens. If breaks occur in the grips, test additional filaments until 10 valid tests have been obtained. Report the arithmetic mean, the gage length, the gripping method, and the rate of loading.

4.5.2 Modulus of Elasticity in Tension: Shall be determined by testing not less than 3 individual filament specimens. If breaks occur in the grips, test additional filaments until 3 valid tests have been obtained. Report the values for each individual specimen and the average of all valid specimens. Report the gage length, gripping method, rate of loading, and formula used to calculate the modulus.

4.5.3 Filament Density: Shall be determined on a suitable length of an individual filament, measured accurately in length to the nearest 0.001 in. (0.03 mm). The area of the filament shall be determined by calculation from the diameter determined as in 4.5.4, recording the arithmetic mean of the three determinations to the nearest 0.00001 sq in. (0.0003 mm^2). The dry, clean specimen shall be weighed in a draft-free chamber to the nearest 0.00001 gram. Calculate the density by dividing the weight in grams by the volume in cubic metres (g/m^3) to the nearest 0.0001 g/m^3. For each determination, use 5 specimens from each sample and report the arithmetic mean of the density values obtained as the density of the sample.

4.5.4 Filament Diameter: Shall be determined on any suitable instrument to the accuracies noted below:

4.5.4.1 For size determination and ultimate tensile strength, measure the filament diameter of the specimen to the nearest 0.00005 in. (0.0013 mm).

4.5.4.2 For density and modulus of elasticity determinations, measure the diameter of the specimen at each end and the approximate center. Record the arithmetic mean of the three measurements to the nearest 0.00001 in. (0.0003 mm) as the diameter of the specimen.

4.6 Reports:

4.6.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests made on the product to determine conformance to the acceptance requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's material designation, date of manufacture, lot number, quantity, method of determining tensile strength, and, when specified, the number and location of splices.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, supplier's material designation, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.7 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 The filaments shall be supplied in continuous lengths wound on spools with cores having an outside diameter of not less than 8 in. (203 mm). Winding shall be uniform and provide for proper unreeling. Ends shall be secured.

5.1.2 Each spool shall be identified by a nonremovable label using characters of such size as to be clearly legible and which will not be obliterated by normal handling. Each label shall show the following information:

BORON FILAMENTS, TUNGSTEN SUBSTRATE, CONTINUOUS
AMS 3865A
FILAMENT DIAMETER (See 8.2)_____
MANUFACTURER'S MATERIAL DESIGNATION_____
LOT AND SPOOL NUMBER_____
DATE OF MANUFACTURE_____
NUMBER AND LOCATION OF SPLICES_____
QUANTITY_____

5.1.3 Each spool shall be wrapped individually in a material which will ensure protection from damage that may result from handling, shipping, and storage.

5.1.4 Each exterior package shall be legibly marked with the following information in such a manner that the markings shall not smear or be obliterated during normal handling or use:

BORON FILAMENTS, TUNGSTEN SUBSTRATE, CONTINUOUS
AMS 3865A
FILAMENT DIAMETER (See 8.2)_____
PURCHASE ORDER NUMBER_____
MANUFACTURER'S MATERIAL DESIGNATION_____
LOT NUMBER OR SHIPPING DESIGNATION_____
QUANTITY_____