de Havilland Inc.

Material Specification

TITLE:	**PLASTIC SHEET AND FILM POLYVINYL FLUORIDE**
SPECIFICATION NUMBER:	**DHMS P 1.27**
ISSUE:	**B**
AMENDMENT:	**1**
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PAGE:	**1 of 10**

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REVISION RECORD

Issue	Page	Description and Reason for Change
A Amd.5	9	Para. 8.1 was added regarding MSDS. Para. 9.0 was revised regarding MSDS.
A Amd.6	2 4 10	Para. 1.2 - Type 5 Gr.B added Table I - Type 5 Gr.B added Type 5 Gr.B added to QPL NOTE: Type 5 is the same as Type 4, except the colour.
A Amd. 7	7	Acceptance criteria changed from thickness verification to area factor verification
A Amd. 8	4 10	Table 1 - Type 1, Gr. B added. Type 1, Gr. B, TTR05BG2 added to QPL.
B		This is complete revised issue. Detail changes have not been noted.
Amd. 1	10	Removed Products TTR05AG2, TUT10AG3, TTR05BG2, as products are obsolete.

1 SCOPE

This specification covers the requirements of a polyvinyl fluoride film or sheeting, one or both sides adherable. Surface finish on opposite side is optional.

1.1 Classification

The polyvinyl fluoride product shall be one of the following types and grades:

1.1.1 Types:

Type 1	0.0005 inches thick
Type 2	0.001 inches thick
Type 3	0.002 inches thick
Type 4	0.0015 inches thick
Type 5	0.0015 inches thick

1.1.2 Grades:

Grade A	One side adherable
Grade B	Both sides adherable

2 APPLICABLE DOCUMENTS

ASTM D1003-61	-	Test Method for Haze and Luminous Transmittance of Transparent Plastics
ASTM D882	-	Test Method for Tensile Properties of thin Plastic Sheeting
FAR 25.853(a), APP. F, PART I (2)(ii) Amd. 25-86	-	Flammability Requirements
MIL-C-5541	-	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
U.S. National Bureau of Standards Technical Note 708		
Federal Specification L-P 1040A	-	Plastic Sheet and Film (ref. only)

3 REQUIREMENTS

3.1 Material

The material shall be a flexible, unsupported sheet or strip, made from polyvinyl fluoride, transparent or coloured, and be with or without pigments, fillers and additives, with one or both sides adherable.

3.2 Physical Properties

The polyvinyl fluoride sheet or strip shall meet the requirements of Table 1 and the contents specified herein.

3.3 Flammability

The material shall meet the requirement of FAR 25.853(a), APP. F, PART I (2)(ii) Amd. 25-86.

3.4 Smoke Emission

The polyvinyl fluoride sheet or strip, in any thickness, shall have a smoke rating not greater than 5 Ds.

3.4.1 At least 3 specimens, with the results averaged, shall be tested in accordance with National Bureau of Standards Technical Note 708, "Inter Laboratory Evaluation of Smoke Density Chamber", Dec. 1971, Appendix II, "Test Method for Measuring the Smoke Generation Characteristics of Solid Material', dated September 1971.

3.4.2 Test specimens shall be conditioned prior to testing at $70^{o}F \pm 5^{o}F$, at 50% ± 5% relative humidity until moisture equilibrium is reached, or for 24 hours. Only one specimen at a time may be removed from the conditioning environment immediately before subjecting it to the test.

Note: Specimen conditioning as per NBS Technical Note 708 shall not be used.

3.5 Adhesion

The adherable side of the product shall be treated or manufactured in such a manner that it will promote excellent adhesion between the product and a substrate with the use of heat curing, pressure sensitive, or single part general purpose adhesives. Test in accordance with Para.4.6.

3.6 Resistance to Solvents

The sheet and strip shall show no visible evidence of swelling or dissolving in methyl ethyl ketone and tetrahydrofuran, when exposed as in Para.4.7.

3.7 Workmanship

The polyvinyl fluoride sheet or film shall be of uniform texture and colour and free of foreign materials and imbedded articles. There shall be no cuts, tears, blisters, creases, wrinkles, bubbles, voids or distortions. Surfaces shall be smooth, with uniform, straight cut edges.

Table 1:

Test		Values		Reference	Test Method
Thickness				Para.3.2	
Type	**Nom. Thick.**	**Min**	**Max**		
1 Gr.A	0.0005"	0.00037"	0.00063"		
2 Gr.A	0.001"	0.0008"	0.0012"		
1 Gr.B	0.0005"	0.00037"	0.00063"		
2 Gr.B	0.001"	0.0008"	0.0012"		
3 Gr.B	0.002"	0.0016"	0.0024"		
4 Gr.B	0.0015"	0.0013"	0.0017"		
5 Gr.B	0.0015"	0.0013"	0.0017"		
AREA FACTOR Gram / sq. meter		**Min**	**Max**	Para.4.3	
Type 1 Gr.A		15.7	19.3		
Type 2 Gr.A		31.5	38.5		
Type 1 Gr.B		16.6	18.4		
Type 2 Gr.B		38.5	43.0		
Type 3 Gr.B		60.0	80.0		
Type 4 Gr.B		50.4	61.6		
Type 5 Gr.B		50.4	61.6		
SHRINKAGE		**Temp.^{o}C ± 1^{o}C**	**% Max**	Para.4.4	
Type 1 Gr.A		130	4.0		
Type 2 Gr.A		170	5.0		
Type 1 Gr.B		130	4.0		
Type 2 Gr.B		170	4.0		
Type 3 Gr.B		170	5.0		
Type 4 Gr.B		170	5.0		
Type 5 Gr.B		170	5.0		
HAZE		**% Max**		Para.4.5	ASTM D1003-61
Type 1 Gr.A		12.0			
Type 2 Gr.A		14.0			
CEMENTABILITY		PASS		Para.4.6	
RESISTANCE TO SOLVENTS		PASS		Para.4.7	
FLAMMABILITY		PASS		Para.3.3	FAR 25.853(a), APP. F, PART I (2)(ii) Amd. 25-86
SMOKE EMISSION		PASS Not mandatory		Para.3.4	NBS 708
WORKMANSHIP		PASS		Para.3.7	

4 TEST METHODS

4.1 Preparation of Specimens

Test specimens shall be taken across the width of sheet or strip, excluding areas of wrinkles, folds, and other obvious visually determined imperfections.

4.2 Test Conditions

Unless otherwise specified, all tests shall be performed at 75°F ± 5°F and 50% ± 2% relative humidity on specimens that have been conditioned for a minimum of 24 hours at these conditions.

4.3 Area Factor

The area factor shall be measured by weighing a sample of sheet or strip at least one-half square meter in area. dimensions of the sheet or strip shall be measured to the nearest millimeter and the weight of the sheet or strip shall be to the nearest gram. The weight in grams, divided by the area in meters, equals the area factor. One determination shall be made to ascertain conformance to **Table 1** properties.

4.4 Shrinkage

The shrinkage shall be determined by selecting four specimens, each four by five inches from any roll or sheet. Three measurements shall be made along either the length or width direction of each specimen, using a scale calibrated to 0.01 inch. Each specimen shall be suspended freely in an oven at the temperature noted in **Table 1** for 30 minutes. The specimen shall be measured. The shrinkage shall be calculated as follows:

$$\text{Shrinkage Percent} = \frac{\text{Initial Measurement - Final Measurement}}{\text{Initial Measurement}} \times 100$$

Note: 12 specimens shall be averaged to determine a value.

4.5 Haze (Grade A only)

Haze shall be determined on three specimens in accordance with ASTM D1003-61, using procedure A. The average of three determinations shall be used to ascertain conformance to **Table 1**.

4.6 Cementability

An approximately 1 by 5 inch piece of aluminum 0.019 to 0.22 inch thick shall be pretreated with Bonderite 721, or equivalent, to meet the requirements of MIL-C-5541. One side of the aluminum shall be coated with one coat of E.1. duPont adhesive F + F Dept. #6840, or equivalent, and air dried between 10 and 11 minutes followed by baking in a circulating air oven at $250^{o} \pm 3^{o}C$ ($482^{o} \pm 5.4^{o}F$) for 60 to 65 seconds. The aluminum strips shall be taken from the oven and placed in a desiccator for storage until needed. Using a model RF "Robot" heat sealer, or equivalent, at $154^{o} \pm 2^{o}C$ ($309^{o} \pm 3.6^{o}F$), an air pressure of 25 psi and timed for 10 to 11 seconds, an approximately 1 by 5 inch piece of tedlar film being evaluated shall be superimposed and heat sealed to the adhesive coated aluminum across the one inch width (metal below and film on top) approximately 1/2 inch from the top end of metal and film composite. During the heat sealing, the front or long end of the film tab shall be held away from the metal. The bonded samples shall then be soaked in distilled water at $50^{o} \pm 1^{o}C$ ($122^{o}F \pm 1.8^{o}F$) for a minimum of 16 hours. The samples shall then be removed from the water and tested while still wet. The bond strength shall be determined by method A of ASTM D882 using 2 inches per minute ± 10 percent for rate of jaw separation. The results shall be determined in gram of force per inch of width with the aluminum plated gripped by one of the jaws and the film gripped by the other jaw.

4.7 Resistance to Solvents

Six specimens, each 1" ± 0.1" by 1" ± 0.1" shall be prepared. Three of the specimens shall be submerged in boiling methyl ethyl ketone and three shall be submerged in boiling tetrahydrofuran, each for a minimum of 15 minutes.

5 QUALITY ASSURANCE

5.1 Qualification

5.1.1 A supplier is responsible for the performance of all qualification testing, as specified in Table 2 of this specification. A three lots/batches qualification is required.

5.1.2 A supplier desiring qualification shall submit one copy of a report showing actual qualification test data and 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 reasons for failure.

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

5.1.5 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 .

5.1.6 Requalification of the product may be requested by the purchaser for 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 2 of this specification.

5.3.2 The supplier, performing acceptance Tests per Para.5.3.1, shall furnish with each lot of product one copy of the Acceptance Test Report, showing actual test data conformance to the acceptance tests specified in Table 2. The report shall include the supplier's lot or batch identification.

5.3.3 de Havilland 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, per Section 3, will be returned to the supplier at the supplier's expense.

Table 2:

Test	Reference	Qualification	Acceptance
Thickness	Table 1	x	x
Area Factor	Para.4.3	x	
Shrinkage	Para.4.4	x	
Haze	Para.4.5	x	
Cementability	Para.4.6	x	
Resistance to Solvents	Para.4.7	x	
Flammability	Para.3.3	x	
Workmanship	Para.3.7	x	x

6 ORDERING DATA

6.1 Prerequisite

Products furnished under this specification for Production use shall be qualified and listed on the QualifiedProduct List prior to issuing of a purchase order.

6.2 Procurement Documents

Procurement documents shall specify the following:

- Title, Number, Issue and Amendment Number of this specification
- Type and Grade
- Manufacturer's Product Identification
- Width and Length of Roll, or Number of Sheets
- Total Quantity

7 PREPARATION FOR DELIVERY

7.1 Preservation and Packing

7.1.1 Film - Film sheeting shall be supplied in rolls. Each roll shall be wound on a substantial core with an inside diameter of not less than 3 inches. The rolls shall not exceed 150 pounds in weight and shall be suitably restrained from unwinding. Each roll shall be wrapped with at least one layer of kraft wrapping paper.

7.1.2 Sheets - Sheet material shall be interleaved to prevent adherence of sheets to each other and then overwrapped with kraft wrapping paper.

7.1.3 The wrapped film or sheet shall be packaged in such a manner as to assure that, during shipment and storage, the product will 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 roll or package shall be legibly marked with permanent, non-degrading ink, with the following information:

- Film (or Sheet) Polyvinyl Fluoride
- DHMS Pl.27 and Applicable Type and Grade
- Manufacturer’s Name and Product Identification (Trade Name or Code Number)
- Quantity.

8 SHIPPING DOCUMENTS

Shipping document shall show:

- de Havilland Purchase Order Numbers
- Specification Number, Type and Grade
- Manufacturer's Product Identification
- Number of Rolls or Sheets
- Total Quantity.

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

9 HEALTH AND SAFETY DATA

When supplying samples for qualification per **Para.5.1.2**, 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.

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.			MATERIAL SAFETY DATA SHEET NO.	DE HAVILLAND QUALIFICATION SHEET NO.	DATE OF PRODUCT APPROVAL
E.I. DuPont De Nemours & Co. Inc., Film Department, Wilmington, Delaware, 19898.	TY. 2	Gr.B	TWH10BS3	N/A	PQS #4	May 4, 1983
	TY. 3	Gr.B	TWH20BS3			
	TY. 4	Gr.B	TDS15BL3		PQS #5	Dec. 20, 1984
	TY. 5	Gr.B	TWH15BL3			