BOMBARDIER
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de Havilland

Material Specification

TITLE:	**ENAMEL, EPOXY POLYAMIDE**
SPECIFICATION NUMBER:	**DHMS C 4.11**
ISSUE:	**A**
AMENDMENT:	**2**
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ENAMEL, EPOXY POLYAMIDE	

REVISION RECORD

Issue	Page	Description and Reason for Change
Original Amd. 1	9	New supplier added to QPL.
A		QPL: Corrected to product designation of Tristar Coatings, Starpoxy 410 Clarified finishing of Durathane , 1900, 1800, 1700 series. Updated format.
Amd.1	9	Update manufacturer paint system call out
Amd.2	All	Updated title of spec

1. SCOPE

1.1 This specification covers the requirements for two-component, fluid resistant, epoxy-polyamide finish for spray or brush application, suitable for use as an aircraft topcoat (de Havilland designation F22).

1.2 The enamel may be available in gloss, semigloss or camouflage (matt) types.

2. APPLICABLE DOCUMENTS

The following document shall form part of this specification of the adhesive defined herein. In the event of conflicting requirements between this and the requirement listed below, the requirement of this specification shall govern.

2.1. De Havilland Specification

DHMS C4.01 Fluid Resistant Epoxy Primer

2.3. U.S. Federal Specification

QQ-A-250/5 Aluminum Alloy, Alclad 2024, Plate and Sheet

2.3. U.S. Military Specifications

MIL-C-5541B Chemical Conversion Coatings for Aluminum Alloys

MIL-H-5606 Hydraulic Fluid, Petroleum Base, Aircraft

MIL-T-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5

MIL-L-23699 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

2.4. De Havilland Specification and Standards

Federal Test Method Standard No. 141A- Paint, Varnish, Lacquer and Related Materials, Method of Inspection, Sampling and Testing

3. REQUIREMENTS

3.1. Components

The enamel shall consist of two components, packaged separately and supplied in kit form. The components shall not be batch matched.

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

3.2. Physical Properties

3.2.1 Condition in Container - The base component, in a closed container that has been allowed to stand without agitation for at least two weeks, shall be capable of being easily mixed by hand with a paddle to a smooth, homogeneous, pourable condition. There shall be no trace of pigment flotation of coarse particles and no evidence of settling that cannot be dispersed readily. The catalyst component shall be homogeneous, clear, and free from suspended matter.

3.2.2 Viscosity - The viscosity of the admixed enamel, determined 30 minutes after mixing, shall be such that the enamel can be sprayed, with or without the addition of thinners. A suggested spraying viscosity is 16-18 seconds in a #4 Ford Cup.

3.2.3 Fineness of Grind - The fineness of grind of the admixed enamel shall be not less than 7 for the gloss, nor less than 5 for semigloss and camouflage. The test shall be conducted 6 hours after mixing in accordance with Federal Test Method Standard 141A, Method 4411.1.

3.2.4 Storage Stability - The previously unopened, packaged product shall meet all the requirements specified herein for a period of one year, when stored at a temperature of 10 to 30°C.

3.2.5 Pot Life - The admixed enamel, thinned, if necessary for application, shall show no lumping, gelling or separation after being stored in a closed container for 8 hours at 20-30°C.

3.3. Film Properties

3.3.1 Drying Time - The enamel, applied to a dry film thickness of 0.0010-0.0015 in. one hour after mixing, shall have the following drying characteristics:

Dry to touch – 1 hour maximum

Dry through – 24 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. Camouflage, semigloss and aluminized colours shall show no cratering. For gloss colours and clear, evidence of more than three craters on any 12" x 12" panel shall be cause for rejection

3.3.3 Adhesion - The enamel, prepared per para. 4.0, shall exhibit no removal from the primer or the system from the substrate, when tested in accordance with Federal Test Method Standard No. 141A, Method 6301.1, the scratches having been made before immersion. The enamel shall show no blistering or other defects.

3.3.4 Flexibility - The enamel, prepared per para. 4.0, shall not exhibit flaking when bent over a 0.5 inch mandrel in accordance with Federal Test Method Standard No. 141A, Method 6221.

3.3.5 Colour - The enamel film, after drying through, shall match the colour chip standard agreed upon by the purchaser and the vendor.

3.4. Resistance Properties

3.4.1 Hydraulic Fluid Resistance - The enamel, prepared per para. 4.0, shall withstand immersion in MIL-H-5606 hydraulic fluid for 7 days at room temperature without showing any surface defects.

3.4.2 Lubricating Oil Resistance - The enamel, prepared per para. 4.0, shall withstand immersion in MIL-L-23699 lubricating oil at 120^{o}C for 4 hours without showing any defects except a very slight softening of the paint film. Upon cooling to room temperature, the film shall not exhibit flaking when bent over a 0.5 inch mandrel. Discolouration of the film shall not be cause for rejection.

3.4.3 Aircraft Fuel Resistance - The enamel, prepared per para. 4.0, shall withstand immersion in Jet A1 fuel to MIL-T-5624 for 7 days at room temperature without showing any defects.

4. TEST PANELS

Test panels shall be 2024 clad aluminum alloy, 0.032"T, conforming to QQ-A-250/5, minimum size 3" x 6". They shall be given a chromate conversion treatment in accordance with MIL-C-5541B, Class 1A. They shall be primed with epoxy primer to DHMS C4.01, Type 2 to a dry film thickness of 0.0004-0.0006 in. This primer may be cured at temperatures up to 100°C. The enamel shall be mixed according to the manufacturer's recommendation, reduced with thinner (if necessary) to a viscosity of 16-18 seconds in a No. 4 Ford Cup and allowed to stand 1 hour before using. A mist coat shall be applied and air dried for 20 minutes. A second coat shall be applied to a total dry enamel thickness of 0.0020-0.0025 in. Panels shall be allowed to dry under ambient conditions for 8 days before testing. At least two panels shall be used for each test.

5. QUALITY ASSURANCE PROVISIONS

5.1 Qualification and Batch Acceptance Tests

5.1.1 Qualification Tests

(a) All requests for source/product qualification shall be directed to the Quality Assurance Department of the de Havilland Aircraft of Canada, Ltd.

(b) A supplier is responsible for the performance of all qualification testing, as specified in Table 1 of this specification.

(c) A supplier desiring qualification shall submit one (1) copy of a report showing actual qualification test data and a sufficient quantity of product for de Havilland evaluation tests.

(d) Upon review of supplier's data and de Havilland tests, the supplier will be advised either of product qualification or reasons for failure.

(e) Products which are qualified will be listed in the Qualified Source List of this specification.

(f) No changes in the method of manufacture and/or formulation shall be made without notification and prior written approval of Standards, Materials and Process Engineering and Quality Assurance Departments.

(g) Requalification of the product may be requested by the purchaser for any changes in the method of manufacture and/or formulation.

5.1.2 Qualification by similarity – Where a product has been qualified to another similar specification, the supplier may submit this qualification test report in lieu of performing a separate qualification test required by para. 5.1.1 of this specification. The similar specification may be a government, company or other specification, where the requirements are similar to those of this specification.

Table 1: Qualification and Batch Acceptance Tests

Text	Paragraph	Qualification	Acceptance
Condition in Container	3.1.3	X	
Viscosity	3.2.2	X	X
Fineness of Grind	3.2.3	X	
Storage Stability	3.2.4		
Pot Life	3.2.5	X	X
Drying time	3.3.1	X	X
Surface Appearance	3.3.2	X	
Adhesion	3.3.3	X	X

Flexibility	3.3.4	X	X
Colour	3.3.5		X
Hydraulic Fluid Resistance	3.4.1	X	
Lubricating Oil Resistance	3.4.2	X	
Aircraft fuel Resistance	3.4.3	X	

5.1.3 Acceptance Tests

(a) Unless otherwise specified in the contract or purchase order, the supplier is responsible for all Batch Acceptance Tests, as specified in Table 1 of this specification.

(b) The supplier, performing batch acceptance tests per para. 5.1.3 (a), shall furnish with each lot of product one copy of a Batch Acceptance Test Report showing actual test data conformance to the acceptance tests specified in Table 1. The report shall include the supplier's batch identification.

(c) De Havilland Aircraft 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.

5.1.4 Definitions

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

6. ORDERING DATA

6.1 Prerequisite

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

6.2 Procurement Documents

Procurement documents should specify the following:

(a) title, number, issue and amendment number of this specification
(b) type and size of containers (Imperial or U.S. measure)
(c) total quantity (Imperial or U.S. measure)
(d) colour, colour chip standard number or colour control sample

7. ORDERING DATA

7.1 Preservation and Packing

The enamel shall be packed 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 3.0 of this specification.

7.2 Packaging

The enamel shall be supplied in a two-component kit, packaged as a unit. Thinners shall be packaged separately.

7.3 Marking

Each container shall be legibly marked with the following information:

Enamel, Epoxy-Polyamide, Conforms to DHMS C4.11

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 or U.S. Measure)

Colour and Colour Chip Standard Number

Mixing Ratio

7.4 Shipping Documentation

Shipping document shall show:

De Havilland Purchase Order No.

Specification Number

Number of Containers

Batch Number

Total Quantity (Imperial or U.S. Measure)

Acceptance Test Reports

QUALIFIED PRODUCTS LIST

Classification	Manufacturer's Name and Address	Manufacturer's Product Identification	MSDS No.	Product Qualification Sheet no.	Date of Product's Approval
n/a	Tempo Paint & Varnish Co., 205 Fenmar Drive Weston, ON M9L 2X4 (416) 746-2233	Durathane *1900 Series BASE (Gloss) 1900-C-1A Or 1900-C-1B } Catalyst *1800 Series BASE (Semi- Gloss) 1800-C-1A Or 1800-C-1B } Catalyst *1700 Series BASE (FLAT) 1700-C-1A Or 1700-C-1B } Catalyst *Reducer is 4500-S23/23X		PQS #1	April 6, 1978
n/a	Tristar Coatings Ltd 18 Cadetta Road Brampton, ON L6T 3Z8 (905) 794-1100	Epoxy Enamel Starpoxy 410 (Gloss) Base: 419H5274 Catalyst: 410C5275 Reducer: SB43		PQS #2	March 25, 1999