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

AEROSPACE MATERIAL SPECIFICATION

AMS 3894

Issued 11-15-72
Revised

GRAPHITE FIBER TAPE AND SHEET
Epoxy Resin Impregnated
For Hand Layup

1. SCOPE:

1.1 Form: This specification and its supplementary detail specifications cover graphite fibers in the form of tape and sheet 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.

1.3 Classification: The tapes and sheets shall be as specified in the applicable detail specifications, wherein each material is defined by basic fiber property characteristic and continuous service temperature. An example is shown in 8.1. The material covered by each detail specification appears as part of the title.

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
AMS 3892 - Fibers, Graphite, Tow and Yarn, For Structural Composites

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM D792 - Specific Gravity and Density of Plastics by Displacement
ASTM D1505 - Density of Plastics by the Density-Gradient Technique
ASTM D2734 - Void Content of Reinforced Plastics

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

2.3.1 Federal Specifications:

O-A-51 - Acetone, Technical

2.3.2 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

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

3.2 Material:

3.2.1 Construction: The product shall consist of parallel, unidirectional graphite fibers meeting the requirements of AMS 3892 and its applicable detail specification impregnated with the epoxy resin meeting the requirements of the applicable detail specification hereunder and arranged in a single in-plane layer.

3.2.2 Ends: Unless otherwise specified, the product shall contain no unspliced yarn or tow ends.

3.2.3 Storage Life: The product, when packaged in waterproof heat sealed bags, shall be capable of meeting the requirements of the applicable detail specification after storage as specified therein.

3.2.4 Working Life: The product shall meet the requirements of the applicable detail specification after exposure for a continuous period at the relative humidity and temperature specified therein.

3.2.5 Bending: The product shall withstand bending through an angle of 180 deg (3.14 rad) around a 1.0 in. (25 mm) diameter mandrel with the fiber direction perpendicular to the axis of bend without visible material damage; magnification of 10X shall be used in examination for damage.

3.3 Properties of Uncured Impregnated Material: The product as received shall conform to the requirements of this specification and the applicable detail specification. Tests shall be performed on the product supplied and in accordance with applicable test procedures of this specification as follows:

Property	Number of Specimens per Test min	Test Procedure
Volatile Content	1	4.5.1
Total Nonfiber Content	2	4.5.2
Resin Flow	1	4.5.3
Gel Time	1	4.5.4
Tack	1	4.5.5

3.4 Properties of Cured Laminate: Test laminates shall conform to the requirements of this specification and the applicable detail specification. Tests shall be performed on specimens cut from laminates produced as in 3.4.1 and in accordance with the applicable test procedures of this specification as follows:

Property	Number of Specimens per Test min	Test Procedure
Tensile Strength and Modulus of Elasticity	4	4.5.6
Compressive Strength and Modulus of Elasticity	4	4.5.7

(continued next page)

Property	Number of Specimens per Test min	Test Procedure
Flexural Strength and Modulus of Elasticity	4	4.5.8
Short Beam Shear Strength	4	4.5.9
Density	3	4.5.10
Void Content	3	ASTM D2734
Fiber Volume	3	4.5.11

3.4.1 Preparation of Test Laminate: Test laminates of suitable thickness and area shall be prepared from sufficient plies of impregnated material oriented unidirectionally and cured in an autoclave or equivalent at a temperature and pressure to provide optimum properties. The temperature and pressure used shall be noted in the report. The resultant laminate shall be uniform in thickness within ±0.003 in. (0.08 mm) and shall have a fiber volume of 60% ± 3.

3.5 Quality: The product shall be uniform in quality and condition, clean, and free from foreign materials and from internal and external imperfections detrimental to fabrication, appearance, or performance of parts.

3.6 Sizes and Tolerances: Tape and sheet shall be supplied to the dimensions specified in the purchase order. The width shall not vary more than ±0.040 in. (1.02 mm) for each 3.0 in. (76 mm) of width specified, and the length shall be not less than the net length specified on the purchase order.

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 construction (3.2.1), bending (3.2.5), properties of uncured impregnated material (3.3), longitudinal flexural strength, modulus of elasticity in flexure and short beam shear strength of cured laminate at room temperature (3.4), and tolerance (3.6), 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 and the applicable detail specification are classified as qualification or periodic control tests.

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	Accept	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 100%.

4.3.2 Lot: A lot is defined as all material produced in a single production run made from the same batch of raw materials under the same fixed conditions and submitted for delivery at one time.

4.3.3 Inspection Unit: Unless otherwise specified, an inspection unit is defined as each 25.0 lb (11.35 kg) of impregnated material or fraction thereof.

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 samples.

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 Volatile Content:

4.5.1.1 Cut sufficient material to obtain a specimen weighing approximately 1 g, and weigh to the nearest mg (W_1).

4.5.1.2 Suspend the specimen on a removable tray (areas of the tray in contact with the specimen shall be covered with a suitable parting agent film) in a circulating air oven preheated to the temperature specified in the applicable detail specification for the product being tested. Heat the specimen at that temperature for the time specified in the applicable detail specification.

4.5.1.3 Remove specimen from the tray and place in a desiccator.

4.5.1.4 Cool specimen to room temperature inside the desiccator for at least 30 min., and weigh to the nearest mg (W_2).

4.5.1.5 Calculate volatile content as follows:

$$\text{Volatile Content, \% by weight} = \frac{W_1 - W_2}{W_1} \times 100$$

where, W_1 = Original weight of specimen, mg

W_2 = Final weight of specimen, mg

4.5.2 Total Nonfiber Content:

4.5.2.1 Cut sufficient material to obtain 2 specimens each weighing approximately 1 g, and weigh to the nearest mg (W_3).

4.5.2.2 Place the specimens in separate containers and wash with a suitable boiling solvent for not less than 2 minutes. Time starts when the solvent starts to boil. Decant the solvent. The solvent used shall be selected on the basis of being able to completely dissolve the resin under the conditions of this test. Report the solvent and temperature used.

4.5.2.3 Repeat 4.5.2.2 for 3 complete wash cycles.

4.5.2.4 Dry the specimens by placing them in a circulating air oven maintained at 325 F ± 10 (162.8 C ± 5.6) for not less than 1 hr, or until weight is constant. Remove and place in desiccator.

4.5.2.5 After 10 min., remove specimens from desiccator and weigh to the nearest mg (W_4).

4.5.2.6 Calculate nonfiber content as follows:

$$\text{Total Nonfiber Content, \% by weight} = \frac{W_3 - W_4}{W_4} \times 100$$

where, W_3 = Original weight of specimen, mg

W_4 = Final weight of specimen, mg

4.5.2.7 Calculate the arithmetic mean of the two determinations as total nonfiber content of the sample. Report both the individual results and the arithmetic mean.

4.5.3 Resin Flow:

4.5.3.1 Cut 2 pieces of impregnated graphite material, each piece approximately 2 in. (51 mm) square and weigh to the nearest mg (W_5). Cut 4 pieces of a suitable release bleeder cloth and 2 pieces of porous polytetrafluoroethylene glass cloth, each piece approximately 3 in. (76 mm) square.

4.5.3.2 Layup a flow specimen assembly of 2 layers of bleeder cloth, 1 layer of polytetrafluoroethylene glass cloth, the 2 pieces of graphite material crossplied at approximately 90 deg (1.57 rad) centered in the middle, 1 layer of polytetrafluoroethylene glass cloth, and 2 layers of bleeder cloth. Weight the assembly to the nearest mg (W_6). Impregnated graphite material in widths less than 2 in. (51 mm) shall be cut and positioned to form an approximately 2 in. (51 mm) square.

4.5.3.3 Place the flow specimen assembly in a heated platen press between nonporous polytetrafluoroethylene sheets and cover with a heat resistant elastomeric sheet approximately 0.06 in. (1.5 mm) thick. Heat the assembly at a temperature and pressure recommended by the resin manufacturer for 15 min. ± 0.25, cool to room temperature, and weigh to the nearest mg (W_7).

4.5.3.4 Remove the cured graphite material from the bleeder cloth and porous polytetrafluoroethylene layers and trim the specimen free from resin flash, taking care not to remove any graphite fibers. Weigh the graphite material to the nearest mg (W_8).

4.5.3.5 Calculate the volatile free resin flow as follows:

$$\text{Resin Flow, \% by weight} = \frac{W_5 - (W_6 - W_7) - W_8}{W_5 - (W_6 - W_7)} \times 100$$

where, W_5 = Original weight of graphite material, mg

W_6 = Original weight of specimen assembly, mg

W_7 = Weight of specimen assembly after press heating, mg

W_8 = Weight of graphite material after trimming, mg

4.5.3.6 Report the test results and the temperature and pressure used in press heating of the specimen assembly.

4.5.4 Gel Time:

4.5.4.1 Cut a piece of impregnated graphite material approximately 0.25 in. (6.4 mm) square.

4.5.4.2 Preheat a hot plate to the same temperature ± 2 F (± 1.1 C) used for resin flow.

4.5.4.3 Place a micro cover glass on the hot plate allowing 20 sec for it to reach temperature equilibrium. Position the specimen at the center of the micro cover glass and simultaneously commence timing. Within 5 sec, place a second micro cover glass over the specimen. After the resin softens and during the first 30 sec, probe the top micro cover glass and isolate a drop of resin. Observe the fluidity and color of the isolated resin drop periodically (continuously as the end point approaches). The lateral (spreading) movement of the resin upon probing will decrease or regress and the color shade will change as the gel point approaches. Stop the timer at the first indication of resin immobility and record the lapsed time to the nearest second.

4.5.5 Tack:

4.5.5.1 Cut 2 pieces of impregnated graphite material approximately 25.4 x 76.2 mm 1 x 3 in. (25 x 76 mm), retaining the protective film until immediately before using the specimens. Fiber direction shall be parallel to the 1 in. (25 mm) dimension. For material less than 3 in. (76 mm) wide, butt sufficient pieces on the panel to produce a 3 in. (76 mm) wide specimen.

4.5.5.2 Remove the protective film from one side of one specimen and apply the material to the center of a clean piece of austenitic corrosion resistant steel sheet with a commercial 2D finish, any thickness by approximately 4 x 8 in. (102 x 203 mm). Apply light pressure with a squeegee or roller over the backing film. Remove the backing film and apply the second specimen to the first, in exactly the same manner, making sure the opposing faces of the material are not covered with protective backing film. The second layer of narrow material shall be so positioned that the butt joints do not coincide with those of the first layer. Remove the protective film from the exposed surface of the material and maintain the test plate and the long dimension of the test specimen in a vertical position for not less than 30 min. at 70 - 80 F (21.1 - 26.7 C) and 50 - 70% relative humidity.

4.5.5.3 Report results as pass or fail. If a specimen fails to adhere for the test period, record the elapsed time at failure.

4.5.6 Tensile Strength and Modulus of Elasticity:

4.5.6.1 Specimen Preparation: The specimens taken from the laminate prepared in 3.4.1 shall be straight sided coupons. Specimen edges shall be ground to the required width and length dimensions with abrasive finer than 400 grit.

4.5.6.1.1 Longitudinal Specimen: Test specimens shall conform to Fig. 1, with adhesive bonded laminate tabs. Specimen fibers shall be parallel to the longitudinal axis.

4.5.6.1.2 Transverse Specimen: Test specimens shall conform to Fig. 2. Specimen fibers shall be normal to the longitudinal axis. Tabs are not used.

4.5.6.2 Procedure: The specimen shall be loaded to failure at a 0.050 in. ± 0.005 (1.27 mm ± 0.13) per min. crosshead speed in a testing machine, using instrumentation as shown in Figs. 1 and 2. Test temperatures shall be as specified in the applicable detail specification. Specimens shall be tested after exposure for not less than 30 min. at the test temperature.

4.5.6.3 Calculation Using U. S. Customary Units of Measure: Tensile strength and modulus of elasticity shall be obtained by the formulas given below (See 4.5.6.5):

$$\text{Ultimate Tensile Strength, psi} = \frac{F_t}{A}$$

$$\text{Tensile Modulus of Elasticity, psi} = \frac{F_t}{\varepsilon}$$

where, F_t = Maximum tensile load, lb

A = Specimen cross-sectional area, sq in.

ε = Corresponding strain in in. per in.

4.5.6.4 Calculation Using SI Units of Measure: Tensile and modulus of elasticity shall be obtained by the formulas given below (See 4.5.6.5):

$$\text{Ultimate Tensile Strength, MPa} = \frac{F_t}{A} \times 10^6$$

$$\text{Tensile Modulus of Elasticity, MPa} = \frac{F_t}{\varepsilon} \times 10^6$$

where, F_t = Maximum tensile load, N

A = Specimen cross-sectional area, mm^2

ε = Corresponding strain in mm per mm

4.5.6.5 Obtain the modulus of elasticity by extending the initial straightline portion of the load-deflection curve and graphically determining the ratio of stress to corresponding strain.

4.5.6.6 Reporting: Calculate the arithmetic mean of 4 determinations for each test as tensile strength and modulus of elasticity of the sample. Report both the individual test results and the arithmetic mean.

4.5.7 Compressive Strength and Modulus of Elasticity: The test method used shall be reported. The method identified as "Celanese Compression Test" is preferred.

4.5.8 Flexural Strength and Modulus of Elasticity:

4.5.8.1 Specimen Preparation: The specimens, taken from the laminate prepared in 3.4.1, shall be 0.080 in. (2.03 mm) nominal thickness, 0.500 in ± 0.010 (12.70 mm ± 0.25) wide, and 3.00 in. ± 0.03 (76.2 mm ± 0.08) long. Specimen edges shall be ground to the required length and width dimensions with abrasive finer than 400 grit. The fiber direction of the specimen shall be parallel to the longitudinal axis of the specimen. Other specimen configurations are acceptable provided that the fiber direction is parallel to the longitudinal axis of the specimen, the thickness of the specimen is equal to or less than the width of the specimen, and the length of the specimen is sufficient to provide a span equal to 32 ± 2 times the thickness.

4.5.8.2 Test Procedure: The specimen shall be loaded to failure at a crosshead speed of 0.050 in. ± 0.005 (1.27 mm ± 0.13) per min. in a testing machine with fixture and instrumentation as indicated in Fig. 3. The deflectometer shall be of the linear differential transformer type. Necessary adjustments shall be made so that the deflectometer pushrod is midway between the supports ± 0.03 in. (± 0.8 mm). The span length shall be 32 ± 2 times the specimen thickness.

4.5.8.3 Calculation Using U. S. Customary Units of Measure: Flexural strength and modulus shall be obtained by the formulas given below:

$$\text{Flexural Strength, psi} = \frac{3PL}{4bt^2}$$

$$\text{Flexural Modulus of Elasticity, psi} = \frac{11}{64} \frac{L^3}{bt^3} \frac{(\Delta P)}{(\Delta_\delta)}$$

where, P = Load at failure, lb

L = Span, in.

b = Width, in.

t = Thickness, in.

ΔP = Increment of load, lb

Δ_δ = Increment of deflection, in.

$\frac{\Delta P}{\Delta_\delta}$ = Slope of initial straightline portion of the load deflection curve, lb per in.

4.5.8.4 Calculation Using SI Units of Measure: Flexural strength and modulus shall be obtained by the formulas given below:

$$\text{Flexural Strength, MPa} = \frac{3PL}{4bt^2} \times 10^6$$

$$\text{Flexural Modulus of Elasticity, MPA} = \frac{11}{64} \frac{L^3}{bt^3} \frac{(\Delta P)}{(\Delta_\delta)} \times 10^6$$

where, P = Load at failure, N

L = Span, mm

b = Width, mm

t = Thickness, mm

ΔP = Increment of load, N

Δ_δ = Increment of deflection, mm

$\frac{\Delta P}{\Delta_\delta}$ = Slope of initial straightline portion of the load deflection curve, N per mm

4.5.8.5 Reporting: Calculate the arithmetic mean of 4 determinations as the flexural strength and modulus of elasticity of the sample. Report the individual test results and the arithmetic mean.

4.5.9 Short Beam Shear Strength:

4.5.9.1 Specimen Preparation: The specimen, taken from the laminate prepared in 3.4.1, shall be 0.250 in. ± 0.005 (6.35 mm ± 0.13) wide, and 0.700 in. ± 0.010 (17.78 mm ± 0.25) long. Specimen edges shall be ground to the required length and width dimensions with abrasive finer than 400 grit. The fibers shall be parallel to the longitudinal axis.

4.5.9.2 Test Procedure: A 3-point loading device as shown in Fig. 4 with loading nose and supports of diameters indicated shall be used. The specimen shall be loaded at the center of a span 4 ± 0.1 times the thickness of the specimen. The loading device shall provide for accurate centering and alignment. The centerlines of the cylindrical surfaces of the loading nose and the supports shall be parallel. The longitudinal axis of the specimen shall be perpendicular to the centerlines of the cylindrical surfaces within ±1 deg (± 0.017 rad). The specimens shall be loaded to failure at a crosshead speed of 0.050 in. ± 0.005 (1.27 mm ± 0.13) per minute. Observe the break before the specimen binds in the test fixture.

4.5.9.3 Calculation Using U. S. Customary Units of Measure: The short beam shear strength shall be calculated as follows:

$$\text{Short Beam Shear Strength, psi} = \frac{3P}{4A}$$

where, P = Load at failure, lb

A = Specimen cross-sectional area, sq in.

4.5.9.4 Calculation Using SI Units of Measure: The short beam shear strength shall be calculated as follows:

$$\text{Short Beam Shear Strength, MPa} = \frac{3P}{4A} \times 10^6$$

where, P = Load at failure, N

A = Specimen cross-sectional area, mm^2

4.5.9.5 Reporting: Calculate the arithmetic mean of 4 determinations as the short beam shear strength of the sample. Report the individual test results and the arithmetic mean.

4.5.10 Density: The density of the test laminate prepared as specified in 3.4.1 shall be determined in accordance with ASTM D792 using a suitable nonaqueous liquid or in accordance with ASTM D1505.

4.5.11 Laminate Fiber Volume:

4.5.11.1 Preparation of Specimens: Three pieces, each not less than 1 in. (25 mm) square, shall be cut from the laminate prepared in 3.4.1, and weighed in separate cleaned and tared (W_9) thimbles to the nearest mg (W_{10}).

4.5.11.2 Acid Digestion: Place each thimble in a separate 150 cm^3 beaker and add 100 cm^3 of acid to the beaker. The beaker with the contents shall be heated at a suitable temperature until the resin has dissolved and digestion is complete, and cooled to room temperature.

4.5.11.3 Filtration: Discard the acid used in the digestion without loss of residue and attach the thimble on a vacuum filter flask. Rinse the fibers with additional clean acid, followed by distilled water, and finally with acetone. The acetone shall remain clear, indicating complete removal of resin from the fibers.

4.5.11.4 Drying and Weighing: Each thimble, with the contents shall be heated in a circulating air oven at 250 F ± 10 (121.1 C ± 5.6) for 15 min. ± 1, cooled in a desiccator to room temperature for at least 60 min. and weighed immediately to the nearest mg (W_{11}).

4.5.11.5 Calculation: The laminate fiber volume shall be calculated as follows:

$$\text{Fiber Volume, \%} = \frac{(W_{11} - W_9)\, D_1}{(W_{10} - W_9)\, D_2} \times 100$$

where, W_9 = Weight of extraction thimble, mg

W_{10} = Weight of extraction thimble plus specimen, mg

W_{11} = Weight of extraction thimble plus specimen after digestion, mg

D_1 = Density of graphite fiber as specified in applicable detail specification of AMS 3892

D_2 = Density of laminate determined in accordance with 4.5.10.

4.5.11.6 Reporting: Calculate the arithmetic mean of 3 determinations as the fiber volume of the test laminate. Report the individual test results and the arithmetic mean.

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 test requirements of this specification and the applicable detail specification, including the identification of the resin system used, the cure cycle and fiber volume of the test laminate, and a statement that the product conforms to all other technical requirements of this specification and the applicable detail specification. This report shall include the purchase order number, material specification number including the applicable detail specification number, vendor's material designation, lot number, spool or sheet numbers, date of manufacture, quantity (tape width and length, or sheet width and length and number of sheets), and location of test samples within the lot and spool or sheet.

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 including the applicable detail specification number, 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 the applicable detail 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: Disposition of product rejected under 4.3.1 and Table I 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 Identification: Each spool of tape and each sheet shall be identified by attached removable tags using characters approximately 3/8 in. (9.5 mm) in height which will not be obliterated by normal handling. Each tag shall be legibly marked to give the following information:

GRAPHITE FIBER TAPE (OR SHEET), EPOXY RESIN IMPREGNATED
AMS 3894/_____
MANUFACTURER'S MATERIAL DESIGNATION _____
PURCHASE ORDER NUMBER_____
DATE OF MANUFACTURE_____
LOT AND SPOOL OR SHEET NUMBERS_____
QUANTITY_____

5.2 Packaging:

5.2.1 Tape: Unless otherwise specified, tape material shall be wound on spools not less than 3 in. (76 mm) in hub diameter and interleaved with nonadherent film. Winding shall be uniform and shall provide for proper unreeling. Tape ends shall be secured.

5.2.2 Sheet: Unless otherwise specified, each sheet shall be supplied flat with a suitable nonadherent protective covering or separator film on each side.

5.2.3 Package Sealing: Unless otherwise specified, each spool and each sheet of material shall be sealed in a bag of suitable nonadherent material to prevent penetration of moisture or loss of impregnating resin solvent.

5.3 Exterior Packaging:

5.3.1 Packing: The protected spools and sheets shall be packed in an exterior shipping container identified with a package number and capable of protecting the materials adequately during transit and storage below the temperature specified in the applicable detail specification and meeting carrier rules and regulations applicable to the mode of transportation.

5.3.2 Marking of Exterior Package: Each exterior shipping container 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.

GRAPHITE FIBER TAPE (OR SHEET), EPOXY RESIN IMPREGNATED
AMS 3894/_____
PURCHASE ORDER NUMBER_____
MANUFACTURER'S MATERIAL DESIGNATION_____
LOT AND PACKAGE NUMBERS_____
QUANTITY_____
PERISHABLE - STORE BELOW_____ (See applicable detail specification)

6. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Classification System: The classification system used to identify each detail specification material is shown by the following example:

G 110,000 (758) Tensile, (27,000,000) (186) Modulus, 350 (177) Service Temperature _____
- Property Characteristics of Resultant Composite (See 8.1.1)
- Graphite

8.1.1 Property Characteristic: The property characteristic of the resultant laminate is taken from the room temperature property requirements shown in Table I of each detail specification. The characteristics selected are the tensile strength and modulus of elasticity in tension. In the example, the characteristic 110,000 psi (758 MPa) minimum tensile strength and 27,000,000 psi (186 GPa) tensile modulus.

8.1.2 Service Temperature: Service temperature indicates the maximum recommended service temperature, F (C).

8.2 Laminate Thickness Per Ply: The thickness per ply of the test laminate required by 3.4.1 is determined according to the following calculation:

$$\text{Thickness per ply, in. (mm)} = \frac{A}{B}$$

where, A = Thickness of test panel, in. (mm)

B = Number of layers of material in the panel

8.3 Tape Width Increments: The following increments are considered standard:

8.3.1 U. S. Customary Units of Measure:

a. Tapes 1/2 to 3 in. wide at 1/2-in. increments
b. Tapes 3 to 6 in. wide at 1-in. increments
c. Tapes 6 to 12 in. wide at 2-in. increments

8.3.2 SI Units of Measure:

a. Tapes 12 to 72 mm wide at 12-mm increments
b. Tapes 75 to 150 mm wide at 25-mm increments
c. Tapes 150 to 300 mm wide at 50-mm increments