BOMBARDIER

de Havilland
Material Specification

TITLE:	**COATING, POLYURETHANE, ANTI-STATIC**
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REVISION RECORD

Iss.	Page	Description and Reason for Change
A	13	Para. 7.4.1 was added regarding MSDS.
Amd.1		Para. 8 was revised regarding MSDS.
B	All	New Material Added to QPL and Specification Retyped
Amd. 1	QPL	Product designation for type II changed. Revised manufacturer address.
C	4,8	Referenced tape adhesion test to DHLP 3055 Table 3, referenced to DHLP 3055 Revised overall headings.
Amd. 1	QPL	Updated Product designation Type I, Aerazur .

1 SCOPE

This specification covers the requirements for anti-static, flat black polyurethane enamel suitable for application on nonmetallic and metallic surfaces.

1.1 Classification and Code Designation

Type I - 1.5 megohms per square max. 3" x 3" (de Havilland Code F31)

Type II - .5 megohms per square max. 3" x 3" (de Havilland Code F34)

2 APPLICABLE DOCUMENTS

The following documents form part of this specification, to the extent defined herein. In the event of conflicting requirements between this specification and those listed below, the requirements of this specification shall govern.

2.1 U.S. Government Specifications

QQ-A-250/5	-	Aluminum Alloy, Alclad 2024, Plate and Sheet
MIL-A-8625	-	Anodic Coatings, for Aluminum and Aluminum Alloys Type I, Class I
MIL-L-23699	-	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
Federal Test Method	-	Paint, Varnish, Lacquer and Related Materials
Standard 141		Method of Inspection, Sampling and Testing

2.2 American Society for Testing and Materials

ASTM D1210	-	Fineness of Dispersion of Pigment Vehicle Systems
ASTM D1308	-	Effect of Chemicals on Clear and Pigmented Organic Finishes
ASTM D1737	-	Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus
ASTM D2369	-	Volatile Content of Paints
ASTM D2794	-	Resistance of Organic Coatings to Effect of Rapid Deformation (Impact Resistance)
ASTM G26	-	Light Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

2.3 De Havilland Specifications

DHMS P1.24	-	Fabric, Organic Fiber, High Modulus, Epoxy Resin "B" Staged, Impregnated
DHMS C4.01	-	Primer, Fluid Resistant, Epoxy
BMS 3-11 Type IV, Cl 1, Gr A	-	Fire Resistant Hydraulic Fluid

3 REQUIREMENTS

3.1 Component Requirements

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

3.1.2 Components - The enamel shall consist of two components, packaged separately, and supplied in kit form. The components shall not be batch oriented.

3.1.3 Condition in Container - Freshly opened, full containers of the base components shall be free from lumps, skins, grit and coarse particles and shall show no more settling or caking than can be easily dispersed with a paddle to a smooth, homogeneous condition. The catalyst component shall be clear and clean.

3.1.4 Storage Stability - The previously unopened, packaged product shall meet all the requirements specified herein for a period of at least one year when stored at a temperature of 20^{o} to 30^{o}C (68^{o} to 86^{o}F).

3.2 Mixed Enamel Requirements

3.2.1 Mixing Ratio - The base and catalyst shall be mixed according to the manufacturer's instructions.

3.2.2 Spraying Properties - When the enamel base component is mixed with the catalyst according to manufacturer's instructions, the mixed enamel shall exhibit satisfactory spraying characteristics with acceptable leveling properties.

3.2.3 Viscosity - The viscosity of the base and catalyst without thinner shall not be less than 20 seconds for #2 Zahn Cup.

3.2.4 Fineness of Grind - The fineness of grind of the catalysed enamel shall be not less than 5. The test shall be conducted one hour after mixing, in accordance with ASTM D1210.

3.2.5 Pot Life - Approximately 1 pint of catalysed enamel, reduced if necessary, shall show no lumping, gelling or separation after being stored in a closed container for 8 hours at 20^{o}-30^{o}C (68^{o}-86^{o}F) and shall meet all requirements of paragraphs 3.2.2 and 3.3.1 to 3.4.8, as applicable.

3.2.6 Nonvolatile Content - The non volatile content of the mixed, unthinned enamel shall be determined in accordance with the procedure given in ASTM D2369. The value obtained shall not vary more than +/ - 2 percent from the value established during qualification.

3.3 Physical Properties of Enamel Film

3.3.1 Drying Time - The enamel, applied to a dry film thickness of 0.003 to 0.004 in., shall have the following drying characteristics, when tested in accordance with Federal Test Method Standard 141 Method 4061.1:

Set-to-touch - 2 hours maximum

Dry-to-recoat - 4 hours maximum

Dry-through - 12 hours maximum

3.3.2 Surface Appearance - The enamel film, after drying through, shall be free from streaks, blisters, coarse particles or other irregularities of surface.

3.3.3 Adhesion Wet Tape - The enamel applied to test panel per Table 2, shall exhibit no removal from the primer, or the system from the substrate, after 24 hrs immersion in water and tested in accordance with DHLP No. 3055, Method III.

3.3.4 Flexibility - The enamel applied to test panel per Table 2, shall not exhibit cracking, crazing or loss of adhesion when bent over a 0.5 inch mandrel, in accordance with ASTM D1737.

3.4 Resistance Properties

3.4.1 Water Resistance - The enamel applied to test panel per Table 2, and tested in accordance with ASTM D1308, shall show no blistering, pigment leaching or loss of adhesion after 7 days immersion in distilled water at room temperature. After a drying period of 24 hours, the enamel shall have regained its pretest pencil hardness.

3.4.2 Fuel Resistance - The enamel applied to test panel per Table 2, and tested in accordance with ASTM D1308, shall withstand immersion in Jet A-l Turbine Fuel for 7 days at room temperature without showing any defects.

3.4.3 Lubricating Oil Resistance - The enamel applied to test panel per Table 2, and tested in accordance with ASTM D1308, shall withstand immersion in MIL-L-23699 lubricating oil at 160^{o}F (71^{o}C) for 24 hours without showing any defects except a very slight softening of the paint film. After cleaning and a drying period of 24 hours, the enamel shall have regained its pre-test hardness. Slight staining will not constitute failure.

3.4.4 Hydraulic Fluid Resistance - The enamel applied to test panel per Table 2, and tested in accordance with ASTM D1308, shall withstand immersion in phosphate ester hydraulic fluid to BMS 3-11 Type IV Class 1 Grade A for 30 days at room temperature without showing any surface defects.

3.4.5 Weather Resistance - The enamel applied to test panel per Table 2, shall show no chalking and also shall meet the flexibility requirements per Para. 3.3.4 of this specification after exposure for 1000 hours in a xenon arc weatherometer, in accordance with ASTM G26.

3.4.6 Impact Resistance - The enamel applied to test panel per Table 2 shall not exhibit flaking or cracking when subjected to the following impact energy values, using a Gardner Impact Tester as described in ASTM D2794. Inspection of indentations shall be performed with unaided eye.

Direct Impact - 30 in.lb.

Reverse Impact - 10 in.lb.

3.4.7 Abrasion Resistance - The enamel applied to test panel per Table 2 and tested as specified in Federal Test Method Standard 141, Method 6192, shall not show penetration to the substrate or more than 0.03g weight loss after 2000 cycles, using l000g load and CS-10 wheels.

3.4.8 Electrical Resistance - The enamel applied to test panel per Table 2 shall show surface resistivity values per Table 1. The surface resistivity of the coating shall be determined by using a standard ohmmeter and 3M conductive electrical tape (Copper X-1181 or Aluminum X-1170) as illustrated in Fig. 1. Take a minimum of three readings.

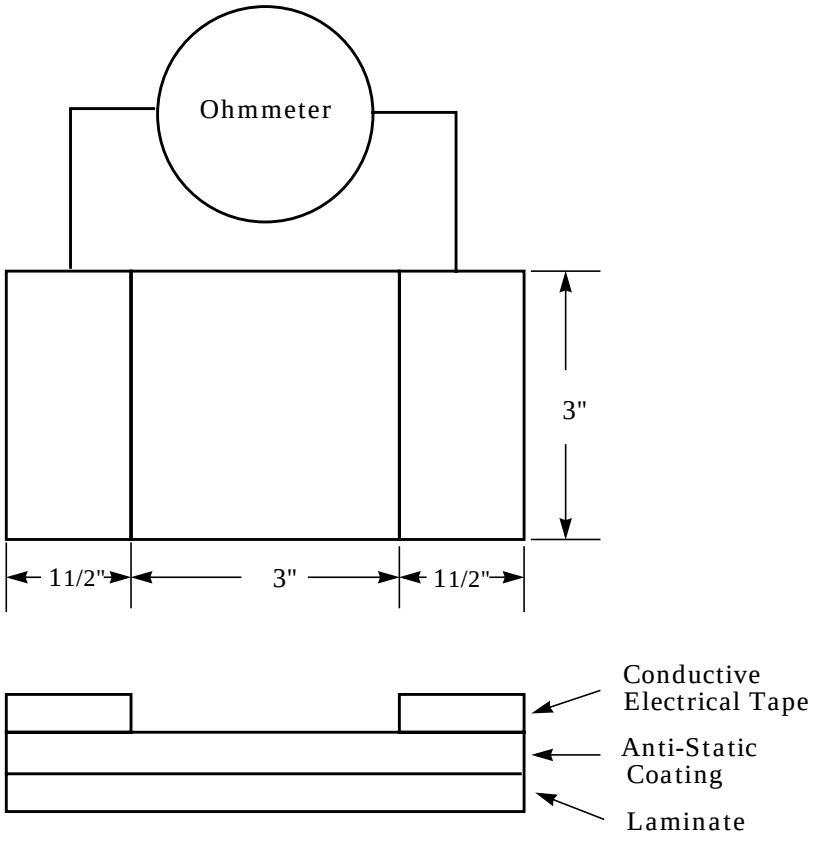

FIGURE 1.

TABLE 1.

	Type I	Type II
Surface Resistivity Per Square (3" x 3") Max.	1.5 Megohm	0.5 Megohm

TABLE 2.

Test	Per Para	Test Specimen	No. of Specimen Per Test	Test Specimen Treatment		Test Specimen Prep.Para.	Test Spec. Size (in.)
				Scored	Unscored		
Adhesion, Wet Tape	3.3.3	A	3		x	4.1.1	3 x 6
		B	3	x		4.1.2	3 x 6
Flexibility	3.3.4	B	3		x	4.1.2	3 x 6
Water Resistance	3.4.1	A	3		x	4.1.1	3 x 6
Fuel Resistance	3.4.2	A	3		x	4.1.1	3 x 6
Lubricating Oil Resistance	3.4.3	A	3		x	4.1.1	3 x 6
Hydraulic Fluid Resistance	3.4.4	A	3		x	4.1.1	3 x 6
Weather Resistance	3.4.5	A	3		x	4.1.1	3 x 6
Impact Resistance	3.4.6	B	3		x	4.1.2	3 x 6
Abrasion Resistance	3.4.7	A	3		x	4.1.1	4 x 4
Electrical Resistance	3.4.8	A	3		x	4.1.1	3 x 6

A - Aramid Fibre, Epoxy Impregnated B - Anodized Aluminum

4 TEST PANELS

4.1 Type of Test Panels

Test panels shall be one of the following types.

4.1.1 Test Panel A - shall be 2-ply laminates, panel size 3 x 6", prepared from epoxy preimpregnated Aramid fabric to DHMS P1.24, Type 2. The panels shall be prepared for painting by lightly abrading with 320 grit paper, cleaning with tack rag, and solvent washing with methyl ethyl ketone. If necessary, pin holes shall be filled with Ultra Filler #14 compound, sanded and wiped with a tack rag. Test panels shall be primed with epoxy primer to DHMS C4.01, Type 3 to a dry film thickness of .0004 - .0006 in. Primer shall be cured at room temperature.

4.1.2 Test Panel B - shall be 2024 clad aluminum alloy, 0.032 thick, conforming to QQ-A-250/5, panel size 3 x 6 . They shall be given an anodized treatment in accordance with MIL-A-8625. Test panels shall be primed with epoxy primer to DHMS C4.01, Type 2 to a dry film thickness of .0004 - .0006 in. Primer shall be cured at approximately 248^{o}F (120^{o}C).

4.2 Painting of Test panels

The enamel shall be mixed according to the manufacturer's recommendation, reduced with thinner (if necessary) to spraying viscosity and allowed to stand 30 minutes before using. The enamel shall be applied to a total dry film thickness of .003 to .004 inches. Unless otherwise specified, coated test panels shall be air cured at room temperature for 7 days before testing.

5 QUALITY ASSURANCE

5.1 Qualification

5.1.1 All requests for product qualification shall be directed to the Quality Assurance Department of de Havilland Inc.

5.1.2 A supplier is responsible for the performance of all qualification testing, as specified in Table 3 of this specification.

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

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

5.1.5 Products which are qualified will be listed in the Qualified Products List of this specification.

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

5.1.7 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

5.2.1 Where a product has been qualified to another similar specification, the supplier may submit this qualification test report required by para. 5.1 of this specification. The similar specification may be a government, company or other specification where the requirements are similar to this specification.

5.2.2 If upon review of the aforementioned test reports (Para. 5.2.1), de Havilland does not find the data to be satisfactory for qualification by similarity, the supplier shall carry out the test per Table 3 as directed by de Havilland, at his own expense.

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 3 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 an Acceptance Test Report showing actual test data conformance to the acceptance tests specified in Table 3. The report shall include the supplier's 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 will be returned to the supplier at the supplier's expense.

TABLE 3.

Test	Fed. Standard 141 & ASTM Test Methods	Para.	Qualification	Acceptance
Condition in Container		3.1.3	x	x
Spraying Properties		3.2.2	x	
Viscosity		3.2.3	x	x
Fineness of Grind	ASTM D1210	3.2.4	x	
Pot Life		3.2.5	x	
Non-Volatile Content	ASTM D2369	3.2.6	x	x
Drying Time	F.S.4061.1	3.3.1	x	x
Surface Appearance		3.3.2	x	x
Adhesion, Wet Tape	DHLP No. 3055	3.3.3	x	
Flexibility	ASTM D1737	3.3.4	x	
Water Resistance	ASTM D1038	3.4.1	x	
Fuel Resistance	ASTM D1308	3.4.2	x	
Lubricating Oil Resistance	ASTM D1308	3.4.3	x	
Hydraulic Fluid Resistance	ASTM D1308	3.4.4	x	
Weather Resistance	ASTM G26	3.4.5	x	
Impact Resistance	ASTM D2794	3.4.6	x	
Abrasion Resistance	F.S.6192	3.4.7	x	
Electrical Resistance		3.4.8	x	x

5.4 Definitions

5.4.1 Batch is defined as the end product of all the raw materials mixed and/or manufactured at the same time and place. The weight or volume may vary, depending upon the capacity of the manufacturer's facilities.

5.4.2 Lot is defined as the total quantity of product in a shipment taken from the same batch.

6 ORDERING DATA

6.1 Prerequisite

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

6.2 Procurement Documents

Procurement documents shall specify the following:

- Title, Number, Issue and Amendment Number of this Specification
- Type and Size of Containers (Imperial, Metric or U.S. Measure)
- Total Quantity (Imperial, Metric or U.S. Measure)
- Coating Type: Type I or Type II
- Colour: Flat Black
- Acceptance Test Report
- Certificate of Compliance

7 PREPARATION FOR DELIVERY

7.1 Identification

Each container shall be legibly marked with the following information:

- Enamel, Polyurethane (conforms to DHMS C4.13)
- Component 1 (Base)
- Component 2 (Catalyst)
- Manufacturer's Name and Product Identification (Trade Name or Code Number)
- Date of Manufacture
- Batch Number
- Net Quantity (Imperial, Metric or U.S. Measure)
- Colour: Flat Black

7.2 Preservation

The enamel shall be packed in such a manner as to ensure 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.

7.3 Packaging

The enamel shall be supplied in a kit packaged as a unit, consisting of either four litre, one U.S. gallon or one Imperial gallon base component and the required amount of catalyst and thinners (urethane grade) to bring the enamel to spraying consistency.

7.4 Shipping Documentation

Shipping document shall show:

- De Havilland Purchase Order No.
- Title, number, issue and amendment number of this specification
- Coating Type (Type I or II)
- Colour: Flat Black
- Total Quantity (Imperial, Metric, or U.S. Measure)
- Number of Containers
- Batch Number
- Acceptance Test Reports.

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

8 HEALTH AND SAFETY DATA

When supplying samples for qualification per Para. 5.1.2, 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.

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

COATING, POLYURETHANE, ANTI-STATIC

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.	DE HAVILLAND QUALIFICATION SHEET NO.	MSDS #	DATE OF PRODUCT APPROVAL
	Type I			
Tempo Paint & Varnish Co., Div. of Tower Chemical Co., 205 Fenmar Drive, Weston, Ontario. M9L 2X4. (416) 746-2233	2800-B-1 Base 2800-C-1 Catalyst			
Aerazur Groupe Zodiac 4 Rue Lesage Maille 76320 Caudebec Les Elbeuf France	706 032 Base 706 320 Hardener	3		25 Aug. 1999
	Type II			
Akzo Nobel East Water Street Waukegan, Illinois USA (847) 623 4200	8B6A Laminar X-500 Black Conductive Coating 8B6A Base 50C3A Hardener		3649 3650	