de Havilland Inc.

Material Specification

TITLE:	**THERMOFORMABLE PLASTIC SHEET FOR INTERIOR APPLICATIONS**
SPECIFICATION NUMBER:	**DHMS P 1.46**
ISSUE:	**A**
AMENDMENT:	**---**
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PAGE:	**1 of 10**

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REVISION RECORD

Issue	Page	Description and Reason for Change
Original Amd.1	10	Product designation has been added to QPL.
Amd. 2	2 10	Para. 1.1.1: Type II and Type III have been reversed. QPL: Type II has been changed to Type III.
Amd. 3	10	QPL: Material designation for various textures added.
Amd. 4	2	Para. 1.1.1: Type IV added.
A	10 All	QPL: Material designation for various Types and Grades added. Detailed changes have not been noted.

1 SCOPE

This specification covers the requirements for a self extinguishing, low heat release, low smoke emission, impact and chemical resistant, thermoplastic, chlorinated polyvinyl chloride (CPVC) sheet form material for vacuum forming.

1.1 Classification

The materials supplied to this specification shall be one of the following Types and Grades:

1.1.1 Types

Type I	Grey, BAC 704
Type II	Beige, BAC 80831
Type III	Grey Cloud, DA 2.8
Type IV	White

1.1.2 Grades

Grade 1	0.045" thick
Grade 2	0.065" thick
Grade 3	0.085" thick
Grade 4	0.125" thick

2 APPLICABLE DOCUMENTS

The following documents form part of this specification to the extent specified herein. In the event of conflicting requirements between this specification and those listed below, the requirements of this specification shall take precedence. 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 American Society for Testing and Materials

ASTM D638	-	Tensile Properties of Plastics
ASTM D790	-	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Material
ASTM D792	-	Specific Gravity and Density of Plastics by Displacement
ASTM D1238	-	Definitions of Terms Relating to Veneer and Plywood
ASTM D3029	-	Impact Resistance of Rigid Thermoplastic Sheet by Means of a TUP, Method F
ASTM E308	-	Computing the Colours of Objects by Using CIE System, Method For

2.1.2 Federal Aviation Administration

FAR 25.853 (a) APP.F, Part I(a)(1)(i)- Amd. 25-83 Flammability Requirements

FAR 25.853(d) APP. F, Part IV & V,- Amd. 25-83 Heat Release & Smoke Density

3 REQUIREMENTS

Prior to procurement, for applications requiring OSU heat release and NBS smoke density attributes, equivalency to currently procured materials tested in accordance with FAR 25.853(d), App. F Part IV and V, Amd. 25-83 must be demonstrated.

3.1 Materials

Materials used in the manufacture of this product shall be of high quality and suitable for the intended purpose.

3.2 Finished Product

The self extinguishing, low smoke emission, low heat release, impact and chemical resistant, thermoplastic, CPVC sheet material shall meet all of the requirements contained herein.

3.3 Preproduction Samples

For qualification of sheet material purposes, the vendor shall submit five 6-1/2" x 10-1/2" samples of the initial batch of material manufactured to this specification, for approval of texture and colour. One sample shall be designated as the master standard; the remaining four samples shall be used as working standards. de Havilland Inc. (DHI) will assign a standard number to these samples. A batch is defined as a production run of sheet material manufactured from one batch of resin with uninterrupted production.

TABLE 1. Physical and Chemical Property Requirements

Test	Material Requirements	Test Method
Specific Gravity	1.55	ASTM D792
Colour and Finish	Shall match standard.	**Para.4.1**
Workmanship	Sheet material shall be free of voids, blisters, foreign particles and scratches. It shall not be cracked, chipped, warped or twisted. Perforations are not permitted.	**Para.4.2**

TABLE 1. Physical and Chemical Property Requirements

Test	Material Requirements	Test Method
Vacuum Forming	Material when vacuum formed per Para.4.3 shall not cause any detrimental defects to the part.	Para.4.3
Sheet Thickness	Sheet thickness shall be within ±10% of the specified dimension.	Gauge the thickness at four different locations

TABLE 2. Mechanical Property Requirements

Property	Minimum Value Average		Test Method
Tensile Strength, PSI Room Temperature	7,500		ASTM D638 Para.4.4
Tensile Modulus, PSI Room Temperature	300,000		ASTM D638 Para.4.4
Flexure Strength, PSI Room Temperature	10,000		ASTM D790 Para.4.5
Flexure Modulus, PSI Room Temperature	300,000 300,000		ASTM D790 Para.4.5
Impact Strength, inch/pounds Gardner, Free Falling Dart	Grade 1 40-60 in/lb	Grade 2, 3, 4 80 in/lb	ASTM D3029

TABLE 3. Flammability Requirements

Test	Requirement	Test Method
60 Second Vertical (i) extinguishing time (ii) burn length (iii) drip extinguishing time	 12 seconds 6 inches no drips	FAR 25.853(a) APP. F, Part I(a)(1)(i), Amd. 25-83
Heat Release Properties	Material shall exhibit a 2 minute: 65 kW-min/m^2 peak: 65 kW-m^2	FAR 25.853(d) APP. F, Part IV, Amd. 25-83
Smoke Ds at 4 minutes.	Not to exceed 150	FAR 25.853(d) APP. F, Part V, Amd. 25-83

4 TEST METHODS

4.1 Colour and Finish

Comparison shall be made by placing the new sample side by side with the control sample in a Macbeth Industrial Colour Matching Unit, or equivalent. The direction of illumination shall be normal to the surfaces being compared. Both "North Sky Daylight" (7500K) and "Horizon Sunlight" (2300K) shall be used to compare colours. An acceptable alternative is sample comparison using a spectrophotometer in accordance with ASTM E308.

4.2 Workmanship

For inspection purposes, the product shall be viewed from a distance of one yard with the material in the vertical position. Adequate illumination must be used which produces a 25 to 35 foot-candles of light at the surface of the specimen.

Test equipment shall consist of a Spectra Lumicon Series II Incident Light Meter (manufactured by Photo Research Division of Kollmorgen Corporation, Burbank, California, U.S.A.) or equivalent.

4.3 Forming

4.3.1 Prepare three 12 x 12-inch samples of sheet material.

For thickness of 45-85 mil dry for 16 -24 hours at $160^{o}F \pm 5^{o}F$.

For thickness of 105-125 mil dry for 16-24 hours at $170^{o}F \pm 5^{o}F$.

4.3.2 Form the samples at 300^{o} - $350^{o}F$ (majority of heat should be applied to the backside of the product)

For thickness of 45-85 mil heat for 30 to 90 seconds.

For thickness of 105-125 mil heat for 60 to 120 seconds.

4.4 Tensile Strength and Modulus of Elasticity

Determine the tensile strength and modulus of elasticity in accordance with ASTM D638. Cross-head speed shall be 0.20 ± 0.05 inch per minute. Test a minimum of five specimens.

4.5 Flexural Strength and Flexural Modulus

Determine the flexure properties in accordance with ASTM D790, Method I. A minimum of five specimens shall be tested.

4.6 Impact Resistance

Test per ASTM D3029, method F, Geometry FB.

5 QUALITY ASSURANCE

5.1 Qualification

5.1.1 A supplier is responsible for the performance of all qualification testing as specified in **Table 4** of this specification. A three lots/batches qualification is required.

5.1.2 A supplier desiring qualification shall submit a copy of a report showing actual qualification test data and a sufficient quantity of product for de Havilland evaluation tests.

5.1.3 Upon review of supplier's data and de Havilland tests, the supplier will be advised either of product qualification or of reasons for disqualification.

5.1.4 No changes in the method of manufacture and/or formulation shall be made without notification and prior written approval of Materials Technology Department of de Havilland Inc.

5.1.5 Requalification of the product may be requested by the purchaser if there are any changes in the method of manufacture and/or formulation.

5.2 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 specification where the requirements are similar to this specification.

5.3 Acceptance Tests

5.3.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for all acceptance tests, as specified in **Table 4** of this specification.

5.3.2 The supplier, performing acceptance tests per **Table 4** shall furnish with each lot of product one copy of an Acceptance Test Report showing actual test data conformance to the acceptance tests specified in **Table 4**. The report shall include the supplier's batch identification.

5.3.3 De Havilland Inc. 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.

TABLE 4. Qualification and Acceptance Test

Property	Reference	Qualification	Acceptance
Specific Gravity	Table 1	x	
Colour and Finish	Table 1	x	x
Workmanship	Table 1	x	
Vacuum Forming	Table 1	x	
Sheet Thickness	Table 1	x	x
Tensile Strength	Table 2	x	x
Tensile Modulus	Table 2	x	
Flexural Strength	Table 2	x	
Flexural Modulus	Table 2	x	
Impact Strength,	Table 2	x	x
Impact Strength, scratched	Table 2	x	
60 second vertical	Table 3	x	x
OSU Heat Release	Table 3	x	
NBS Smoke Density	Table 3	x	

6 ORDERING DATA

6.1 Prerequisite

6.1.1 The CPVC sheet or pellet furnished under this specification for production use shall be qualified and listed on the Qualified Products List prior to issuing a purchase order.

6.1.2 Prior to shipment of material a 6-1/2" x 10-1/2" sample, taken from the lot of material to be shipped, shall be forwarded to de Havilland Inc. for lot approval.

6.2 Procurement Documents

Procurement documents shall specify the following:

- Title, Number, Issue and Amendment Number of this Specification
- Type, Grade
- Manufacturer's Product Identification
- Total Quantity
- Sheet Size

7 PREPARATION FOR DELIVERY

7.1 Preservation and Packing

The CPVC sheets or pellet shall be packed in such a manner as to assure that, during shipment and storage, the product shall be protected against damage from exposure to hazards which would affect adversely the property conformance to **Section 3** of this specification.

7.2 Marking

Each container shall be legibly marked with the following information:

- CPVC Sheet Material (conforms to DHMS P1.46 Type, Grade)
- Manufacturer's Name and Product Identification (Trade Name or Code Number)
- Date of Manufacture
- Sheet Size
- Quantity
- Purchase Order Number - Lot Number.

7.3 Shipping Documentation

The shipping document shall show:

- de Havilland Purchase Order Number
- Specification Number, Type, Grade
- Quantity
- Number of Containers or Packages
- Acceptance Test Report
- Total Quantity.

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

8 HEALTH AND SAFETY DATA

When supplying samples for qualification per **Para.5.1**, 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, reactivity 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.

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.	MATERIALS SAFETY DATA SHEET NO.	PQS NO.	DATE OF PRODUCT APPROVAL
Schneller, Inc. 6019 Powdermill Road, P.O. Box 670 Kent, Ohio 44240 Ph.: (330) 673-1400 Fax: (330) 673-6374	**Type I, Grade 2** AERFORM LHR .065/7993/ 670P/48x96 P/N SO7993-001-00	N/A	1	March 8, 1999
	Type I, Grade 3 AERFORM LHR .085/7993/ 670P/48x96 P/N S1584	N/A	5	March 8, 1999
	Type II, Grade 2 AERFORM LHR .065/ 14239/670P/48x96 P/N S14239-001-00	N/A	2	March 8, 1999
	Type II, Grade 3 AERFORM LHR .085/ 14239/670P/48x96 P/N S1585	N/A	6	March 8, 1999
	Type II, Grade 4 AERFORM LHR .125/ 14239/670P/48x96 P/N S1739	N/A	7	March 8, 1999
	Type III, Grade 1 AERFORM LHR .045/9935/ 670P/48x96 P/N SO9935-001-00	N/A	3	March 8, 1999
	Type III, Grade 3 AERFORM LHR .085/9935/ 670P/48x96 P/N SO9935-002-00	N/A	4	March 8, 1999

NOTE: Material purchased to Hunting specifications 6311044, 6311045, 6311047 is acceptable to use in lieu of DHMS P1.46 until depletion or until June 30, 1998 whichever comes later.