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Material Specification

TITLE:	**FABRIC AND UNIDIRECTIONAL TAPE, GLASS FIBER 250^{O}F CURE EPOXY RESIN IMPREGNATED; FLAME RESISTANT**
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FABRIC AND UNIDIRECTIONAL TAPE, GLASS FIBER 250^{O}F CURE EPOXY RESIN IMPREGNATED; FLAME RESISTANT

REVISION RECORD

Issue	Page	Description and Reason for Change
E	21	This is a revised specification, detailed changes will not be noted. Fiberite was deleted from QPL
E	12	Changed conditioning time for test pieces from 40 hours to 24 hours.
Amd. 1	21	Address for American Cyanamid changed from Saugus, California to Harve de Grace, maryland.
E	5	Working life specification changed: 10 days for type 1 and 3 and 7 days for type 2.
Amd. 2		Para. 3.3.8 revised.
E	21	Resin flow for type 1 and type 3, from Structural Polymer System, Inc. changed from 15-20% to 15-25%.
Amd. 3		
F		This is a complete revised issue. Detail changes have not been noted.
F	7	Figure 1 has been changed.
Amd. 1	12	Figure 5 has been changed.
Amd. 2	7	Figure 1 has been corrected.
	13	Figure 6 has been changed.
	15	Table 6: Note 3 has been added.
Amd. 3	12	Figure 5 has been changed.
G	All	This is a complete revised issue. Detail changes have not been noted.

REVISION RECORD (Continued)

Issue	Page	Description and Reason for Change
Amd 1	18, 19	QPL: Culver City Composites were deleted from QPL.
Amd 2	18	QPL: Cytec was deleted from QPL.
Amd. 3	8,9 11	Specified testing with load applied at tool side of the specimen. Specified breather cloth to DSC 234-9 or 234-11
Amd. 4	8, 9	Specified Flex test with support span of 2", load span of 0.67" Shear test with support span of 0.5", cross head speed 0.05"/min.
H		This is a complete revised issue. Detail changes have not been noted.
Amd. 1	7 11, 12	Clarified Flow Test method Revised para. 3.5.3.1, 3.5.3.2 and Table 4 to specified the requirement values is average.
Amd. 2	11	Corrected the ASTM called out for Flexural test on table 3.
Amd. 3	20	QPL: Ciba product R2520 deleted. Product and site no longer exist.
Amd. 4	15	5.1.3, added requirement for PCD.
I		This is complete revised issue. Detail changes have not been noted.
J		This is a complete revised issue. Resin content test method updated to standardize prepreg specs.

REVISION RECORD (Continued)

Issue	Page	Description and Reason for Change
K		This is a complete revised issue.
		Conditioning of test specimens Was:"40hrs.", Is: "24 hrs. minimum"
		Added Materials Qualification Requirements, Quality Assurance Requirements sections.
		Table 6: clarified supplier and purchaser testing.
	10	Table 3: Added requirement for Flex and Compressive, Shear Strength test at hot/wet condition. Value TBD
Amd. 1	6	3.4.8 Reword tack test
	7	3.5.1 Specifies direction for test specimens
	QPL	Added Axiom product
Amd.2	3	2.4, 3.1 Revised reference MIL-C9084 to AMS-9084
	7	3.5.1 Revised Max humidity is 60%
	QPL	Added Cytec Industries, Winona
Amd. 3	19	8.2.1 Clarified the non-adherent film on the outside.
L	4	3.3 Defect: Max Defect allowable 5%
		3.4.3 Formability: Clarified temperature and humidity
		3.4.2 Working Life: Maximum humidity of 60%
	6	3.4.8 Tack: Maximum humidity of 60%
		3.4.10 Marking: Added example of marking
	7	3.4.12 Reword Workmanship
	10	Table 3: Specified test within an hour after conditioning.
	17	Table 6 Revised acceptance test requirements for both Supplier and Purchaser/ User.
		Revised note 3 regarding test temperature and humidity.
	21	QPL: Cytec name changed to Cytec Solvay Group

FABRIC AND UNIDIRECTIONAL TAPE, GLASS FIBER 250°F CURE EPOXY RESIN IMPREGNATED; FLAME RESISTANT

1 SCOPE

This specification establishes the requirement for a 250˚F cure epoxy resin impregnated, glass fabric and unidirectional tape, supplied in a "B" stage condition, suitable for vacuum or autoclave pressure laminating of exterior parts.

1.1 Classification

The materials supplied to this specification shall be one of the following types:

TABLE 1.

Type	Style	Resin Content	Cure Ply Thickness (Nominal)
1	181, 1581 or 7781	37%-43%	0.010"
2	S-2 (unidirectional)	37%-43%	0.009"
3*	7781	37%-43%	0.010"

* For Radome applications only, and as Type 1.

2 APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. In the event of conflicting requirements between this and the specifications listed below, the requirements of this specification shall govern. Where a specific issue of a document is not specified, the current issue shall be used.

2.1 U.S. Government Specifications

2.1.1 Federal Aviation Administration

FAR 25.853(a) APP. F, Part I (1) (i) - Flammability Requirements

Amd.25-86

Advisory Circular No: 21-26 - Quality Control for the Manufacture of Composite Structures.

2.2 American Society for Testing and Materials

ASTM C297 - Tension Test of Flat Sandwich Constructions in Flatwise Plane

ASTM D3410 - Compressive Properties of Rigid Plastics

ASTM D6272 - Flexural Properties of Unreinforced and Reinforced Plastics and

		Electrical Insulating Materials by Four-Point Bending
ASTM D1781	-	Climbing Drum Peel Test for Adhesives
ASTM D2344	-	Apparent Horizontal Shear Strength of Reinforced Plastics by Short Beam Method
ASTM D2584	-	Ignition Loss of Cured Reinforced Resins
ASTM D3039	-	Tensile Properties of Oriented Fiber Composites
SACMA SRM-1	-	Compressive Properties of Oriented Fiber-Resin Composites

2.3 de Havilland Specifications & Standards

DHMS A6.09	-	High Temperature Epoxy Adhesive/Liquid Shim Material
DHMS P1.26	-	Core, Honeycomb, Fibrous Aramid Base, Phenolic Coated
DSC 234	-	Composite Manufacture Expendable Materials

2.4 Aerospace Material Specification

AMS 3906	-	Glass Non Woven Fiber Tape and Flat Sheet
AMS-C-9084	-	Glass Cloth Finished for Resin Laminates
ANSI B46.1-78	-	Surface Texture

3 REQUIREMENTS

3.1 Fabric

The glass fabric, Type 1 and Type 3, shall meet the requirements of AMS-C-9084, Type VIII, VIII A or VIII B (commercial designation style #181, #1581 or #7781). The unidirectional glass fibre, Type 2, shall meet the requirements of AMS 3906.

3.1.1 Ends - The fabric shall not contain any spliced yarns or tow ends outside the requirements of AMS-C-9084 and AMS 3906 (for unidirectional glass fibre).

3.1.2 Fabric Weight - The basic weight of the fabric shall meet the requirements given in **Table 2**. For acceptance test, the weight of the fabric shall be determined in accordance with ASTM D2584.

3.2 Preimpregnated, Glass Fabric/Tape

The product shall be one of the fabrics/tape listed in **Table 2** of this specification, impregnated with an epoxy resin system, supplied in the “B” stage condition, and shall be formulated to meet the requirements of this specification.

TABLE 2.

Type	Style	Construction Ends/Inch	Weave	Basic Weight oz/sq.yd.	Thickness (Nom)
1 & 3	181, 1581 or 7781	56 x 53	5-counter 8 Harness Satin	8.65 ± 0.5	0.010" ± 0.002
2	Unidirectional	-	-	7.6 ± 0.5	0.008"

3.3 Defects

Materials may not contain defects in excess of totalling more than 5% of the area of the complete roll. Defects shall be flagged by placing a strip of polyethylene backing, or other identifying material, at the location of the defect and extending it out one or both ends of the roll. Additional material may be added to the roll to compensate for all defect areas occurring in the roll or supplier will deduct the defect length from the roll length sold to the customer. Compensating material shall be the full roll width for each length of affected area. Alternatively, the purchase liability shall be reduced equal to the amount of compensating material otherwise due.

3.4 Physical Properties and Test Methods of Uncured Impregnated Fabric/Tape

Tests shall be performed on the product as received after warming to above the dew point prior to sampling and in accordance with the test methods specified herein.

3.4.1 Storage Life - The storage life of the prepreg shall be a minimum of 180 days from date of shipment, 210 days from the date of manufacture, when stored at a temperature of 10 ˚F or below.

3.4.2 Working Life - The product shall meet the requirements of this specification when tested after exposure to a temperature not greater than 77˚F, with a humidity not greater than 60%, for a continuous period of up to 10 days for Type 1 and 3, and 7 days for Type 2.

3.4.3 Formability - Formability is defined as the ability of the product to be deformed or contoured over a mould during normal fabrication processes at a temperature range of 65-77˚F with maximum humidity of 60% and be cured in that position. The product shall be formable over, or into, a 0.15 inch minimum radius and remain in position throughout fabrication. Heat may be applied locally to aid in achieving this requirement.

3.4.4 Volatile Content - Three, 4 x 4 inch specimens of the uncured material shall be weighed individually on an analytical balance to the nearest 10 mg and placed in an air circulating type oven at 260 ± 10 ˚F for 15 minutes, removed from oven and placed in a desiccator. The specimens shall then be cooled to room temperature, reweighed, and the volatile content calculated as follows:

$$\text{Volatile Content,\% by weight} = \frac{W1 - W2}{W1} \times 100$$

W1 = Original Weight

W2 = Weight After Heating Cycle

The volatile content, by weight, shall not be greater than 2%.

3.4.5 Resin Content by Weight - The resin content by weight shall be calculated and recorded and shall

meet the requirements of **Table 1**. Three specimens approximately 4 x 4 inch each, shall be cut from the roll so that one sample comes from the centre of the width and the other two from the edges.

Note: volatile content must be performed on different samples.

The three samples shall be individually weighed on an analytical balance and weights recorded to the nearest 10 mg.Completely submerge the three samples in separate beakers containing minimum of 50 ml Methyl Ethyl Ketone, Acetone, or Methylene Chloride for at least 5 minutes. Decant the solvent, being careful to retain all fibers and replace with clean solvent. Continue to extract and decant the sample for a minimum of 3 extractions, until all trace of resin has been removed. Dry the fibers at $210^{o} \pm 10^{o}$ F for 15 minutes. The specimens shall then be cooled to room temperature in a desiccator, reweighed, and the resin content /fabric weight calculated as follows:

Resin Content, % by weight = $\frac{W1 - W2}{W1} \times 100$

W1 = Original Weight

W2 = Weight After Extraction

- Alternatively, Three specimens, approximately 5 grams each, can be tested to the requirements of ASTM D2584.

3.4.6 Resin Flow by Weight

3.4.6.1 Type 1 and 3

Three specimens, 4" x 4" x 4 plies each, of the uncured material shall be laid up cross plied (90^{o} to each other) and weighed on an analytical balance to the nearest 10 mg. The specimens shall then be positioned between Aluminum foil (maximum thickness 0.020") coated with release agent or non-perforated release film A4000 and placed individually in a press, preheated to 260˚F ± 10˚F at 50 psi ± 5 psi pressure and cured for 15 minutes. The foil shall be removed, the flash broken off, each specimen individually reweighed to the nearest 10 mg, and the percent flow calculated.

3.4.6.2 Type 2

Three specimens, each 4 inches x 4 inches x 4 plies of the uncured material, shall be laid up cross plied (90˚ to each other) and weighed on an analytical balance to the nearest 10 mg. The specimen shall be positioned between two plies of porous teflon coated glass. Three plies of 181, 1581, or 7781 style glass fibre and aluminum foil of maximum thickness 0.020" shall be placed on both sides. The entire lay-up should be placed individually in a press, preheated to 260˚F ± 10˚F at 50 psi ± 5 psi and cured for 15 minutes. The foil, glass fibre and porous teflon shall be removed, the flash removed, if any, and each specimen individually reweighed to the nearest 10 mg and the percent flow calculated.

The resin flow shall be as stated on the Qualified Products List of this specification.

3.4.7 Gel Time -

3.4.7.1 Method 1

Three specimens, each being approximately 1/4” square, shall be cut from the uncured material. A hot plate shall be preheated to 260˚F ± 10˚F unless otherwise specified and a micro cover glass placed on the hot plate, allowing a minimum of 20 seconds for it to reach equilibrium. One specimen shall be placed at the centre of the micro cover glass and timing shall be commenced.

Within 5 seconds, a second micro cover glass shall be placed over the specimen. When the resin softens during the first 30 seconds, the top micro cover glass shall be probed to isolate a drop of resin. The fluidity and colour of the isolated drop shall be observed periodically at first, and continuously as the end point approaches. The lateral spreading movement of the resin, upon probing, will decrease and the colour will change as the gel point approaches. The timer shall be stopped at the first indication of resin immobility and the elapsed time to the nearest minute shall be recorded.

3.4.7.2 Method 2

Apparatus:

1. Fisher-Johns melting point apparatus
2. Micro cover glasses, thickness approximately 18 mm (ie.thickness #2)
3. Timer or stopwatch
4. Wooden picks or equivalent

Procedure:

1. Preset the Fisher-Johns melting point apparatus to read ± 10˚F of the specified temperature of 260˚F.
2. Insert three 1/4” x 1/4” samples between 2 cover glasses and place on the Fisher-Johns apparatus.
3. Start the timer and probe the specimen with a wooden pick.
4. When resin gels (this is usually evident when no resin movement is seen when moderate pressure is applied to the specimen), stop the timer and report the gel time to the nearest 0.1 minute.

The product shall have a gel time as shown on the Qualified Products List of this specification unless otherwise specified.

3.4.8 Tack - The product shall exhibit a degree of tackiness to enable easy handling during normal fabrication processes at a temperature range of 65- 77˚F, with a humidity not greater than 60% anytime during the defined shelf life. Both sides of the fabric shall exhibit a degree of tackiness so that the fabric, when folded 180˚, will adhere lightly to itself. It shall also be capable of being removed, after light hand pressure during lay-up, without disturbing the previously positioned mating ply.

3.4.9 Colour - Unless otherwise specified, the colour shall be the natural, uniform colour of the resin-fabric system.

3.4.10 Marking - The warp direction of the woven impregnated fabric shall be marked in a manner that is acceptable to Materials Technology. Acceptable methods include but are not limited to ink arrows, ink lines, incorporated tracer yarns.

3.4.11 Dimensions -

Width - Unless otherwise specified, the overall width of Type 1 and Type 3 material, as supplied, shall be 38" or 50", inclusive of the selvedge. Width tolerance shall be -0.25 inches to +0.50 inches. Type 2 material shall be 12" wide, width tolerance shall be ±0.25".

Length - Unless otherwise specified, the overall length of the material, as supplied, shall be 25 ± 1 yard, 50, 100 or 150 yards ± 5 yards for Type 1 and Type 3, and 100 or 150 yards ± 5 yards for Type 2.

3.4.12 Workmanship - The impregnated glass fiber fabric and tape shall be evenly impregnated, uniform in quality and free from gaps, holes, resin pockets, cured resin particles, foreign materials, creases and other similar defects which would render the product unsuitable for its intended purpose.

3.4.13 Bias or Bowed Filling - The filling strands of Type 1 and Type 3 fabric shall not be distorted from the horizontal by more than 3" for 38" widths and proportionally for all other widths.

3.5 Properties and Test Methods of Cured Impregnated Fabric

3.5.1 Unless otherwise specified, tests shall be conducted at 70˚F ± 10˚F and a relative humidity of maximum 60%. Specimens tested at room temperature shall be conditioned for a minimum of 24 hours at 70 ± 10˚F and maximum 60% relative humidity prior to the test At least five specimens shall be used per test except for flammability test which requires a minimum of three specimens, and the results averaged. No individual value shall be less than 90% of the value specified; this shall not apply to flammability tests.

Unless otherwise specified,all test pieces shall be cut with the longer dimension parallel to the warp direction of the fabric or fiber direction of unidirectional material.

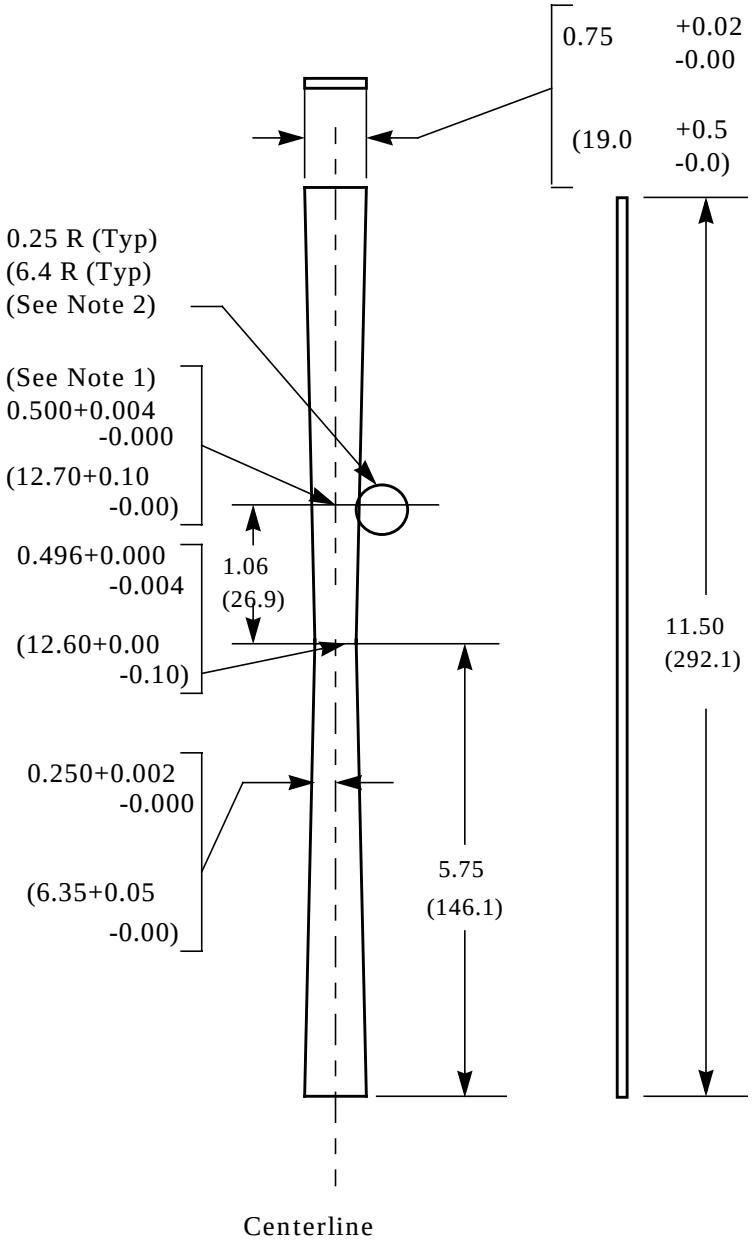
3.5.2 Flammability - For Types 1 and 3, a 2 ply cured laminate shall meet the requirements of FAR 25.853(a) APP. F, Part I (1) (i), Amd.25-86.

3.6 Laminate Mechanical Properties

3.6.1 Tensile Tests - The ultimate tensile strength and the tensile modulus of each specimen shall be calculated and recorded and shall be not less than values given in **Table 3**. Five tensile test specimens shall be tested in accordance with ASTM D3039 except that the specimens shall conform to **Figure 1**.

3.6.2 Flexural Test

The flexural strength (modulus of rupture) and flexural modulus (tangent modulus of elasticity) shall be calculated and recorded and shall be not less than the values given in **Table 3**. Five flexural specimens, 3" warp x 1" fill, with the long dimension parallel to the warp direction shall be tested in accordance with ASTM D6272, Procedure A, L/d=16 and test with a crosshead speed of 0.06"/minute, support span of 2", load span of 0.67". Test with load apply at tool side (smooth side) of the specimen.



Dimensions are in inches (millimeters)

Notes:
1. The width outward from 0.496 (12.60) shall be increased gradually and equally on each side up to 0.500 (12.70) so that no abrupt change in dimensions results.

2. Transition from straight sided center section to tapered section shall be smoothly joined in the area of the 0.250 (6.35) rad.

3. Test at crosshead speed of 0.15”/min.

FIGURE 1. Tensile Test Specimen

3.6.3 Compressive Strength

The ultimate compressive strength of each specimen shall be not less than the value given in **Table 3**. Five specimens conform to **Figure 2** shall be test in accordance with ASTM D3410. Alternatively, Compressive Strength can be test in accordance with SACMA SRM-1.

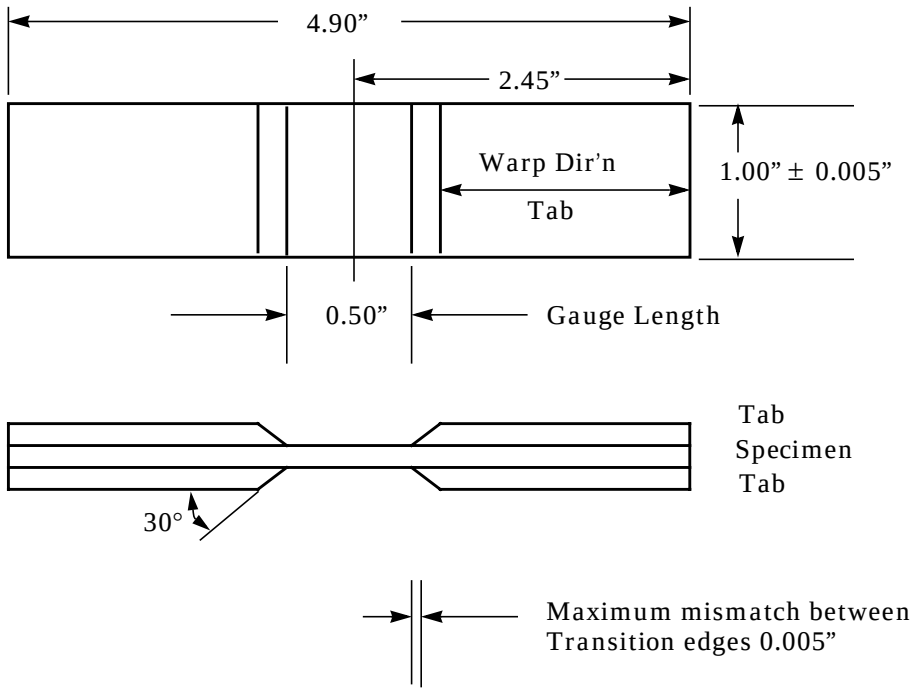


FIGURE 2. Compressive Test Specimen

Notes:

1. Tabs to be manufactured from 10 plies DHMS P1.22 Type 2 glass fabric and cured at 260˚F ± 10˚F, 35 ± 5 psi for one hour.
2. Use Frekote 44NC or 700NC on caul plate (0.032 - 0.060 thick) on upper surface. Do not use Tooltec.
3. Tab face which is to be bonded to specimen shall be cured with peel ply to DSC-234-12 to provide adequate bond surface.
4. Tab thickness is 0.100 ± 0.010" but all 4 tabs on a specimen must be within 0.002" of each other.
5. Maximum mismatch between tab transition edges is 0.005".
6. Warp direction shall be ±1˚ for specimen and tab layup.
7. Tab layup may be done in panels and cut to size; no tab may be cut from material within 1/2 inch of the edge of the panel. Bond surface is surface which was cured with peel ply on it.
8. Bond tabs to specimen using 3M, 2 part adhesive EC 2216 or DHMS A6.09 liquid shim. Lightly abrade specimen surface (320 grit abrasive) only where tabs are to be bonded on. Use a fixture to maintain warp direction of tab during layup. Peel ply must be removed from tab before bonding commences. Wipe bond surfaces with MEK immediately before bonding.

9. √125 edge finish is required in accordance with ANSI B46.1-78.

3.6.4 Horizontal Shear Test

The Horizontal Shear strength shall be calculated and recorded and shall be not less than the value given in **Table 3**. Five test specimens 1.125" long (parallel to fill) by 0.25" wide (parallel to warp), for Type 2 material, the fiber direction must be in the 1.125" long direction; shall be tested in according to ASTM D2344 with a crosshead speed of 0.05"/min. and a support span of 0.50". Test with load apply at tool side (smooth side) of the specimen.

TABLE 3. Mechanical Properties of Laminate

Test	Reference	Minimum Average Values	
		Type 1 & 3	Type 2
Tensile Strength (psi)	ASTM D3039	40,000	140,000
Tensile Modulus (psi)	ASTM D3039	2.8×10^6	6×10^6
Flexural Strength (psi) Condition 1 Condition 2	ASTM D6272	 60,000 TBD	 160,000 TBD
Flexural Modulus (psi)	ASTM D6272	3.0×10^6	5.5×10^6
Compressive Strength (psi) Condition 1 Condition 2	ASTM D3410	 45,000 TBD	 80,000 TBD
Horizontal Shear Strength (psi) Condition 1 Condition 2	ASTM D2344	 3,500 TBD	 8,000 TBD
Flammability	FAR 25.853(a) APP. F, Part I (a) (1) (i),		N/A

Condition 1 - Conditioned at 70˚± 10˚F,60% maximum relative humidity for a minimum of 24 hrs. Test specimens at room temperature.

Condition 2 - Conditioned at 170˚± 5˚F, 95± 5% relative humidity until a moisture content level of 3-5% by weight (relative to the condition 1 specimens) or equilibrium has been achieved. Test specimens at room temperature within an hour after conditioning.

3.7 Sandwich Mechanical Properties

3.7.1 Flatwise Tensile -Five specimens, each 2" x 2" shall be tested in accordance to ASTM C297. The Tensile strength shall be calculated and recorded and shall meet the requirements given in **Table 4**.

3.7.1.1 Peel Torque -Five specimens for each configuration, 3" x 12", shall be tested in accordance to ASTM D1781. The Peel Torque shall be calculated and recorded and shall meet the requirement given in **Table 4**.

TABLE 4. Mechanical Properties of Sandwich Panel

Test	Reference	Minimum Average Values
Flatwise Tensile	ASTM C297	300 psi
Peel Torque*	ASTM D1781	20 in-lb / 3 in. width

* Both toolside and bagside must meet the minimum value when tested parallel and transverse to the warp direction.

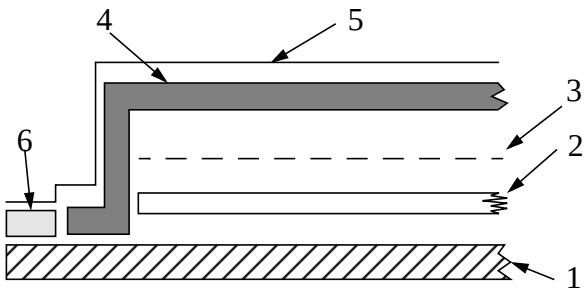
4 TEST PANEL FABRICATION

4.1 Laminate Specimen

Test laminate 18" warp x 12" fill shall lay up with number of plies specified in **Table 5** with the long dimension parallel to the fiber direction or warp direction. Laminate shall be vacuum bagged per the applicable **Figure 3** and **Figure 4** and cured per **Figure 5**.

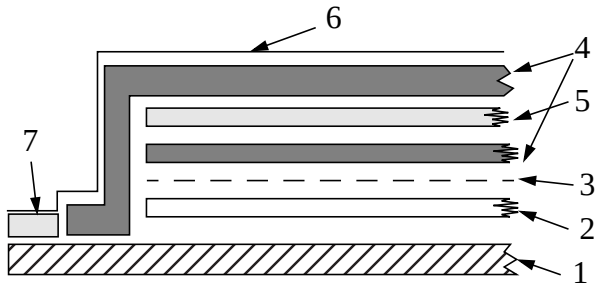
TABLE 5.

Test Specimen	# Plies for Types 1 and 3	# Plies for Type 2
Flexural	10	10
Horizontal Shear	10	10
Tensile	10	6
Compression	10	10
Flammability	2	2



1. Tool (coated with mould release Frekote 44NC or 700NC) Use DSC 234 expendable materials
2. PART
3. Perforated Release Film A4000P3
4. Airweave SS-FR Breather
5. Nylon Vacuum Bag
6. GS 43 MR Vacuum Sealant Tape

FIGURE 3. Bagging Procedure for Types 1 &3 Laminate And Sandwich Panels



1. Tool (coated with mould release Frekote 44NC or 700NC) Use DSC 234 expendable materials
2. PART
3. Perforated Release Film A4000P3
4. Airweave SS-FR Breather
5. Intensifier (0.032" to 0.060" Al. Plate)
6. Nylon Vacuum Bag
7. GS 43 MR Vacuum Sealant Tape

FIGURE 4. Bagging Procedure for Type 2 Laminate

APPROVED EXPENDABLE MATERIALS TO DSC 234

Vacuum bag, Ipplon DP1000	(DSC 234-1-54)	Airtech International Inc.,
or Vacuum bag, Wrightlon 8400	(DSC 234-2-54)	2542 East Del Amo Blvd.,
Perforated Release Film A4000P3	(DSC 234-5-48)	
Airweave Breather	(DSC 234-11) or (DSC 234-9)	
Mould Release, Frekote 44NC or 700NC	(DSC 234-13)	Frekote Inc.,
Vacuum Sealant Tape, GS 43 MR	(DSC 234-17-1)	

NOTE: Additional sources are listed in DSC 234.

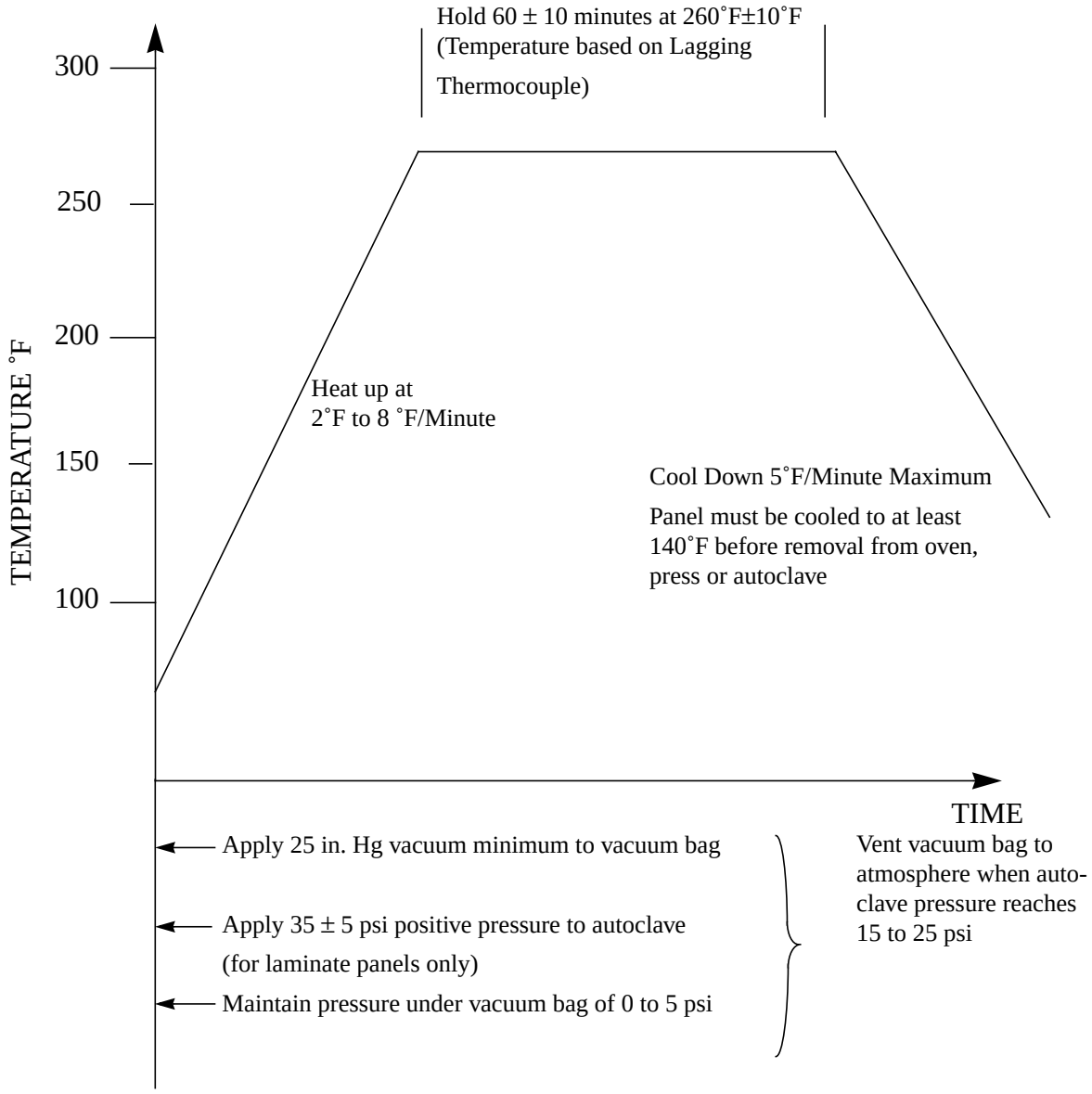


FIGURE 5. Cure Cycle

4.2 Sandwich Test Panel

Test panel 18" warp x 15" fill shall be lay up according to **Figure 4.2**, vacuum bag per **Figure 3** and **Figure 4** and cured per **Figure 5**.

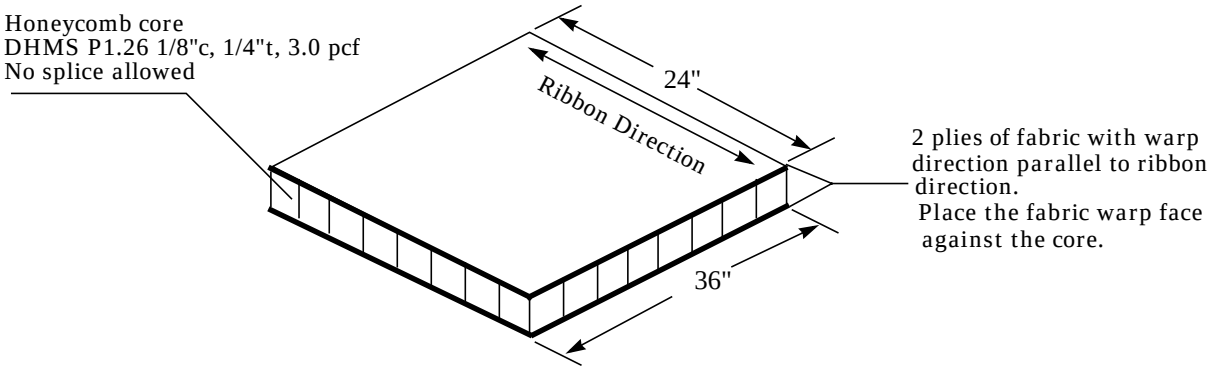


FIGURE 6. Sandwich Panel

5 MATERIAL QUALIFICATION REQUIREMENTS

5.1 Request For Qualification

All requests for qualification to this specification shall be addressed to Bombardier Aerospace Materials Technology Engineering department for approval.

All material qualification shall be site specific.

An audit of the manufacturers and/or test facilities by Materials Technology Engineering may be necessary prior to approval.

5.2 Qualification testing

Potential suppliers shall submit a written qualification test report based on 3 batches/lots of materials showing compliance with the requirements contained in section 3. The test report shall contain actual numerical test values, average test results as well as failure modes where applicable.

5.2.1 A sample shall be submitted for testing at the discretion of Bombardier Aerospace Materials Technology for evaluation.

5.3 Qualification by Similarity

Where a product has been qualified to another similar specification, the supplier may submit the qualification data applicable to this specification for consideration. The similar specification may be a government, company, or other aerospace specifications where the requirements are similar to this specification.

5.4 Process Control Document

5.4.1 The manufacturer shall develop and maintain a Process Control Document (PCD).

5.4.2 The PCD shall define the manufacturing and quality control requirements and procedures for assuring consistent, uniform and compliant products. The PCD shall identify baseline chemical constituents, in-process test procedures and requirements, and manufacturing procedures. All specifications and test procedures employed during the process shall also be listed and issue/date controlled.

5.4.3 When qualification has been granted, the PCD shall be signed by the supplier and Bombardier Aerospace Materials Technology Engineering and shall not be changed without prior written approval.

5.4.4 The PCD and all production data shall be available to Bombardier Aerospace auditors when requested.

5.5 Qualification Approval

5.5.1 Upon review of supplier's data, PCD and de Havilland tests, the supplier will be advised either of product qualification or reasons for not qualifying the product.

5.5.2 Products that are qualified will be listed in the Qualified Products List of this specification.

5.5.3 No changes in the method of manufacture and/or formulation, shall be made without notification and

prior written approval of Materials Technology Department.

5.5.4 Re-qualification of the product may be requested by the Bombardier Materials Technology if there are any changes in the method of manufacture and/or formulation.

6 QUALITY ASSURANCE REQUIREMENTS

6.1 Manufacturer/Supplier Batch/Lot Acceptance Tests

6.1.1 The manufacturer/supplier is responsible for the performance of all sampling, inspection and testing of each batch/lot as specified in **Table 6.**

6.1.2 The manufacturer/supplier shall issue with each batch of product one copy of an Acceptance Test report showing actual test data conformance to the acceptance tests specified in **Table 6** The report shall include the supplier's batch identification, materials specification and date of testing.

6.1.3 Bombardier Aerospace Materials Technology Engineering reserves the right to perform any or all of the tests set forth in this specification to ensure that the product continues to meet specification requirements. Any product not meeting the requirements of this specification will be returned to the supplier at the supplier's expense.

6.1.4 The manufacturer/supplier shall certify with a Certificate Conformance that each batch of each shipment meets the requirements of this specification.

6.2 Purchaser/User Batch/Lot acceptance tests

6.2.1 The purchaser/user is required to perform of all sampling, inspection and testing of each batch/lot as specified in **Table 6.**

TABLE 6. Qualification and Batch Acceptance Tests

Property	Requirement	Qualification (Supplier)	Acceptance	
			Supplier	Purchaser/User
Fabric Weight	Para.3.1.2	x	x	
Storage Life	Para.3.4.1	x		
Working Life	Para.3.4.2	x		
Formability	Para.3.4.3	x	x	
Volatile Content	Para.3.4.4	x	x	
Resin Content	Para.3.4.5	x	x	x
Resin Flow	Para.3.4.6	x	x	x
Gel Time	Para.3.4.7	x	x	x
Tack	Para.3.4.8	x	x	x
Colour	Para.3.4.9	x		
Dimensions	Para.3.4.11	x		
Workmanship	Para.3.4.12	x	x	
Bias or Bowed Filling	Para.3.4.13	x		
Cure Cycle	Figure 5	x		
Flatwise Tensile	Table 4	x		
Peel Torque	Table 4	x	x *	x *
Flammability	Para.3.5.2	x		
Tensile Strength	Table 3	x		
Tensile Modulus	Table 3	x		
Flexural Strength	Table 3	x	x	x
Flexural Modulus	Table 3	x		
Compressive Strength	Table 3	x		
Horizontal Shear Strength	Table 3	x	x**	x **

1. * For acceptance, peel testing parallel to ribbon direction on both tool side and bag side are required.
2. ** For Type 2 only.
3. For mechanical properties acceptance test, condition at 70° ± 10°F, 60% maximum relative humidity for a minimum of 24 hours. Test specimens at room temperature.

6.3 Sampling

6.3.1 Sampling Schedule - Sampling shall be in accordance with **Table 7**.

TABLE 7. Sampling Schedule

Number of Rolls in Batch	Frequency of Inspection
1 - 10	1 roll
11 - 39	2 rolls
40 and more	3 rolls

6.3.2 Batch - A batch shall be all the product produced in a single production run from the same lot of raw materials under the same fixed conditions and submitted for inspection at one time. When more than one lot of glass fibre fabric is used in production of a batch of prepreg to this specification, acceptance test shall be conducted so as to cover all lots of fabric batches utilized.

7 ORDERING DATA

7.1 Prerequisite

Material furnished under this specification for production use shall be qualified and listed on the Qualified Products List prior to issuing of a Purchase Order.

7.2 Procurement Documents

Procurement documents shall specify the following:

- Title, Number, Issue and Amendment Number of this Specification
- Type of Pre-Impregnated Fabric
- Manufacturer's Material Designation
- Total Quantity

8 PREPARATION FOR DELIVERY

8.1 Identification

8.1.1 Each roll of impregnated fabric shall be identified with a label or marking, securely affixed to the inside of the core or with a removable tag.

8.1.2 The label or removable tag shall use characters of a size such as to be clearly legible and which will not be obliterated by normal handling. Each label or tag shall show the following information:

- Glass Fiber Fabric/Tape, Epoxy Impregnated
- DHMS P1.22, Latest Issue and Amendment, (Enter Type)
- Manufacturer's Material Designation
- Purchase Order Number
- Batch/Lot and Roll Numbers
- Quantity
- Perishable - Store Below 10˚F
- Date of Manufacture

8.2 Packaging

8.2.1 The impregnated fiber shall be wound on spools not less than 3 inches in hub diameter and interleaved with a non-adherent film. The non-adherent film must be on the outside to prevent penetration of moisture or loss of impregnating resin solvent.The backing type shall be that is acceptable to Materials Technology.

Winding shall be uniform and shall provide for proper unreeling. Fabric ends shall be secure.

8.2.2 Each roll shall be adequate support at both ends through the center of the core.

8.2.3 Each roll shall be sealed in a bag of suitable non-adherent material to prevent penetration of moisture or loss of impregnating resin solvent.

8.2.4 The roll shall be packed in an exterior shipping container capable of protecting the impregnated materials adequately at 10˚F or lower during shipment and storage.

8.3 Shipping Documentation

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

- Glass Fiber Fabric/Tape, Epoxy Impregnated
- DHMS P1.22, Latest Issue and Amendment, (Enter Type)
- Manufacturer's Material Designation
- Purchase Order Number
- Batch/Lot and Roll Numbers
- Quantity

- Perishable - Store Below 10˚F

8.3.2 Containers shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery.

8.3.3 Each shipment shall contain a copy of the Material Safety Data Sheet.

9 HEALTH AND SAFETY DATA

When supplying samples for qualification per **Para.5.2**, the supplier shall submit a Material Safety Data Sheet (MSDS) complying with the "Controlled Products Regulations" of the Hazardous Products Act (also known as W.H.M.I.S. Regulations). The document must state all hazardous ingredients, safe-handling procedures, first-aid measures, fire and explosion data, re-activity data, physical properties, preparation information and procedures for storage and disposal.

This (MSDS) must then be supplied with a completed DH 4339 "Application To Introduce A New Material" form to the Material Safety Committee.

Upon receipt of DH 4340 "Recommendation" form that approves the use of the material, it can then be included on the Qualified Products List.

NOTE:Any changes in the formulation of the material require a re-submission of the Material Safety Data Sheet.

FABRIC AND UNIDIRECTIONAL TAPE, GLASS FIBER 250^{O}F CURE EPOXY RESIN IMPREGNATED; FLAME RESISTANT

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.	MATERIALS SAFETY DATA SHEET NO	PRODUCT QUALIFICATION SHEET NO.	DATE OF PRODUCT APPROVAL
	Type 1			
Umeco Structural Materials (CA) Inc. 851 W. 18th Street Costa Mesa, CA 92627 (949) 650-8106	L-530-7781 Gel Time 2-15 min. Resin Flow 10-30%	2653	PQS #9 PQS #11	January 14, 1999 December 19, 2014
Cytec Solvay Group 501 West Third Street Winona, MN 55987				
	Type 1			
Axiom Materials Inc. 2322 Pullman Street, Santa Ana CA 92705	AX-3112T-7781-50" RC40 Gel Time: 5-10 min. Resin Flow: 15-30%		PQS#10	September 16, 2014