INCH-POUND
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MILITARY SPECIFICATION

THERMOSETTING POLYMER MATRIX, UNIDIRECTIONAL CARBON FIBER REINFORCED PREPREG TAPE (WIDTHS UP TO 60 INCHES), GENERAL SPECIFICATION FOR

This specification is approved for use within the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the general requirements for thermosetting polymer matrix, unidirectional carbon fiber prepregs. Specific requirements for the prepreg material are governed by this document along with the applicable specification sheet. This specification contains qualification requirements Qualification pertains only to the requirements of this specification and does not qualify the material for use in the fabrication of a structural component in a particular system. Qualifying a material for use in the fabrication of a structural component requires additional testing requirements as determined by the government and the system manufacturer (see 6.3).

1.2 Classification. The various classifications of the prepreg material are covered in each individual specification sheet. Each specification sheet covers a particular prepreg material according to the matrix type and carbon fiber properties (see paragraph 6.8)

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

PPP-B-601	Boxes, Wood, Cleated Plywood
PPP-B-636	Box, Shipping, Fiberboard

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Air Engineering Center, Systems Engineering and Standardization Department (Code 53), Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A AREA CMPS

MILITARY

MIL-P-116	Preservation, Methods of
MIL-B-117	Bags, Sleeves And Tubing
MIL-H-5606	Hydraulic Fluids, Petroleum Base, Aircraft, Missile, and Ordinance
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-L-7808	Lubrication Oil, Aircraft Turbine Engine, Synthetic Base
MIL-A-8243	Anti Icing and Deicing Defrosting Fluid
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-H-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, NATO Code Number H-537
MIL-C-87936	Cleaning Compounds, Aircraft Exterior Surfaces, Water Dilutable

STANDARDS

FEDERAL

FED-STD-313	Material Safety Data Sheets, Preparation And The Submission of

MILITARY

MIL-STD-105	Sampling Procedures and Table for Inspection by Attributes
MIL-STD-129	Marking For Shipping and Storage

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications The following documents form a part of this document to the extent specified herein Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D740	Methyl Ethyl Ketone
ASTM D792	Specific Gravity and Density of Plastics by Displacement
ASTM D1505	Density Of Plastics By The Density Gradient Technique
ASTM D1655	Aviation Turbine Fuels, Standard Specifications for
ASTM D3530	Volatile Content Of Carbon Fiber-Epoxy Prepreg
ASTM D3531	Resin Flow Of Carbon Fiber-Epoxy Prepreg
ASTM D3532	Test Method For Gel Time Of Carbon Fiber Epoxy Prepreg
ASTM D3951	Practice For Commercial Packaging
ASTM D4065	Determining And Reporting Dynamic Mechanical Properties Of Plastics
ASTM D4473	Measuring The Cure Behavior Of Thermosetting Resins Using Dynamic Mechanical Procedures

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B46.1 Surface Texture, Surface Roughness, Waviness and Lay

(Application for copies should be addressed to the American National Standards Institute, 345 East 47th Street, New York, NY 10017).

SUPPLIERS OF ADVANCED COMPOSITE MATERIALS ASSOCIATION (SACMA)

SRM 1	Compressive Properties Of Oriented Fiber-Resin Composites
SRM 2	Compression After Impact Properties Of Oriented Fiber-Resin Composites
SRM 3	Open-Hole Compression Properties Of Oriented Fiber-Resin Composites
SRM 4	Tensile Properties Of Oriented Fiber-Resin Composites
SRM 5	Open-Hole Tensile Properties Of Oriented Fiber-Resin Composites
SRM 7	Inplane Shear Stress-Strain Properties Of Oriented Fiber-Resin Composites
SRM 8	Apparent Interlaminar Shear Strength Of Oriented Fiber-Resin Composites By The Short Beam Method
SRM 11	Conditioning Of Composite Test Laminates

(Application for copies should be addressed to the Suppliers of Advanced Composite Materials Association, 1600 Wilson Blvd., Suite 1008, Arlington, VA 22209)

2.3 Order of precedence In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3 1 Specification sheets The individual prepreg requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this document and the specification sheet, the latter shall govern.

3.1.1 Qualification The materials furnished under this document and the applicable specification sheets shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time set for opening of bids (see 4 3 and 6 3)

3.2 Materials.

3.2 1 Resin matrix. The resin matrix shall be capable of impregnating the carbon fibers such that the resulting material shall meet the requirements of this specification and the applicable specification sheet.

3.2.2 Carbon fiber tow. The carbon fiber tow shall be compatible with the resin system used and shall meet the requirements specified in the applicable specification sheet

3.3 Prepreg. The prepreg material shall consist of unidirectional and continuous, parallel carbon fiber tows per 3 2 2, impregnated with a resin matrix as specified in 3 2 1. The tows shall run parallel to the roll length (see Figure 1) The prepreg material shall meet the requirements specified herein and in the applicable specification sheet.

3 3 1 Physical properties The physical properties of the prepreg material shall be as specified in Table V

3.3 2 Chemical properties. The chemical properties of the prepreg material shall be determined as specified in Table I. The results of each analysis shall be within the ranges provided in the original qualification data (see 4 3 2 3). In addition, no impurities shall be detected

TABLE I Prepreg Chemical Property Tests

Chemical Test	Test Reference
IR	4.7.2.1
HPLC	4.7.2 2
RDS	4.7.2.3

3.3 3 Manufacture of prepregs up to 60 inches (152 cm) in width Prepregs up to 60 inches (152 cm) in width shall be processed by either of the methods described herein except as specified in 3.3 5

3.3.3.1 Edge splicing This method shall produce prepregs of desired widths by edge splicing narrower tapes together The gap tolerance between tows of adjacent edges shall be 0.00 + 0.03 inches (0 00 + 0.08 cm) Edge splices shall not overlap. The edge waviness for each foot length of the narrower tapes being spliced shall be as specified in Table II when determined in accordance with ANSI B46 1

Table II. Edge Waviness

Prepreg Width	Edge Waviness, Max
Up to and incl 12 inches(30 cm)	0.02 inch(0 05 cm)
Over 12 inches(30 cm) up to and incl 24 inches(60 cm)	0 03 inch(0 08 cm)
Greater than 24 inches(60 cm)	0.05 inch(0 13 cm)

3 3 3 2 Direct impregnation This method shall produce prepregs of desired widths by directly impregnating sufficient carbon fiber from a large creel of spools

3.3 4 Prepreg width and tolerances. The width and tolerances of the prepreg material shall be as specified in the contract or order (see 6 2). If required, the prepreg material shall be slit to the specified width Roll winding tension shall be controlled during the slitting process in order to prevent prepreg resin and fiber squeeze out from adhering adjacent wraps together at roll edges.

3.3.5 Defect removal and identification. As specified in the contract or purchase order, defects as specified in 3.8 shall be either removed in accordance with 3.3.5.1 or identified in accordance with 3.3.5.2 (see 6.2). If defects are to be identified in accordance with 3.3.5.2, the material shall be manufactured by direct impregnation only (see 3.3.3).

3.3.5.1 Full width defect removal. Defective areas (see 3.8) shall be removed across the entire width of the prepreg. After removal, the full width separations shall be spliced as specified in 3.3.5.1.1. Unless otherwise specified, the distance between any two adjacent splices shall be at least 50 feet (15 24 m). In addition, splices shall be at least 50 feet (15 24 m) from the start or end of the roll length. The location of all splices shall be identified on the roll condition log (see 5.1.1).

3.3.5.1 1 Splicing Unless otherwise specified, splices shall be made in accordance with Figures 2A, 2B, or 2C. When the separations are spliced, the prepreg material shall adhere to itself such that separation during handling does not occur. The pressure sensitive tapes used for liner splicing shall adhere to the liners and release from the prepreg. When splices are made per Figure 2B, the double sided tape shall not extend beyond either edge of the liner overlap

3.3.5.2 Defect identification. Defective areas (see 3 8) shall be identified using a compatible marking ink of contrasting color to that of the prepreg and the material identification marking as specified in 3.7 The defect marking ink shall be used to identify defects but shall not cover or mask them. The roll condition log (see 5 1.1) shall indicate the type, location, and longitudinal length of each defect and shall allow the purchaser to locate defects from the start of the roll to an accuracy of $\pm$ 3 ft (0.91m) Multiple tow defects closer to each other than 3 feet shall be considered as a continuous defect length The cumulative defect lengths within a roll shall not be included in the net roll length. The total defect length per roll shall not exceed 15 percent of the total roll length.

3.3.6 Refrigerated storage life. Refrigerated storage life conditioning shall be as specified in the applicable specification sheet and shall commences from the date of material manufacture (see Figure 3). After conditioning, the material shall meet the handling life and mechanical life requirements specified in 3.3.6.1 and 3 3.6 2

3 3 6.1 Handling life Handling life conditioning shall be as specified in the applicable specification sheet (see Figure 3). After conditioning, the prepreg material shall meet all the requirements in Tables V, VI, VII, and VIII

3.3.6.2 Mechanical life (open mold life). Mechanical (open mold) life conditioning shall be as specified in the applicable specification sheet (see Figure 3). After conditioning, the material shall meet all the requirements in Tables VII and VIII.

3 4 Cured laminate properties

3.4.1 Physical properties The physical properties of the cured laminates shall be as specified in Table VII.

3.4.2 Mechanical properties The mechanical properties of the fully cured laminates shall be as specified in Table VIII.

3.4.3 Fluid resistance. When immersed in the fluids specified in Table III for the exposure times and temperatures specified, the cured composite material shall meet the requirements for thin short beam shear as specified in the applicable specification sheet. The laminates shall show no visible degradation or damage (ie. dissolution, gelation, or swelling). In addition, contact by the cured laminate material shall not alter the properties of the fluids as required by their respective specifications

TABLE III. Fluid Resistance

FLUID	SPECIFICATION	IMMERSION TIME AND TEMPERATURE 1/
Turbine Fuel	MIL-T-5624 2/	90 Days at 75°F(24°C)
Lubricating Oil	MIL-L-7808	90 Days at 180°F(84°C)
Anti-Icing Fluid	MIL-A-8243	30 Days at 32°F(0°C)
Lubricating Oil	MIL-L-23699	90 Days at 180°F(84°C)
Hydraulic Fluid	MIL-H-83282	90 Days at 75°F(24°C)
Cleaning Fluid	MIL-C-87936	7 Days at 75°F(24°C)
Hydraulic Fluid	MIL-H-5606	90 Days at 75°F(24°C)
MEK	ASTM D740	7 Days at 75°F(24°C)

1/ Temperatures shall be as specified ± 5°F(± 3°C).
2/ Or ASTM D1655

3.5 Liners. Liners used shall not alter the physical, chemical or mechanical properties of the prepreg. In the event that liner sections are inadvertently included in a layup, the liner material shall be capable of being detected by ultrasonic pulse echo C-scan or through transmission techniques at frequencies commonly used in part production Liners shall be easily removed at ambient temperature, shall not tear upon standard removal techniques, and shall not misalign, distort, or break fibers after removal No removal of prepreg resin shall be permitted and only minimal transfer of liner release agent shall be allowed The use of silicone release agents shall be prohibited Liners shall be capable of being machine slit, hand knife cut, die cut or automatic knife cut coincident with the prepreg. Clear film liners or black liners, which cannot be readily seen or which may be mistaken for resin, shall not be used

3.6 Prepreg roll requirements All roll requirements such as material length, weight, diameter, outer or inner liners, core requirements, etc shall be as specified in the contract or order (see 6 2)

3 7 Material identification marking Unless otherwise specified, either the uncured prepreg material or the liner shall be printed with the specification number, specification sheet number and Class, manufacturer's name, and the product name. The word "manufacturer's name" may be abbreviated if the number of characters must be limited The printers used shall be in-line with the prepreg process unless pre-printed liners are used Printing shall run parallel to length of the roll, shall not adversely affect the mechanical properties or mask defects in the material, and shall be legible after unwinding the roll. Printing frequency shall be at least once per linear yard If the identification marking is applied on the prepreg material, it shall be of contrasting color to that of the prepreg material and the defect identification marking in 3 3 5 2 If the identification marking is applied on the liner, it shall be of contrasting color to that of the liner.

3.8 Defects. Material defects shall be defined as specified herein.

3.8.1 Tow placement and defects. The lay of the tow shall not deviate from a straight line by more than 0 03 inch (0 08 cm) in each linear foot of material. Fuzz balls which do not distort fibers, do not cause tow separation and are pressed flat, are acceptable provided that the maximum accumulated area of fuzz balls does not exceed 1.5 in^2 (9 7 cm^2) in any 1 ft^2 (0.1 m^2) of material. Other types of fuzz balls shall not be allowed Gaps between fibers shall not be more than 0.03 inch (0.08 cm) wide nor more than 10 feet (3.0 m) long. One gap between 0 01 and 0 03 inch (0.03 and 0.08 cm) is allowed in any 3 inch (8 cm) width of prepreg Open spaces less than 0 01 inch (0 03 cm) are not considered gaps and are acceptable. Fibers shall be flush with the edge of the liner The material shall be free of tow crossovers, tow discontinuities, twisted tows, and visually apparent tow splices.

3.8.2 Resin impurities and defects The preimpregnated material shall be uniform in quality and condition. It shall be free of resin rich areas, resin-starved areas, dry and boardy areas, and cured resin particles. Random, sparse flecks of liner and/or resin material inherent to the prepreg manufacturing process are acceptable provided the fleck is no greater than 0.031 inch(0.079 cm) in any dimension. The prepreg shall be free of all other foreign material.

3.8.3 Other prepreg deformations and defects. The prepreg material shall not contain crimps, puckers in the as-rolled condition only (see 3.8.3 1), or folded sections.

3.8.3.1 Puckers in the unrolled condition. Puckers in the unrolled condition shall not exceed the size and frequency specified in Table IV when examined in accordance with 4.7 3.1.

TABLE IV. Acceptable Puckers In The Unrolled Condition

Largest Dimension Allowed 1/	Frequency, Maximum
0.25 - 0.50 inch (0 64 - 1.28 cm)	3 per 1 ft^2 (0 1 m^2)
Less than 0.25 inch (0.64 cm)	All

1/ All puckers greater than 0 50 inch(1.28 cm) in any dimension are not acceptable.

3.9 Workmanship The prepreg material shall conform to the level of quality established by this specification

4 QUALITY ASSURANCE PROVISIONS

4 1 Responsibility for inspection. Unless otherwise specified herein or in the contract or purchase order, the contractor (material supplier) is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor (material supplier) may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4 1.1 Responsibility for compliance All items must meet all requirements of sections 3 and 5 The inspection set forth in this specification shall become a part of the contractor's (material supplier's) overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor (material supplier) of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material

4 2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a Qualification inspection (see 4.3).
b Quality conformance inspection (supplier (see 4 4))
c. Receiving inspection (purchaser (see 4.5)).
d. Packaging inspection (see 4 6)

4.2.1 Inspection conditions. All inspections shall be performed in accordance with the test conditions specified in the test method document unless otherwise specified in the applicable paragraph of this specification or the specification sheet.

4 3 Qualification inspection. Qualification inspection shall consist of successful completion of all tests specified in Tables V through VIII, and the refrigerated storage requirement specified in 3.3 6

Table V Prepreg Physical Qualification Tests

Property	Number of Tests Required	Requirement	Test Method
Volatile Content	three/lot	Spec Sheet	4 7.1.1
Resin Content	1/	Spec Sheet	4 7.1.2
Fiber Areal Weight	1/	Spec Sheet	4 7.1 2
Resin Gel Time	three/lot	Spec Sheet	4.7.1.3
Resin Flow	three/lot	Spec Sheet	4.7 1.4
Tack	three/lot	Spec Sheet	4 7 1 5

1/ Number of specimens required in 4.7 1 2/lot

Table VI. Prepreg Chemical Qualification Tests

Infrared Scan	three/lot	3 3 2	4 7.2 1
HPLC	three/lot	3 3 2	4.7.2 2
RDS	three/lot	3.3 2	4 7.2 3

Table VII Cured Laminate Physical Qualification Tests

Property	Number of Tests Required	Requirement	Test Method
Cured Ply Thickness	each SBS specimen	Spec Sheet	4 7 5 1
Density	each SBS panel	Spec Sheet	4 7 5 2
Tg (dry) - onset and peak	3/ each SBS panel	Spec Sheet	4 7.5 3
Tg (wet) - onset and peak	3/ each SBS panel	Spec Sheet	4 7 5 3

Table VIII. Cured Laminate Mechanical Qualification Tests

Property	Test Temp. 1/, 2/	Test Cond. 2/	Number Of Tests Required	Individual & Roll Average Requirements	Test Method
0° Ultimate Tensile Strength	Min	DRY	five/lot	Specification Sheet	4.7.6 1
	RT	DRY	five/lot		
	Hot	WET	five/lot		
0° Tensile Modulus	Min	DRY	five/lot	Specification Sheet	4.7.6.1
	RT	DRY	five/lot		
	Hot	WET	five/lot		
0° Tensile Strain	Min	DRY	five/lot	Specification Sheet	4.7 6.1
	RT	DRY	five/lot		
	Hot	WET	five/lot		
90° Ultimate Tensile Strength	Min	DRY	five/lot	Specification Sheet	4.7.6 1
	RT	DRY	five/lot		
	Hot	WET	five/lot		
90° Tensile Modulus	Min	DRY	five/lot	Specification Sheet	4.7.6.1
	RT	DRY	five/lot		
	Hot	WET	five/lot		
90 ° Tensile Strain %	Min	DRY	five/lot	Specification Sheet	4.7.6 1
	RT	DRY	five/lot		
	Hot	WET	five/lot		
Poisson's Ratio	RT	DRY	five/lot	Specification Sheet	4.7.6 1
0° Ultimate Compression Strength	Min	DRY	five/lot	Specification Sheet	4 7 6.2
	RT	DRY	five/lot		
	Hot	WET	five/lot		
	Max	DRY	five/lot		
0° Compression Modulus	Min	DRY	five/lot	Specification Sheet	4.7.6.2
	RT	DRY	five/lot		
	Hot	WET	five/lot		
0° Thin Short Beam Shear	Min	DRY	five/lot	Specification Sheet	4.7.6.3
	RT	DRY	five/lot		
	RT	FLUIDS	five/lot		
	Hot	WET	five/lot		
	Hot	FLUIDS	five/lot		
0° Thick Short Beam Shear	RT	DRY	five/lot	Specification Sheet	4.7.6.3
	Hot	WET	five/lot		
	Max	DRY	five/lot		
Compression After Impact	RT	DRY	five/lot	Specification Sheet	4.7.6 4
Open Hole Compression	RT	DRY	five/lot	Specification Sheet	4.7.6.5
	Hot	WET	five/lot		
	Max	DRY	five/lot		
Open Hole Tension	Min	DRY	five/lot	Specification Sheet	4.7.6 6
	RT	DRY	five/lot		

1/ - RT (room temperature) shall be 75 ± 5°F (24 ± 3°C). Temperatures which apply to Min (minimum service or design temperature), Hot and Max (maximum service or design temperature) shall be as specified in the applicable specification sheet.

2/ - Conditioning shall be as specified in 4 7 4 2.

Table VIII(continued). Cured Laminate Mechanical Qualification Tests

Property	Test Temp 1/, 2/	Test Cond 2/	Number Of Tests Required	Individual & Roll Average Requirements	Test Method
45° In-Plane Shear Stress	Min	DRY	five/lot	Specification Sheet	4.7.6.7
	RT	DRY	five/lot		
	Hot	WET	five/lot		
	Max	DRY	five/lot		
45° In-Plane Shear Modulus	Min	DRY	five/lot	Specification Sheet	4.7.6 7
	RT	DRY	five/lot		
	Hot	WET	five/lot		
	Max	DRY	five/lot		

1/ - RT (room temperature) shall be 75 ± 5°F (24 ± 3°C) Temperatures which apply to Min (minimum service or design temperature), Hot and Max (maximum service or design temperature) shall be as specified in the applicable specification sheet

2/ - Conditioning shall be as specified in 4.7.4.2

4.3 1 Qualification sample Sufficient material (including neat resin samples for RDS testing) from 3 separate prepreg lots containing at least 2 separate fiber lots and 2 separate resin lots shall be identified as follows and forwarded to a laboratory satisfactory to the Naval Air Systems Command, AIR-5304C, Washington, DC 20361, as designated in the letter of authorization (see 6 3).

Qualification test samples
Specification MIL-T-29586(AS) and specification sheet
Ply thickness/Areal weight
Prepreg lot number, fiber lot number, and resin lot number
Manufacturer's name and product number
Submitted by (name and date) for qualification
Testing in accordance with authorization (reference authorizing letter)
Date of manufacture

4 3 2 Manufacturer's data to be submitted with the qualification sample.

4 3 2 1 Test reports The manufacturer shall furnish two copies of the qualification inspection report

4 3 2 2 Toxicological data The manufacturer shall furnish the toxicological data required to evaluate the safety of the material for the proposed use through submission of material safety data sheets prepared in accordance with FED-STD-313

4 3 2 3 Chemical property data The manufacturer shall furnish a baseline IR trace, chromatograph, and RDS (complex viscosity vs time) plot all of which shall have been determined from at least 10 separate resin lots As outlined in the applicable specification sheet, the supplier shall also furnish HPLC peak area ratios ± 2 sigma, the minimum correlation coefficient for the IR trace comparison, and the required RDS data

4.3.3 Retention of qualification. In order to retain qualification of a product previously approved for listing on the Qualified Products List (QPL), the manufacturer shall perform the following in two-year intervals from the date of original qualification:

-Test two rolls from two separate lots of material for 0° compression strength (Hot/Wet) and thick SBS strength (Hot/Wet). Provide the test results and verify by certification that the material meets all the requirements of this specification (see 6.3.1).

The manufacturer shall have on file an approved Process Control Document containing baseline chemical and in-process test information No change shall be made in formulation, raw materials or supplier(s) of raw materials, methods of manufacture, equipment, or geographic location without prior written government approval. The Government (or purchaser) reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specifications requirements.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the tests specified in Table IX The required tests shall be performed on each lot of material (see 4 4 1). Quality conformance testing shall be performed on each shipment from a lot if more than 180 days separate shipments. The prepreg manufacturer shall warranty that each material shipment will meet the refrigerated storage requirement in 3 3 6.

4.4.1 Lot formation A lot shall consist of all rolls of prepreg material produced by one supplier, at one plant, from the same lot of resin and lot of fiber, under essentially the same manufacturing conditions, and submitted for acceptance at one time

TABLE IX. Quality Conformance Tests

Property	Requirement	Test Method	Sampling And Inspection Requirement
Volatile Content	Spec Sheet	4.7.1.1	4.4.2.1
Resin Content	Spec Sheet	4.7.1.2	4.4.2.1
Fiber Areal Weight	Spec Sheet	4.7.1.2	4.4.2.1
Resin Gel Time	Spec Sheet	4 7.1.3	4.4.2 1
Resin Flow	Spec Sheet	4 7.1.4	4.4.2.1
Infrared Scan	3 3 2	4.7.2.1	4.4 2.2
HPLC	3 3.2	4.7.2.2	4.4.2.2
RDS	3.3.2	4.7.2.3	4.4.2.2
Cured Ply Thickness	Spec Sheet	4.7.5.1	4.4.2.3
Tg (dry) - onset and peak	Spec Sheet	4.7.5.3	4.4.2.3
Tensile Strength 0°, 1/	Spec Sheet	4.7.6.1	4.4 2 4
Tensile Strain 0°, 1/	Spec Sheet	4 7.6 1	4.4.2.4
Tensile Modulus 0°, 1/	Spec Sheet	4.7.6 1	4.4 2 4
Compression Strength 0°, 2/	Spec Sheet	4 7.6.2	4.4 2.4
Thick SBS Strength,1/	Spec Sheet	4 7.6.3	4.4.2 4
Visual defects	3.8 - 3.8.3	4.7.3	all prepreg material
Inspection For Puckers	3 8.3.1	4.7 3.1	4.4 2 4

1/ - To be determined at 75±5°F(24±3°C)/DRY.
2/ - To be determined at 75±5°F(24±3°C)/DRY, and Max/Dry Max shall be as specified in the applicable specification sheet

4.4.2 Quality conformance sampling and inspection plan.

4.4.2.1 Prepreg physical property tests. Each roll in the lot shall be tested for resin content and fiber areal weight. In addition, the first and last master rolls in the lot shall be tested for volatile content, resin gel time, and resin flow. Unless otherwise specified herein, the number of specimens per roll required for fiber areal weight and resin content testing shall be as specified in 4 7 1.2, and the number of specimens required for volatile content, gel time, and resin flow shall be three per roll. Acceptance criteria shall be as follows (see Figure 4)

a If the individual or roll average requirements for areal weight or resin content are not met, a retest of both physical properties shall be performed on the same roll using twice the original number of specimens. If a property which initially failed the first test fails the retest, the roll shall be rejected In the event that a property which initially passed the first test fails the retest, a second retest shall be performed for both properties using twice the original number of specimens Any failure in the second retest shall result in rejection of the represented roll

b If the requirements for resin flow, gel time, and volatile content (individual and roll average) are not met in the first and last rolls in the lot, one retesting of the failed property(ies) shall be allowed using the roll(s) in which the failure(s) occurred. The retest shall be performed using six specimens per roll for each test. If the first roll fails the initial test and retest, it shall be rejected and the second and third rolls in the lot shall be tested for all the properties which failed using six specimens per roll for each test. If the last roll fails the initial test and retest, it shall be rejected and the two previous rolls in the lot shall be tested for all the properties which failed using six specimens per roll for each test Any additional failures shall result in rejection of the lot (see 6 5)

4.4.2 2 Prepreg chemical property testing. One run of each prepreg chemical property test as specified in Table IX shall be performed on the first and last rolls in the master lot except for RDS testing which shall be performed on neat resin samples taken just before the first roll and just after the last roll. If impurities are detected or if the requirements for the IR trace correlation coefficient, HPLC peak area ratios, and required RDS data as specified in the original qualification data (see 4.3 2 3) are not met, one retesting of the failed property(ies) shall be allowed using the roll(s) or neat resin samples in which the failure(s) occurred. Retesting shall be conducted using three runs per test Any additional failures shall result in rejection of the lot

4 4.2.3 Laminate physical properties Each short beam shear laminate required for quality conformance mechanical testing shall be tested for cured ply thickness, Tg onset (dry) and Tg peak (dry) as specified in Table IX If a failure occurs, one retesting of the failed property(ies) shall be allowed using the roll(s) in which the failure(s) occurred The retest shall be conducted using a newly fabricated SBS laminate If a retest fails, the represented roll shall be rejected and the two adjacent or closest rolls in the lot shall be tested for all the failed properties Any additional failures shall result in rejection of the lot (see Figure 5)

4.4.2 4 Mechanical property tests. Mechanical property testing as specified in Table IX shall be performed on rolls sampled in accordance with Table X. If all the individual and roll average mechanical property requirements are not met for each roll sampled, one retesting of the failed property(ies) shall be allowed using the roll(s) in which the failure(s) occurred The retest shall be conducted on a newly fabricated panel using ten specimens per test. If a retest fails, the represented roll shall be rejected and the two adjacent or closest rolls in the lot shall be tested for all the failed properties using ten specimens per roll for each test. Any additional failures shall result in rejection of the lot (see Figure 5). In addition to mechanical testing, each roll sampled shall be examined for puckers as specified in 4.7.3.1. If the requirement for acceptable puckers is not met, the disposition of the material shall be as specified by the purchaser.

Table X. Mechanical Property Sampling Plan

Pounds Of Prepreg In Lot	Rolls In Lot To Be Sampled
up to 500	First
501 - 1000	First and Last
1001 - 2000	1 + First and Last
2001 - 3000	2 + First and Last
3001 - 4000 1/	3 + First and Last

1/ - For lot sizes greater than 4000 pounds, use the same sampling approach where one additional roll is sampled for each additional 1000 pound increment.

4.5 Receiving inspection As a minimum, the purchaser shall perform the tests in Table XI to verify the suppliers quality conformance test results. If approved by the contracting officer, receiving inspection may be omitted if the quality conformance testing is witnessed and verified by the purchaser.

TABLE XI. Receiving Inspection Tests

Property	Requirement	Test Method	Sampling Plan
Volatile Content	Spec Sheet	4.7.1.1	4.5.1
Resin Content	Spec Sheet	4.7.1.2	4.5.1
Fiber Areal Weight	Spec Sheet	4.7 1 2	4.5.1
Cured Ply Thickness	Spec Sheet	4 7 5.1	each SBS specimen
Tg (dry) - onset and peak	Spec Sheet	4 7 5 3	each SBS panel
Tensile Strength 0°	Spec Sheet	4.7.6 1	4.5.1
Tensile Strain 0°	Spec Sheet	4 7 6 1	4.5.1
Tensile Modulus 0°	Spec Sheet	4 7 6.1	4.5.1
Compression Strength 0°	Spec Sheet	4.7.6 2	4.5.1
Thick SBS Strength	Spec Sheet	4 7 6 3	4.5 1
Visual defects	3 8 - 3 8.3	4 7 3	1/
Inspection For Puckers	3.8.3 1	4 7 3.1	1/

1/ Visually inspect material used for all receiving inspection tests.

4.5 1 Sampling plan The minimum number of rolls required to be selected for receiving inspection shall be as specified in Table XII. Three specimens shall be used for each prepreg physical property test and five specimens shall be used for each mechanical property test

Table XII Receiving inspection sampling Plan

Pounds Of Prepreg In Lot	Rolls To Be Randomly Sampled
up to 500	1
501 - 1500	2
1501 - 3000	3
3001 - 5000	4
5001 - 7000	5
7001 - 9000 1/	6

1/ - For lot sizes greater than 9000 pounds use the same sampling approach where 1 additional roll is sampled for each additional 2000 pound increment

4 6 Packaging inspection An examination shall be made as specified in Table XIII to determine that the preservation, packing, and marking complies with the requirements of Section 5 The sampling plan shall be as specified in MIL-STD-105 using inspection level II The sample unit for this examination shall be one shipping container fully prepared for delivery just prior to closure. The lot size for the purposes of this examination shall be the number of shipping containers in the end item inspection lot. The acceptance criteria shall be determined using an AQL of 6 5 Table XIII shall be used to score the number of defects The number of allowable defects shall be based on the total number of defects from all samples selected If the acceptance criteria is not met, the shipping lot shall be 100 percent inspected. All discovered defects shall be corrected prior to shipment or the lot shall be rejected

TABLE XIII Preservation, Packing, and Marking Defects

Examine	Defect	Defect Score
Preservation	Bag not as specified	none allowed
	Bag not properly sealed	none allowed
	Roll condition log not correct	3
	Roll condition log incomplete	2
	Roll condition log missing	2
	Material identification label not correct	2
	Material identification label incomplete	1
	Material identification label missing	1
Packing	Packing level not as specified	none allowed
	Roll not supported in shipping container	none allowed
Marking	Incorrect	2
	Incomplete	1
	Illegible	1

4.7 Test methods Testing shall be performed as specified herein All test specimens shall be prepared using material sampled from rolls which have been permitted to stabilize at room temperature in its original packaging No moisture shall be present on the packaging exterior before opening to withdraw a sample

4.7.1 Prepreg physical property tests. When tested as specified herein, the prepreg physical properties shall meet the requirements specified in 3.3.1.

4.7 1.1 Volatile content. Volatile content testing shall be performed in accordance with ASTM D3530. The volatile weight loss shall be determined after the samples have been exposed to the temperature and time specified in the applicable specification sheet

4 7 1.2 Prepreg resin content and fiber areal weight. Prepreg resin content and fiber areal weight shall be determined as follows:

a. All specimens shall have a surface area between 100 and 150 cm^2. The shape and number of specimens required for testing shall be dictated by the material width as specified herein. For material less than 6 inches (15.2 cm) in width, three specimens shall be taken and each one shall be the full width of the prepreg material by the necessary length to meet the area requirement For material widths greater than 6 inches (15.2 cm) and less than 24 inches (61.0 cm), three square specimens shall be taken such that they are equally spaced (or staggered if less than 12 inches (30 5 cm)) across the entire width of the prepreg material. For material widths of 24 inches (61.0 cm) and greater, one square specimen per 6 inches (15 2 cm) of material width shall be taken such that all specimens are equally spaced across the entire width of the prepreg material

b. Determine the length and width of each specimen to the nearest 0.1 cm and calculate the area (A_s) in m^2 to the nearest 0.0001 m^2. Weigh each specimen to the nearest 0.001 gram (W_1).

c Dissolve the resin from each specimen at room temperature in a beaker containing 100 ml of MEK, acetone or any other suitable solvent. Stir occasionally over a period of 15 minutes, minimum.

d After dissolution of the resin, separate the fibers from the solvent by filtering or decanting the solvent Rinse the remaining fibers a minimum of three times, each time decanting or filtering carefully to retain the fibers.

e. Dry the fibers at a maximum temperature of 220°F (104°C) to a constant weight. Allow to cool to room temperature in a desiccator. Weigh fibers to nearest 0 001 gram (W_2).

f. Calculate: $\text{Wet Resin Content } \% = 100 \times (W_1 - W_2)/W_1$

g Calculate: $\text{Fiber, Areal Weight}(g/m^2) = W_2/As$
$\text{Fiber, Areal Weight}(oz/y^{d2}) = 0.029\ W_2/As$

4 7 1 3 Gel time. Gel time shall be determined in accordance with ASTM D3532, the rheometric method specified in the applicable specification sheet, or the Fisher-Johns Method specified in 4.7.1 3 1 The gel time shall be determined at the temperature specified in the applicable specification sheet.

4.7 1.3 1 Fisher-Johns method The Fisher-Johns Method shall be as follows:

a Specimens should be 0 25 by 0 25 inches (0 64 by 0.64 cm) and one ply thick.

b Preheat the Fisher-Johns Platform to the test temperature specified in the applicable specification sheet.

c Insert the specimen between two cover glasses and place on the heated platform. Start the timer.

d Periodically (at least once/30 sec) apply moderate pressure to the top cover glass using a probe and observe any movement of the resin As the resin nears its gel point, probe continuously until no further movement is observed Stop the timer and record the time to the nearest second

4.7 1.4 Resin flow Resin flow shall be determined in accordance with ASTM D3531 except that the porous TFE separator film used in the specimen assembly shall be a 104 style TFE fabric. The platen press temperature and pressure shall be as specified in the applicable specification sheet The specimens shall be exposed to these conditions for a minimum period of 5 minutes beyond the maximum gel time specified in the applicable specification sheet

4.7.1.5 Tack Cut two 1 by 3 inch (25 4 by 76 mm) prepreg samples leaving the liner on The fiber direction shall be parallel with the 1 inch (25 4 mm) dimension For tape material less than 3 inches (76 mm) in width, edge splice sufficient widths of prepreg to obtain the sample width. Apply the material (liner side up) to the center of a clean piece of austenitic corrosion resistant steel with a commercial 2D finish. Apply light pressure with a squeegee or roller over the liner and remove the liner Apply the second piece on top of the first making sure that edge splices do not coincide Apply light pressure with a squeegee or roller over the liner of the second piece and remove the liner Place the test plate such that the 3 inch (25 4 mm) specimen dimension is in a vertical position After maintaining this position for a period of not less than 30 minutes at a temperature of 70 - 80°F (21 - 27°C) and a relative humidity of 50 - 70%, the material shall display complete adherence

4 7.2 Prepreg chemical property tests When tested as specified herein, the prepreg chemical properties shall meet the requirements specified in 3 3 2.

4 7.2.1 Infrared (IR) analysis. The procedure for IR analysis shall be as specified in the applicable specification sheet

4.7.2.2 High performance liquid chromatography (HPLC) analysis. The procedure for HPLC analysis shall be as specified in the applicable specification sheet

4.7 2.3 Rheometric dynamic spectroscopy (RDS) analysis RDS procedures shall be in accordance with ASTM D4473 RDS testing shall be performed on neat resin samples only Additional test details shall be as specified in the applicable specification sheet

4.7.3 Prepreg visual tests. The prepreg material shall be visually inspected to ensure conformance to paragraph 3.8. Puckers shall be evaluated as specified in 4.7.3.1.

4.7.3.1 Evaluation for puckers Leaving the liner on, lay consecutive lengths of prepreg from a roll on a flat surface. The consecutive lengths shall create an area equal to 1.0 ft^2 (0.1 m^2) After thirty minutes exposure to a temperature between 65-80°F (18-27°C) and a relative humidity of 45 ± 5%, visually inspect the prepreg for conformance to the requirements specified in 3.8 3.1

4.7.4 Preparation and conditioning of test specimens for cured laminate physical and mechanical property testing.

4 7.4.1 Preparation of test specimens for physical and mechanical property testing. The curing tool, preferably aluminum with a 0 25 in (0 64 cm) minimum thickness, templates, cutting instruments, and cutting table shall all be free from any visual evidence of foreign debris, burrs, and resin ridges from previous cures prior to their use The cutting instruments shall be replaced at the first indication of reduced cutting ability Test panels shall be fabricated by aligning the prepreg plies within 0.5 degrees of the direction required in the test method The number of plies used in the layup shall be dictated by the specimen configuration requirements specified in the applicable test method (see 4 7.6). Additional fabrication requirements for the 0° tensile and compression panel shall be as specified in 4.7 4.1 1 The bagging procedure shown in Figure 6 shall be used for all panels. If desired, the vacuum bag may be used after each ply to compact the laminate Prior to cure, leak check the vacuum bag as follows.

a. Draw a minimum of 20 inches vacuum in the bag.

b. Close off the vacuum line and determine that the vacuum does not fall more than 5 inches in 5 minutes (or at a rate not to exceed 1 inch/minute).

After the acceptable leak criteria is verified, cure in accordance with the specification sheet If the use of tabs is not required in the applicable test method, the specimens shall be cut from the cured panels in accordance with 4.7.4.1.3. If tabs are required, the cured panels shall be cut to the required specimen length in accordance with 4.7.4 1 3 and tabs shall be applied as specified in 4.7 4 1 2 Adequately sized panels shall be fabricated to allow for edge trim if it is required in the applicable test method.

4.7.4.1 1 Fabrication of 0° tensile and compression panel A 12 inch by 12 inch panel shall be fabricated having the number of plies required to meet the specimen thickness requirement specified in the tensile and compression test methods (see 4.7.6) Each ply shall be layed up such that the tape edge splices required to construct the 12 inch width are equally staggered from and not superimposed on edge splices in the previous ply. The panel shall be bagged and cured as specified in 4 7.4 1. The resulting 12 inch by 12 inch cured panel shall be slit down the middle in the 0° direction with a utility knife. Remove a strip of the peel ply from the middle to facilitate slitting. One 6 inch by 12 inch panel shall be cut as specified in 4.7.4 1 3 to the required 0° tensile specimen length and the other 6 inch by 12 inch panel to the required 0° compression specimen length. The resulting panels shall be tabbed as specified in 4 7 4 1 2

4 7 4 1 2 Tabbing. The tabbing material and its dimensions shall be as specified in the applicable test method. Adhesive (see 6.6) shall be applied to the tab immediately after surface preparation Any air trapped between the adhesive and tab shall be forced out by applying pressure The adhesive backing shall remain in place Peel/release ply remaining on the panel tabbing area shall be removed After the panel has been prepared for bonding, remove the adhesive backing and attach the tabs such that the proper gage length and tab alignment is obtained Cure the adhesive as specified in the manufacturer's instruction It is recommended that the assembly be cured in a vacuum bag to ensure a uniform bond line thickness The required specimen widths shall be cut per 4.7 4 1 3 from the tabbed panel

4 7 4 1 3 Cutting laminates to desired specimen size. Specimens shall be cut and machined (if required) from panels such that all dimensions and surface conditions meet the requirements specified in the applicable test method Each specimen shall be examined for surface, edge and tab defects and shall have it dimensions verified Specimens containing defects or dimensional discrepancies which may result in inaccurate test results shall not be used for mechanical property testing Each test specimen shall be identified as follows

a Roll number
b Panel number
c. Fabrication date
d Quality Assurance test report number
e Specification sheet and material Class
f Number of plies and ply layup
g Panel dimensions

4 7 4 2 Specimen conditioning for cured laminate mechanical and physical(Tg wet) testing If a plus/minus value is not specified, the test temperature shall be within ± 5°F (± 3°C) of the stated values Conditioning shall be as specified herein

4 7 4 2 1 Wet conditioning Wet conditioning shall be performed in accordance with method II of SRM 11. Moisture equilibrium shall be when the change in the average cumulative weight gain is less than 0 05 percent from the last measurement, over three consecutive 24 hour(or more) intervals For example

$$(WG_{264} - WG_{240}) < (0\ 0005)WG_{240}$$
$$(WG_{288} - WG_{264}) < (0\ 0005)WG_{264}$$
$$(WG_{312} - WG_{288}) < (0\ 0005)WG_{288}$$

Where WG_{240} - Moisture weight gain after 240 hrs exposure
WG_{264} - Moisture weight gain after 264 hrs exposure
WG_{288} - Moisture weight gain after 288 hrs exposure
WG_{312} - Moisture weight gain after 312 hrs exposure

4 7 4 2 2 Dry conditioning Dry conditioning shall be in accordance with SRM 11

4 7 4 2 3 Temperature conditioning Temperature conditioning shall be in accordance with SRM 11 Temperatures which apply to Min (minimum service or design temperature), Hot and Max (maximum service or design temperature) shall be as specified in the applicable specification sheet

4.7.4.2.4 Fluid resistance conditioning. Condition the specimens in the fluids given in Table III for the times and temperatures shown. After removal of specimens from the fluids, examine the specimens visually for degradation and damage. Examine the fluid for obvious changes in color, translucence, viscosity, and odor. Discrepancies or their absence shall be noted with reported data. The conditioned specimens shall be tested for conformance to 3 4.3

4.7.5 Cured laminate physical property test methods. When tested as specified herein, the cured laminate physical properties shall meet the requirements specified in 3.4 1. No mechanical test results shall be used from laminates which fail to meet these requirements.

4 7.5 1 Cured Ply Thickness. The cured ply thickness shall be determined for each individual short beam shear specimen The procedure shall be as follows·

a Use a single 0 25 inch (0 64 cm) diameter ball face micrometer capable of reading to 0 0001 inch (0 00025 cm)

c Perform 10 separate thickness measurements over the surface of each specimen.

b Calculate the cured ply thickness as follows·

Cured Ply Thickness = (Average thickness of specimen)/(No. of plies)

The ply thickness of each SBS specimen shall be within the maximum and minimum values specified in to the applicable specification sheet Report the average thickness for each specimen.

4.7.5 2 Density. Determine the laminate density on the short beam shear panel in accordance with ASTM D792 (Method A-1) or by using a density gradient column in accordance with ASTM D1505.

4 7.5 3 Onset and peak glass transition temperatures (dry and wet). Unless otherwise specified, both the onset and peak glass transition temperatures shall be determined by dynamic mechanical analysis (DMA) using a Dupont DMA 983 or equivalent The dynamic mechanical analyzer shall be operated in a flexural oscillation mode with a fixed oscillation frequency and a forced constant amplitude. The flexural oscillation frequency shall be set at 1 Hz with an amplitude of approximately 0 02 inch (0.5 mm). The heating rate shall be set at 18°F (10°C) per minute. The test specimens shall be taken from the middle area and middle plys of the SBS panels and shall be 0 08 ± 0 02 inch (0.20 ± 0 05 mm) in thickness by 0 50 ± 0 13 inch (12 7 ± 3.2 mm) in width. The specimen shall be of sufficient length (fiber direction) to obtain a length between grips to specimen thickness ratio of 15 or greater. For the determination of Tg onset (wet) and Tg peak (wet), the specimens shall be conditioned as specified in 4.7 4.2.1 prior to testing. Perform the test generating both a storage modulus versus temperature curve and a loss modulus versus temperature curve Tg onset and Tg peak shall be determined in accordance with 4.7.5 3.1. Additional test details shall be as specified in ASTM D4065.

4.7.5 3.1 Determination of Tg onset and Tg peak. Tg onset shall be determined by drawing two tangents to the slope of the storage modulus versus temperature curve; one tangent to the baseline and the other tangent to the steepest slope of the curve. The Tg onset value shall be determined at the point where the tangents intercept The Tg peak value shall be determined at the peak of the loss modulus curve Figure 7 provides an example for determining both Tg onset and Tg peak.

4.7.6 Mechanical test methods Mechanical test specimens prepared and conditioned in accordance with this document shall meet the requirements specified in 3.4 2 when tested as specified herein.

4 7 6.1 Tensile Tensile testing shall be in accordance with SRM 4 except as follows

a Only strain gauges shall be used for qualification testing. A suitable extensometer may be used for quality conformance testing unless a retest is required (see 4.4 2 4) in which case only strain gauges shall be used

b The specimen thickness used for mechanical property calculations shall be determined by multiplying the number of plies in the specimen by the nominal ply thickness specified in the applicable specification sheet

4 7 6 2 Compression Compression testing shall be in accordance with SRM 1 except as follows·

a Only strain gauges shall be used

b The specimen thickness used for mechanical property calculations shall be determined by multiplying the number of plies in the specimen by the nominal ply thickness specified in the applicable specification sheet

4 7.6 3 Short beam shear Short beam shear testing shall be in accordance with SRM 8 except as follows

a Thin short beam shear specimens shall have a thickness of 0 085 ± 0 010 inch (0 216 ± 0 025 cm)

b Thick short beam shear specimens shall have a thickness of 0.25 ± 0 02 inch (0.64 ± 0.05 cm)

c The fixture span shall be 4 0 ± 0.1 times the average specimen thickness.

4.7.6 4 Plate compression stress after impact Plate compression stress after impact shall be determined in accordance with SRM 2

4 7.6 5 Open-hole compression Open-hole compression testing shall be in accordance with SRM 3 except as follows

a The specimen thickness used for mechanical property calculations shall be determined by multiplying the number of plies in the specimen by the nominal ply thickness specified in the applicable specification sheet

4 7 6.6 Open-hole tension. Open-hole tension testing shall be in accordance with SRM 5 except as follows:

a. The specimen thickness used for mechanical property calculations shall be determined by multiplying the number of plies in the specimen by the nominal ply thickness specified in the applicable specification sheet

4.7.6.7 In-plane shear stress and modulus. In-plane shear stress and modulus testing shall be in accordance with SRM 7 except as follows

a The specimen thickness used for mechanical property calculations shall be determined by multiplying the number of plies in the specimen by the nominal ply thickness specified in the applicable specification sheet

5 PACKAGING

5 1 Preservation The prepreg material shall be preserved in accordance with Method IA-8 of MIL-P-116 as specified herein Each roll of material shall be individually heat sealed in a watervaporproof bag conforming to MIL-B-117, Type II, Class E, Style 1 Each roll of prepreg material shall contain a roll condition log supplying the information specified in 5.1 1 and a material identification label supplying the information specified in 5.1.2

5 1 1 Roll condition log The roll condition log shall supply the batch and roll numbers, roll width, and roll length It shall also indicate splice locations (see 3 3 5.1) or defect locations, types and lengths (see 3 3.5 2). The roll condition log shall be in an envelope which is attached to the moisture cover. The envelope shall be marked with the words, "ROLL CONDITION LOG DO NOT REMOVE UNTIL READY TO USE. CONTAINS INFORMATION FOR LAYUP, MACHINE OR CUTTING OPERATOR."

5 1.2 Material identification label. Each individual roll of prepreg, regardless of width and length, shall bear an identification label. Whenever the roll width permits, the label shall be affixed to the inner surface of the roll core The supplier shall either affix the label on the inner core or apply a removable label to the outside bag for the purchaser to affix on the inner core when the bag is opened. The label shall contain the following information.

a Supplier and material name
b This specification number and revision letter
c Specification sheet number and revision letter
d Material width
e Nominal thickness
f Areal weight
g. Nominal resin content in percent by weight
h Fiber type
i Batch number
j Date of manufacture
k Roll number and net usable footage of the roll (see 3 3 5 2)

5.2 Packing Packing shall be level A or B as specified in the contract or order (see 6.2) The rolls shall be supported within the shipping container such that it will not be damaged from its own weight during shipping or storage To aid in determining the heat exposure history of the prepreg material during shipment, at least one shipping container shall contain a devise capable of accurately and continuously recording time and temperature exposure during shipment

5.2.1 Level A. Material preserved in accordance with 5 1 shall be packed in shipping containers conforming to PPP-B-601, overseas type

5.2.2 Level B Material preserved in accordance with 5.1 shall be packed in shipping containers conforming to PPP-B-636, weather resistant type.

5.3 Marking Each shipping container shall be permanently and legibly marked in accordance with MIL-STD-129 to give the following information

a. Supplier and material name
b. This specification number and revision letter
c Specification sheet and revision letter
d Material width
e Nominal thickness
f Areal weight
g Nominal resin content in percent by weight
h Fiber type
i Batch number
j Date of manufacture
k Purchase order number.
l Required shipping and storage temperature (10°F maximum).
m Roll number and net usable footage of the roll (see 3 3 5 2)

6 NOTES

6.1 Intended use This material is intended for use in the fabrication of airframe, aerospace, or related primary or secondary load bearing structures where high strength/weight and stiffness is required.

6.2 Ordering data Requests, requisitions, schedules, and contracts or orders should contain the following·

a Title, number and date of this specification.
b Title, number and date of required specification sheet
c. Ply thickness and areal weight
d Required width and tolerances (see 3 3 4).
e. If removal or identification of defects is required (see 3 3 5).
f Roll requirements (see 3.6)
g Level of packing required (see 5 2).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion on QPL-29586 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification The activity responsible for the Qualified Products List (QPL), information pertaining to qualification of products, and the letter of authorization for submittal of samples is the Naval Air Systems Command, AIR-5304C, Washington, DC 20361. Information regarding retention of qualification is provided in 6 3.1 Information of a general or explanatory nature regarding QPL's may be obtained from the SD-6, "Provisions Governing Qualification" (see 6 3.2). As stated in 1.1, qualification pertains only to the requirements of this specification and does not qualify the material for use in the fabrication of a structural component in a particular system. In conjunction with meeting the requirements of this specification and other requirements as determined by the government and system manufacturer, design allowables must be developed for a particular prepreg material before it can be used to fabricate a structural component. The development of design allowables is performed outside the scope of this specification

6 3.1 Retention of qualification. A DD Form 1718, "Certification Of Qualified Products", will be used to provide certification information, and data for 0° compression strength (Hot/Wet) and thick SBS strength (Hot/Wet) testing (see 4.3.3) The Naval Air Engineering Center is responsible for sending the form to each company on the QPL once every two years

6.3.2 Copies of the SD-6 "Provisions Governing Qualification". Copies may be obtained through the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA. 19111-5094

6.4 Definitions

6 4.1 Areal weight (fiber areal weight) The weight of fiber reinforcement per unit area of prepreg tape

6.4.2 Bleeder cloth. A nonstructural layer of porous material used in the manufacture of composite parts to allow the escape of gas and resin during cure The bleeder cloth is removed after the curing process and is not part of the final composite.

6 4 3 Breather A loosely woven material that serves as a continuous vacuum path over a part during cure but is not in contact with the resin The breather is removed after the curing process and is not part of the final composite.

6 4.4 Broadgoods Uncured preimpregnated materials twelve inches or wider made in either one operation or by combining several narrow tape widths.

6.4 5 Carbon Fibers. Fiber produced from pyrolytic degradation of synthetic organic fibers which have 92 percent to 99 percent carbon content by weight

6.4.6 Caul sheets/tool plates. Smooth plates free of surface defects used during the curing process to transmit normal pressure and to provide a smooth surface on the finished laminate.

6 4 7 Compaction, vacuum. The application of a temporary vacuum bag and vacuum to remove trapped air and compact the layup (see 6.4.10 and 6 4 40)

6 4.8 Continuous operation. An operation in which the impregnation process is not interrupted and a different product or batch of resin is not run on the machine.

6.4.9 Crimp. Waviness of fibers.

6 4.10 Debulking, vacuum The application of a temporary vacuum bag, vacuum, and moderate heat to remove trapped air and compact the layup (see 6 4.7 and 6.4 40)

6 4.11 Distortion. An abrupt change in fiber orientation.

6 4.12 Edge Splicing. Joining prepreg material together at the edges of its length to obtain a desired width such that no edge overlap occurs. The material length shall coincide with the fiber direction or it shall not be considered an edge splice

6 4.13 Fiber A general term used to refer to filamentary material, a general term for a filament of finite length. The terminology contained in ASTM D 3878 shall be used to describe high-modulus fibers

6.4.14 Fiber direction The orientation or alignment of the longitudinal axis of the fiber with respect to a stated reference axis

6 4.15 Fiber finish A surface coating applied to fibers to facilitate handling, to provide better wetting and compatibility of fiber and matrix, or to do both

6.4.16 Fiber lot One in which the fibers used to make the carbon tow are traceable to the original tow lots.

6.4.17 Flecks Small pieces of liner and/or resin material which settle on the prepreg during the slitting process.

6 4.18 Fuzz Ball Broken filaments and/or abraded filament particles which collect as loose filament bundles or balls and are occasionally incorporated into the impregnated material.

6 4.19 Gap An open space between fibers greater than .01 inch.

6 4.20 Handling life The out-of-refrigeration time over which the tape material maintains its handleability, drape, and tack

6 4.21 Homogeneous. A descriptive term for material of uniform composition throughout; a medium which has no internal physical boundaries, material whose properties are constant at every point

6 4.22 Impregnate. To apply resin onto fibers or fabrics by any of several processes hot melt, solution coat, or wet layup

6.4.23 Inclusions Foreign material, such as particles, chips, and films.

6.4.24 Loss modulus. A quantitative measure of energy dissipation which is defined as the ratio of stress 90 degrees out of phase with an oscillatory strain to the magnitude of the strain.

6.4.25 Matrix. The material in which the fibers or filaments are embedded

6.4.26 Master prepreg roll. The original full width roll as impregnated and prior to any slitting, respooling or splicing operation.

6.4.27 Mechanical life (open mold life). The out-of-refrigeration to cure time through which the material remains capable of attaining the required mechanical and physical properties when laid up after its handling life.

6.4.28 Peel ply. A removable fabric ply molded onto the surface of a laminate to provide a chemically clean surface for bonding or painting when the peel ply is removed.

6.4.29 Prepreg lot. Tape material manufactured from one batch of resin and one lot of fiber, submitted for acceptance at one time.

6 4.30 Puckers Blisters or areas of the fiber that are raised above the level of the liner when the prepreg is in the rolled or unrolled condition.

6.4.31 Resin lot Resin mixed under identical operating conditions, using the same lots of ingredients having traceability to individual component lots.

6.4.32 Resin content The amount of matrix present in a composite, either by weight or percentage of volume.

6 4 33 Resin rich area. An area containing more than the maximum allowable resin content

6 4 34 Resin starved area An area with less than the minimum allowable resin content

6 4.35 Spool A winding tube or core.

6 4.36 Storage life The time of the tape material in storage at a specified temperature, over which the material maintains its handling life, mechanical life, and all other requirements of the applicable material specification

6.4.37 Storage modulus. A quantitative measure of elastic properties which is defined as the ratio of stress in phase with an oscillatory strain to the magnitude of the strain.

6 4.38 Supplier. A manufacturer or supplier of a commercial product

6.4.39 Tape material batch A quantity of tape material containing reinforcement which meets the carbon tow requirements of this specification, impregnated with one batch of resin in one continuous operation

6.4.40 Temporary vacuum bag. A vacuum bag used for compacting or debulking operations and not intended for use during cure (see 6 4.7 and 6 4 10).

6.4.41 Tow A loose, untwisted strand of fibers

6.4 42 Tow splices. Fiber tows which are joined together by intertwining or interweaving and have a visible overlap.

6.4.43 Vacuum bag molding. A process in which the layup on a tool is cured under pressure generated by drawing a vacuum in the space between the layup and a flexible sheet placed over it and sealed at the edges.

6.5 Resin flow and gel time. After ruling out the use of improper testing practices, failure to conform to resin flow and gel time requirements is usually the result of either a bad resin formulation or a deficiency in parts or all of the prepreg manufacturing process If the failures are the result of a bad resin formulation (ie too much catalyst), they should represent the entire prepreg lot. If the failures can be attributed to a localized fluctuation in the manufacturing process (ie a period of over staging), they may not be representative of the entire lot. In this case it may be desirable for the supplier, purchaser, and government contracting officer to agree upon a method of sorting the good rolls from the bad ones in lieu of rejecting the entire lot Giving approval for and working out the details of a sampling and inspection plan of this type is outside the scope of this specification and should be left to contractual considerations such as a material review board (MRB).

6.6 Tab adhesives. Any high elongation (tough) adhesive system that will meet the temperature requirements can be used. Table XIV lists several adhesives that have been found to be satisfactory.

Table XIV Tab Adhesives

Company	Adhesive
American Cyanamid	FM-123
American Cyanamid	FM-300
American Cyanamid	HT-424 High Temp only
3-M Company	AF-126
3-M Company	AF-163-2

6 7 Conversion factors. Typical conversion factors used for mechanical property data are listed in Table XV.

TABLE XV. Conversions

Multiply (Inch-Pound Unit)	By (conversion)	To get (metric unit)
Inches	2.54	Centimeters
Square Inches	6.45	Square Centimeters
Pounds Force	4.45	Newtons
Psi	0.0069	MPa
Ksi	6.90	MPa
Msi	6.90	GPa

6.8 Prepreg material covered in the specification sheets. The specification sheets cover specific resin matrices and carbon fiber properties as specified in Table XVI.

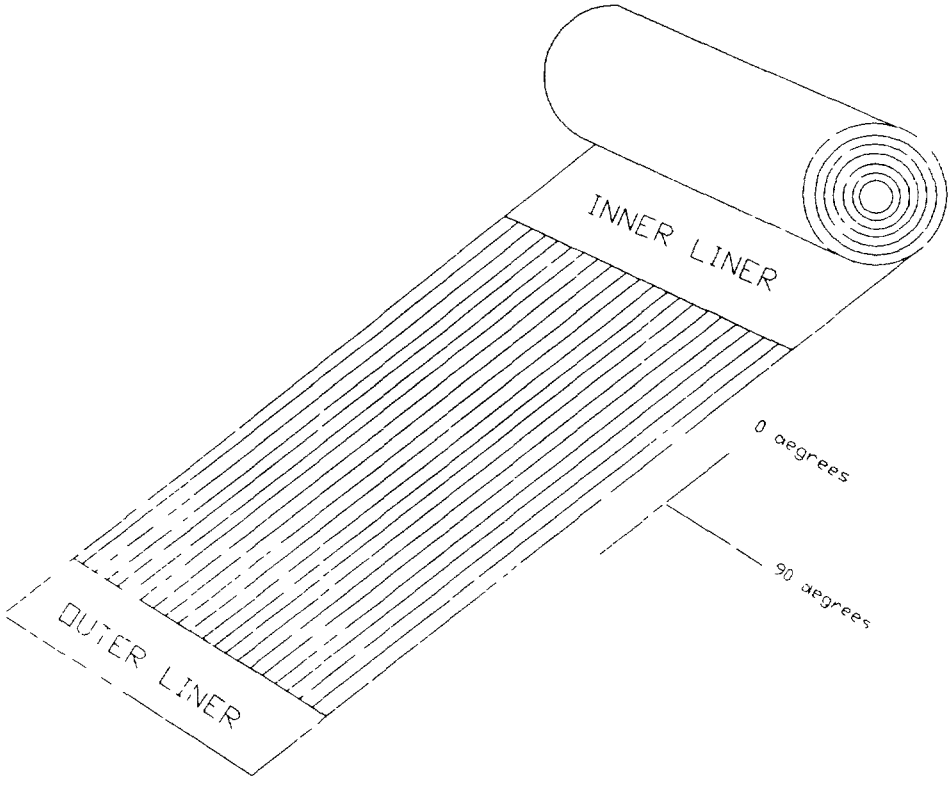
TABLE XVI. Prepreg material covered in the specification sheets

Specification Sheet	Resin Matrix	Fiber Tensile Properties		
		stress	strain	modulus
MIL-T-29586(AS)/1	Epoxy (350°F cure)	590 Ksi min	1.4 % min	38-44 Msi
MIL-T-29586(AS)/2	TBD	TBD	TBD	TBD
MIL-T-29586(AS)/3	TBD	TBD	TBD	TBD
MIL-T-29586(AS)/4	TBD	TBD	TBD	TBD

6.9 Subject term (keyword) listing

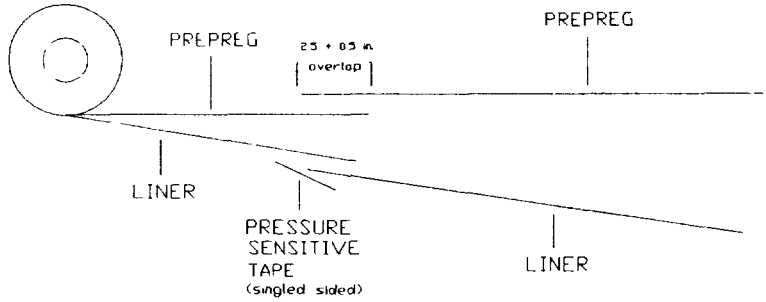
Carbon/Epoxy
Composite
Graphite/Epoxy
Laminate
Polymer Matrix Composite
Prepreg

Preparing Activity
Navy - AS
(DOD Project No. CMPS-N067)



Fibers are oriented parallel to the roll edge

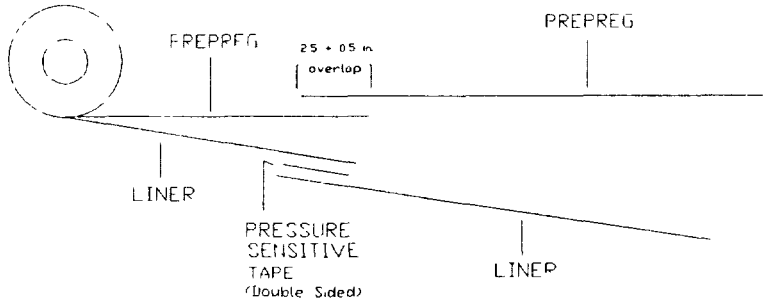
FIGURE 1 Fiber Direction As Viewed On The Roll



1 Liner may also be continuous

2 An outer liner is depicted in the figure The actual liner position shall be as specified in the contract or order

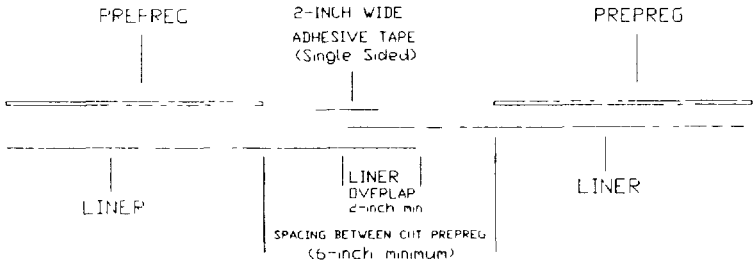
FIGURE 2A Splicing Method A



1 Liner may also be continuous

2 An outer liner is depicted in the figure The actual liner position shall be as specified in the contract or order

FIGURE 2B Splicing Method B



1 Liner may also be continuous

2 The actual liner position shall be as specified in the contract or order

FIGURE 2C Splicing Method C

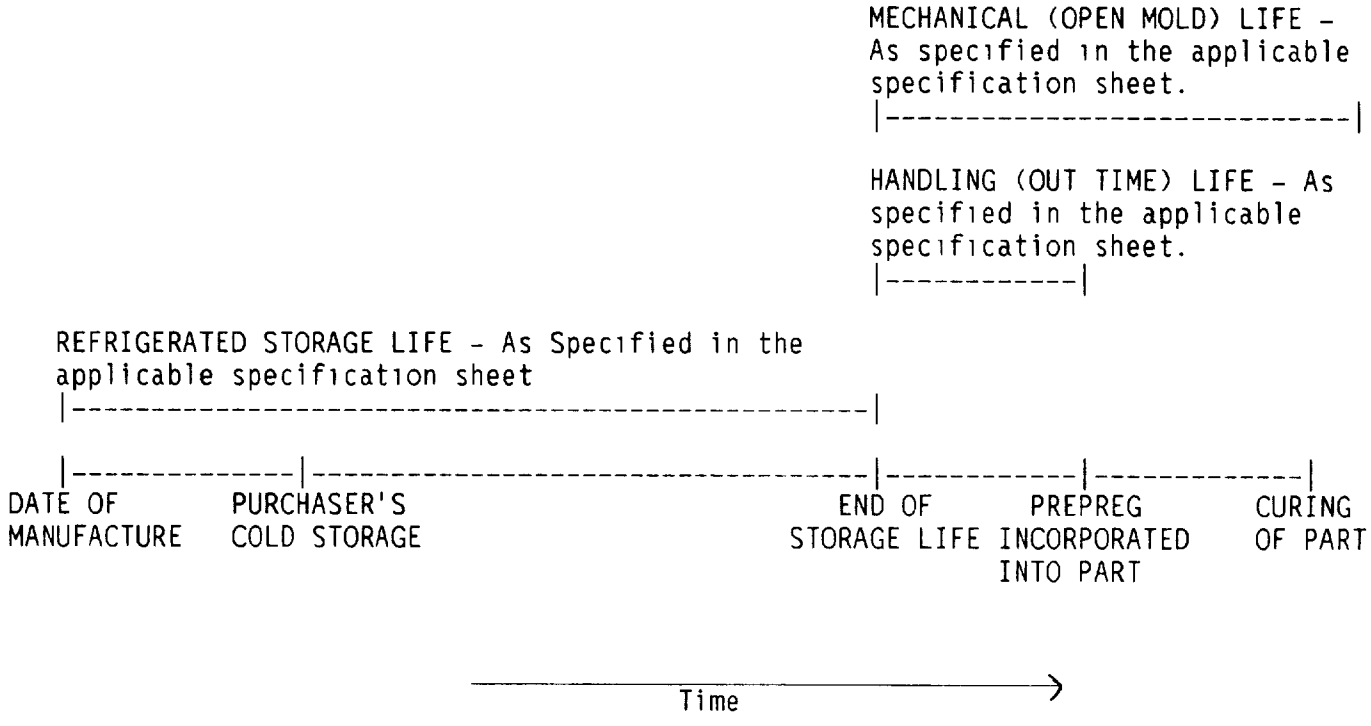


FIGURE 3. Storage, Handling, And Mechanical Life

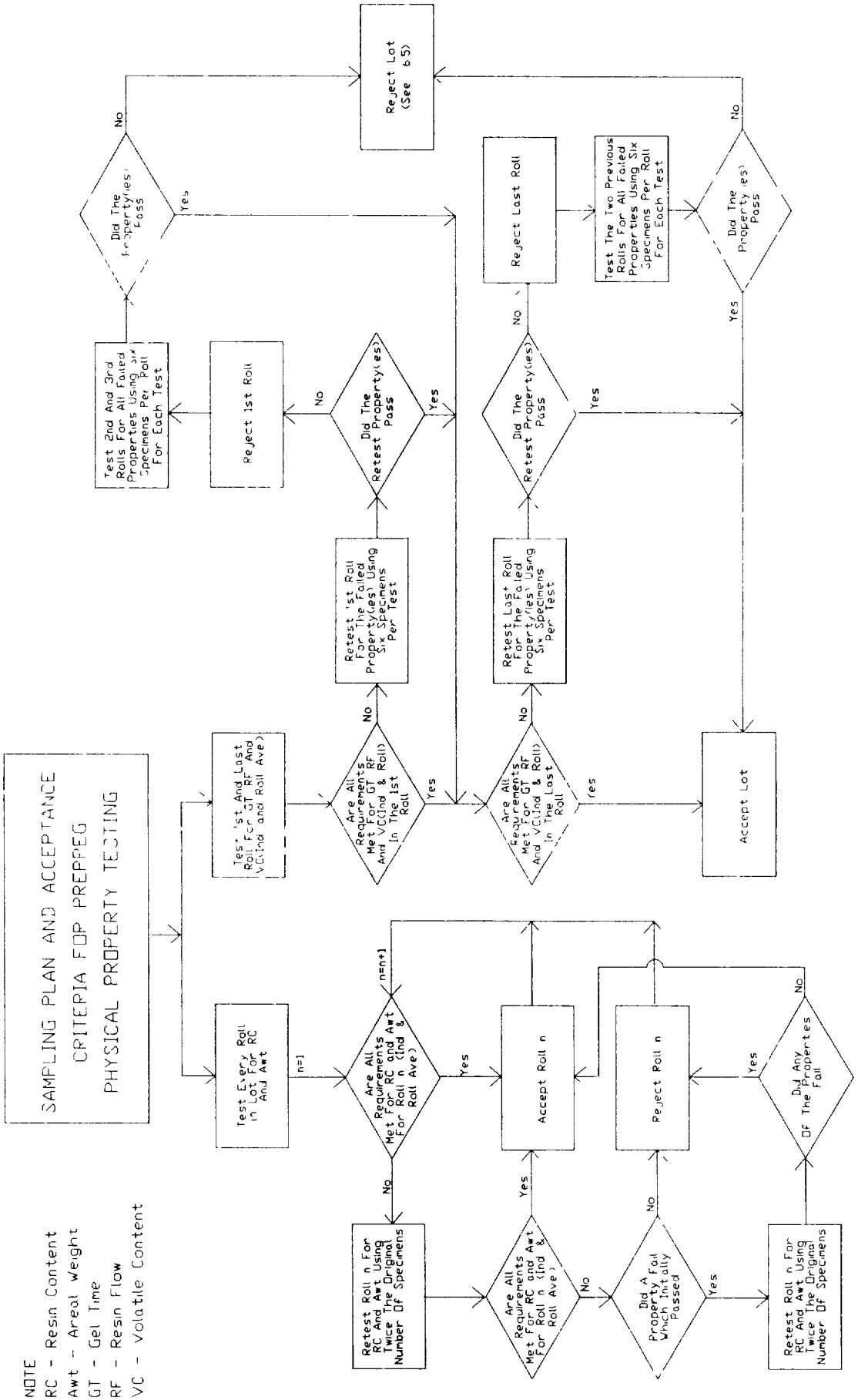


FIGURE 4 Prepreg Physical Property Sampling Plan And Acceptance Criteria For Quality Conformance Testing

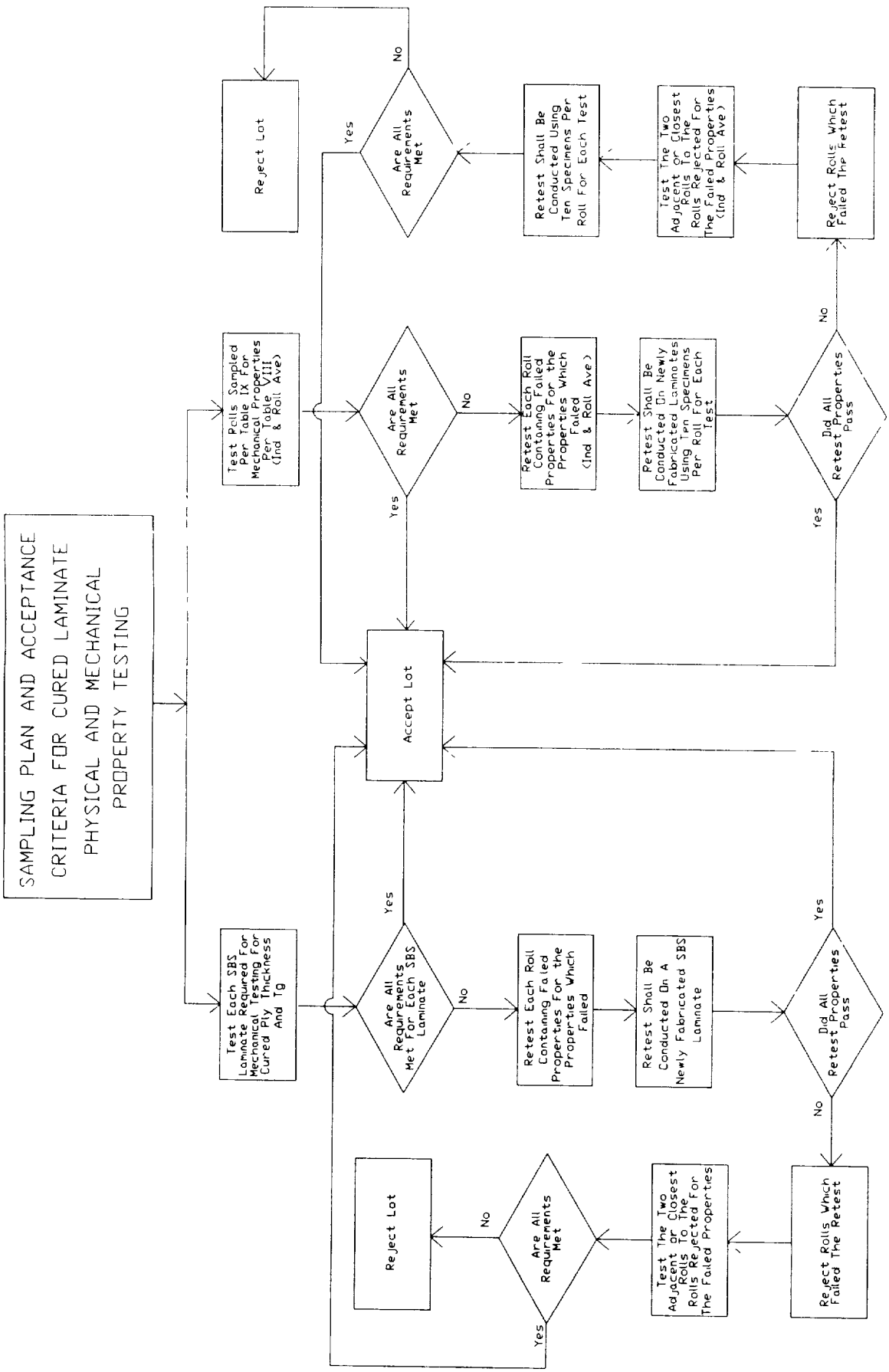
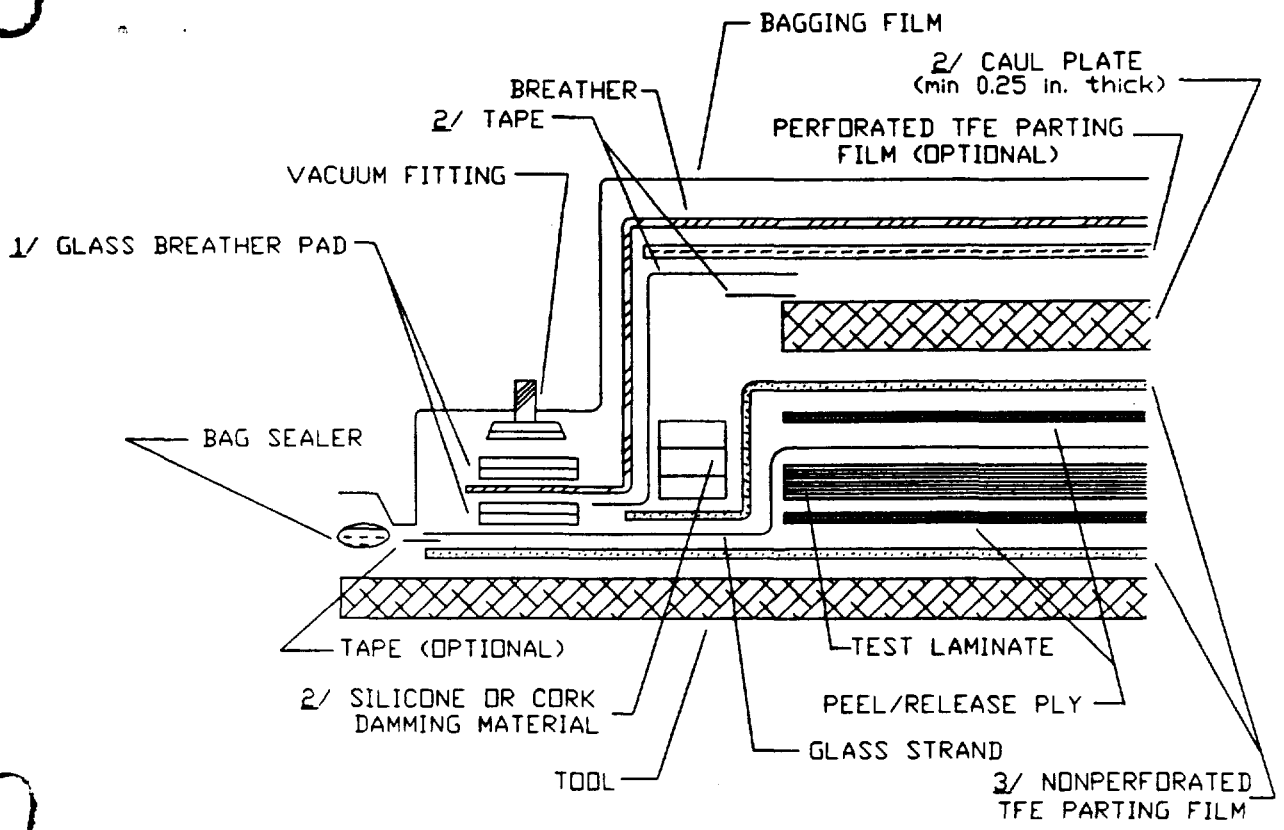


FIGURE 5 Cured Laminate Physical And Mechanical Property Sampling Plan And Acceptance Criteria For Quality Conformance Testing



1/ If no edge dam is used, an edge breather is required. Locate the edge breather a minimum of two (2) inches from the laminate edge extending around the entire laminate periphery. No caul sheet shall be used. Glass strands shall be run to the edge breather to allow trapped air to escape. Strands taken from 1581 style fabric are recommended.

2/ When an edge dam is used, a caul plate shall be used and it shall be taped to the edge dam with a tape capable of sustaining the maximum cure temperature specified. Glass strands shall be run under the edge dam to allow trapped air to escape. Strands taken from 1581 style fabric are recommended.

3/ A perforated TFE parting film may be used on top of the laminate in lieu of the glass strands to allow trapped air to escape (provided it does not result in resin bleed-out).

FIGURE 6. Bagging Arrangement For Making Test Laminates

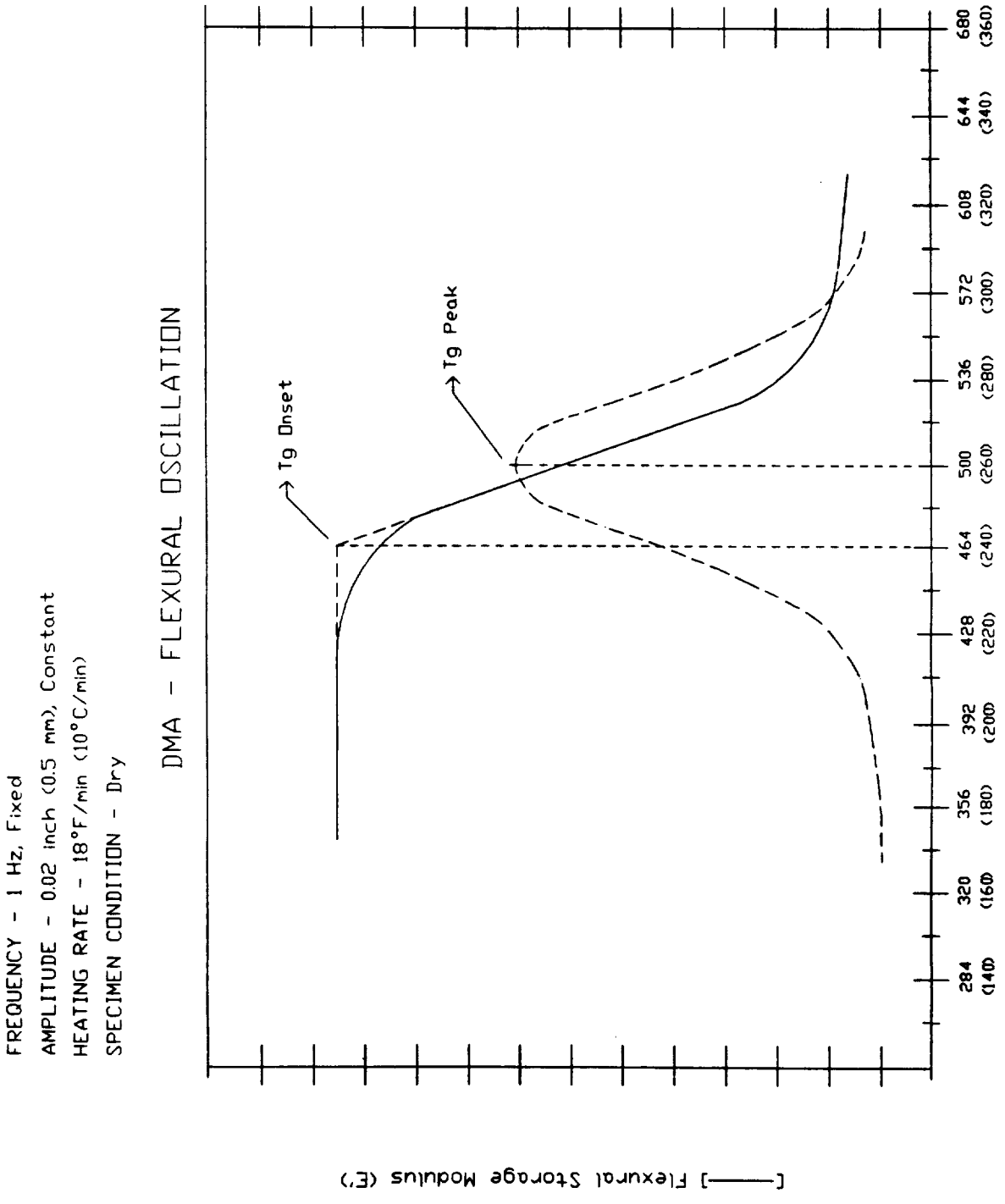


Figure 7. Determination of Tg Onset and Tg Peak

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INDEX(continued)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

The preparing activity must complete blocks 1, 2, 3, and 8 In block 1, both the document number and revision letter should be given.

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I RECOMMEND A CHANGE:	1 DOCUMENT NUMBER [illegible]	2 DOCUMENT DATE (YYMMDD) 30 April 1991

3 DOCUMENT TITLE Fabricating Repair Parts, Unidirectional Carbon Fiber Reinforced Prepreg Tape (Widths Up To 60 Inches), General Specification For

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible Attach extra sheets as needed)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a NAME COMMANDING OFFICER NAVAL AIR ENGINEERING CENTER ASD - CODE 5314	b TELEPHONE (Include Area Code) (1) Commercial: (908) 323-7481 (2) AUTOVON: 624-7481
c ADDRESS (Include Zip Code) Lakehurst, NJ 08733-5100	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT. Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340