



AEROSPACE MATERIAL SPECIFICATION

AMS3867™

REV. C

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Superseding AMS3867B

Boron Filament Tape, Epoxy-Resin-Impregnated

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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1. SCOPE:

1.1 Form:

This specification and its supplementary detail specifications cover boron filaments in the form of tape impregnated with epoxy resin, the resin to be supplied in a “B” stage condition.

1.2 Application:

Primarily for fabricating high-strength and high-modulus composite parts, with either hand-layup or automated-tape-layup.

1.3 Classification:

The tapes shall be as specified in the applicable detail specification, wherein each product is defined by filament nominal diameter, resin system, and continuous service temperature. An example is shown in 8.2. The tape covered by each detail specification appears as part of the title.

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.

2.1 SAE Publications:

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

2.1.1 Aerospace Material Specifications:

AMS 2825	Material Safety Data Sheets
AMS 3824	Cloth, Type "E" Glass, Finished for Resin Laminates
AMS 3865	Filaments, Boron, Tungsten Substrate, Continuous
AMS 3898	Interleaf Carrier Material, Composite Tape

2.2 ASTM Publications:

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

ASTM D 790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 790M	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials (Metric)
ASTM D 792	Specific Gravity (Relative Density) and Density of Plastics by Displacement
ASTM D 2344	Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short Beam Method
ASTM D 3039	Tensile Properties of Fiber-Resin Composites
ASTM D 3171	Fiber Content of Resin-Matrix Composites by Matrix Digestion
ASTM D 3410	Compressive Properties of Unidirectional or Crossply Fiber-Resin Composites
ASTM D 3529	Resin Solids Content of Carbon Fiber-Epoxy Prepreg
ASTM D 3530	Volatiles Content of Carbon Fiber-Epoxy Prepreg
ASTM D 3531	Resin Flow of Carbon Fiber-Epoxy Prepreg

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 Specifications:

MIL-R-9300	Resin, Epoxy, Low-Pressure Laminating
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2.3.2 Military Standards:

MIL-STD-2073-1	DOD Materiel, Procedures for Development and Application of Packaging Requirements
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2.4 AIA Publications:

Available from National Standards Association, Inc., 1321 14th Street, N.W., Washington, DC 20005.

NAS 992	Reel, Composite Filament Tape, Automated Machine Layup
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3. TECHNICAL REQUIREMENTS:

3.1 Detail Specifications:

The requirements for a specific tape shall consist of all requirements specified herein in addition to requirements specified in the applicable detail specification. In case of conflict between the requirements of this basic specification and an applicable detail specification, requirements of the detail specification shall govern.

3.2 Material:

- 3.2.1 Construction: The tape shall consist of parallel, unidirectional, boron filaments conforming to AMS 3865 impregnated with an epoxy resin which will yield a product meeting the requirements of the applicable detail specification. The boron filaments shall be arranged in a single in-plane layer and supported by a glass scrim cloth. The scrim cloth shall be an integral part of the tape and shall hold the collimated boron filaments in their fixed positions while in storage, during shipment, and when being handled during layup operations. The warp of the scrim cloth shall be parallel to the length of the boron filaments in the impregnated material. The glass fabric shall conform to the requirements of AMS 3824 for the type of cloth specified in the applicable detail specification and shall have an A-1100 soft finish.
- 3.2.2 Impregnating Resin: Impregnating resins shall conform to the general requirements of MIL-R-9300 and the physical properties in the detail specifications. The resin shall be free from foreign materials, noncorrosive to metal, and capable of being molded, using low pressure [25 to 100 psi (172 to 689 kPa)] laminating methods, to a fully thermoset state.
- 3.2.3 Splices: Not more than four filament splices shall occur in any 12-inch (305-mm) length of 3-inch (76-mm) wide tape. No more than three such groups of splices per 100 feet (30.5 m) of tape shall be permitted.
- 3.2.4 Storage Life: Tape, packaged in waterproof, heat-sealed bags, shall meet the requirements of the applicable detail specification after storage as specified therein.
- 3.2.5 Working Life: Tape shall meet the requirements of the applicable detail specification after exposure for a continuous period at the relative humidity and temperature specified therein.
- 3.2.6 Interleaf Carrier: When specified, the interleaf carrier shall conform to the applicable detail specification of AMS 3898, as specified in the applicable detail specification of AMS 3867.

3.3 Properties of Uncured Impregnated Product:

The as-received tape shall conform to requirements of this specification and the applicable detail specification. Tests shall be performed on the tape supplied and in accordance with test procedures specified herein or in the applicable detail specification.

3.4 Properties of Cured Laminate:

Test laminates shall conform to requirements of this specification and the applicable detail specification. Tests shall be performed on specimens cut from laminates prepared and tested in accordance with 4.5.

3.5 Quality:

Tape, as received by purchaser, shall be uniform in quality and condition, free from foreign materials and parting agents and free from imperfections detrimental to usage of the tape.

- 3.5.1 Visual Imperfections Acceptance Criteria: In any roll of tape supplied, there shall be no more than the equivalent of 2% of the total tape length of the roll marked for major imperfections based on the following imperfection classification. More than three minor imperfections in a 12-foot (3.7-m) length of tape shall be classified as a major imperfection.

Imperfection	Description and Limitation	Classification
Filaments not wetted	Visible area not wetted	Major
Filaments not collimated parallel to centerline	Filaments ± 0.25 degrees from parallel to centerline	Major
Crimps	Visible crimps present	Minor
Cured resin particles	None permitted	Major
Foreign material	None permitted	Minor
Glass fabric carrier distortion	None permitted	Major
Rippled interleaving	(to be determined)	
Resin starved area and voids	None allowed	Minor
Fiber crossovers	None allowed	Minor
Horizontal waviness (snaking)	Maximum of 0.030 inch (0.76 mm) from the edge for any 24-inch (610-mm) length	Minor
Flatness (marcelling)	Maximum of 0.125 inch (3.18 mm) across the width	Minor
Broken fiber	None allowed	Minor

- 3.5.1.1 Visible major imperfections shall be marked by inserts and shall be cause for rejection only if the total length of such areas exceeds 2% of the total tape length of the roll.

3.6 Sizes and Tolerances:

Shall be as follows, determined as in 4.5.7:

- 3.6.1 Width: Shall be 3.000 inches $\pm$ 0.015 (76.20 mm $\pm$ 0.38), determined by measuring the distance between the outsides of the extreme boron filaments.
- 3.6.2 Length per Roll: Shall be 125 to 500 feet (38 to 152 m) except that the last roll of a lot may have less than 125 feet (38 m). Any length of defective tape shall not be counted in the specified length.
- 3.6.3 Filament Count and Spacing: Shall be as specified in the applicable detail specification and shall be such that the filaments do not touch each other. The filament gap shall not exceed three filament diameters

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of tape 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 tape conforms to the requirements of this specification.

4.2 Classification of Tests:

- 4.2.1 Acceptance Tests: Tests for construction (3.2.1), properties of uncured impregnated product (3.3), longitudinal flexural strength, modulus of elasticity in flexure, and interlaminar shear strength, all at room and elevated temperatures, and fiber volume of cured laminates (3.4), quality (3.5), and tolerances (3.6) are acceptance tests and shall be performed on each lot.
- 4.2.2 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of tape to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.
 - 4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

- 4.3.1 For Acceptance Tests: Sufficient tape shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than as specified in 4.5.