BOMBARDIER

de Havilland
Material Specification

TITLE:	**ENAMEL, PIGMENTED, ABRASION RESISTANT COATING, TEFLON-POLYURETHANE**
SPECIFICATION NUMBER:	**DHMS C 4.08**
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REVISION RECORD

Iss.	Page	Description and Reason for Change
A Amd.1	11	Para. 7.4.1 was added regarding MSDS.
Amd.2	12	QPL was updated to reflect the replacement of 7-W-27/10-C-81 system with the low VOC version, 23-T3 Series
B		QPL updated . Manufacturer Was: Dexter, Now: Akzo Nobel Product identification clarified. General format updated.

1 SCOPE

This specification covers the requirements for a pigmented, Teflon filled, abrasion and impact resistant polyurethane enamel. The de Havilland finishing code number for this enamel is F29.

2 APPLICABLE DOCUMENTS

The following documents, of the issue in effect on date of invitation to bid, form a part of this specification to the extent defined herein. In the event of conflicting requirements between this and specifications listed below, the requirements of this specification shall govern.

2.1 Specifications

QQ-A-250/5	-	Aluminum Alloy Alclad 2024, Plate and Sheet
QQ-A-250/4	-	Aluminum Alloy 2024, Plate and Sheet

2.2 Standards

Federal Test Method Std. No. 141	-	Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing

2.3 De Havilland

DHMS C4.01	-	Primer, Fluid Resistant, Epoxy
DHMS C4.04	-	Enamel, Pigmented Finishing, Polyurethane

3 REQUIREMENTS

3.1 Paint Requirements

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

3.1.2 Components - The teflon filled enamel topcoat shall be a two-component system, consisting of a base component and a catalyst. The components shall be packaged in separate containers and supplied in kit form. The catalyst shall not be batch oriented to the base component.

3.1.3 Mixing Ratio

The teflon filled enamel topcoat shall have a mixing ratio not greater than 4:1, that is not greater than 4 parts (by vol.) of base component to 1 part (by vol.) of catalyst. When mixed according to the manufacturer's directions, the enamel topcoat shall conform to the requirements of this specification.

3.1.4 Performance Tests

Prior to qualification testing per requirements of Table 1 of this specification, a sample of submitted teflon filled enamel topcoat shall be evaluated by the de Havilland Aircraft of Canada, Limited Production Painting Department per the requirements of para's 3.4.1 and 3.5.2.

3.2 Requirements For As Received Base and Catalyst

3.2.1 Condition in Container

The base component and the catalyst in the container shall be free from skins, lumps, gel, grit and foreign contamination, and shall be capable of being easily mixed to a smooth, homogeneous condition. The component containing the pigment shall show no separation of the pigment.

3.2.2 Storage Stability

The base component and the catalyst, when stored in separate, unopened containers for 12 months (min.) at a temperature range of 65^{o} to 95^{o}F (18^{o} to 35^{o}C) shall be capable of meeting the requirements of this specification.

3.3 Requirements for Catalyzed Enamel (Not Thinned)

3.3.1 Solids Content

When tested as specified in para. 4.2, the solids content of the catalyzed, teflon-filled enamel shall be as follows:

Solids by Weight:

55% (min), and they shall not vary more than ± 2% from batch to batch.

3.3.2 Weight

When tested as specified in para. 4.2, the weight of the catalyzed, teflon filled enamel shall be as follows:

Weight per Imperial gallon: 10.8 lbs., minimum

Weight per U.S. Gallon: 9.0 lbs., minimum

The teflon filled enamel shall not vary more than ± .25 lbs (Imp. gal.) or ± .20 lbs (U.S. gal.) from batch to batch.

3.3.3 Colour

The colour of the catalyzed enamel shall be as specified on the Purchase Order. When tested as specified in para. 4.2, the colour shall acceptably match the colour chip standard agreed upon by the Purchaser and the Vendor.

3.3.4 Pigment

The basic hiding pigments shall be chemically pure and free from extenders.

3.3.5 Viscosity

After suitable mixing agitation and a 5-10 minute waiting period, the viscosity of the catalyzed enamel (without addition of thinners) shall not be less than 12 seconds (#4 Ford cup) when tested per para. 4.2.

3.4 Requirements of Spray Consistency Catalyzed Enamel

3.4.1 Spraying Properties

When the enamel base component is mixed with the catalyst according to manufacturer's instructions and reduced with suitable thinners, the mixed enamel shall exhibit satisfactory spraying characteristics when tested in accordance with para. 4.2.

3.4.2 Pot Life

A one-quart sample of catalyzed enamel, mixed as specified in para. 3.4.1, shall be stored in a closed container for a period of 11/2 hours at a temperature of $70^{o}\pm 5^{o}F$ ($21^{o}\pm 3^{o}C$). At the end of the 11/2 hour period, the catalyzed enamel shall show no signs of lumping, seeding, gelling or separation and shall be capable of meeting the requirements of para's 3.3.5, 3.4.1, 3.5.2 and all paragraphs of Section 3.6 and 3.7.

3.5 Requirements of Applied, Uncured Coatings

3.5.1 Surface Appearance

The catalyzed enamel, when applied by spraying, shall show no sagging, running or streaking and shall dry to a hard, low gloss eggshell finish. The dried film shall be free from seeds, blisters, blushing, and other surface irregularities.

3.5.2 Drying Time

The enamel, when applied over a chromated, epoxy primed surface to a dry film thickness specified in para. 4.1 and tested per para. 4.2, shall have the following drying characteristics:

- dry dust free within 2 hours
- dry tack free within 6 hours
- dry through within 12 hours.

The above drying times apply for a temperature of $70^{o}\pm 5^{o}F$ ($21^{o}\pm 3^{o}C$) and a relative humidity of 50 ± 10%.

3.6 Fluid Resistance Requirements of Applied and Cured Coatings

3.6.1 Adhesion (Wet) Tape Test

Three scored test panels, prepared per para. 4.1, shall be immersed in distilled water at $73^{o} \pm 3^{o}F$ ($23^{o} \pm 1.7^{o}C$) for a period of 24 hours. Upon removal, the panel shall be tape tested per para. 4.2, using one-inch masking tape, Scotch No. 250, Tuck No. 160, or equivalent. The test shall not exhibit any removal of the top coat from the primer coat or removal of the complete paint system from the panel.

3.6.2 Corrosion Resistance (Salt Spray Test)

Two scored test panels, prepared per para. 4.1, shall be exposed to 5% salt spray test, per para. 4.2, for a period of

240 hours. The test panel shall be without visible corrosion of the metal and without evidence of blistering, flaking or underscoring. Disregard corrosion due to "edge effect".

3.6.3 Phosphate Ester Fluid Resistance

One scored test panel, prepared per para. 4.1, shall be tested for resistance to phosphate ester hydraulic fluid conforming to DHMS F7.01. The panel shall be wetted (not immersed) with fluid every 24 hours and exposed in an oven operating at $129^{o} \pm 5^{o}$ F ($53^{o} \pm 3^{o}$ C) for a period of 72 hours. Upon removal from the oven, the paint system shall show no blistering, wrinkling, and no more than a slight film softening. After 24 hours air drying the wetted portion of the paint system shall have regained its pretest hardness.

3.6.4 Water Resistance

Three unscored test panels, prepared per para. 4.1, shall be immersed in distilled water at $73^{o} \pm 3^{o}$ F ($23^{o} \pm 1.7^{o}$ C) for 7 days (168 hours) and tested per para. 4.2. The paint system shall show no blistering or wrinkling and no more than a slight softening immediately after removal from the water. After 24 hours air drying, the immersed portion of the paint system shall have regained its pretest hardness.

3.7 Physical Property Requirements of Applied and Cured Coatings

3.7.1 Impact Resistance

Three unscored test panels, prepared per para. 4.1, shall be tested for impact resistance using a Gardner Impact Tester. The paint system shall not show any flaking or cracking at the following impact values:

(a) Negative Impact - 10 in-lbs, i.e. the impact is directed against the unpainted or reverse side of the panel.

(b) Positive Impact - 35 in-lbs, i.e. the impact is directed against the painted or forward side of the panel.

3.7.2 Flexibility

Two unscored test panels, prepared per para. 4.1, shall be subjected to a bend test per para. 4.2. The paint system shall show no failure when bent over a 0.5 inch diameter mandrel through 180^{o}.

3.7.3 Abrasion Resistance

One unscored test panel, prepared per para. 4.1, shall be tested per para. 4.2. The teflon-polyurethane enamel coating shall not show any penetration to the primer and no more than a 0.1 gm weight loss after 10 000 cycles using 1000 gm load and a CS-10 wheel.

4 TESTING

4.1 Preparation of Test Panels

4.1.1 Test panels shall be 3" x 6" x 0.032", except for Abrasion Resistance (Taber Abraser) test panels, which shall be 4" x 4" x 0.032".

4.1.2 The material shall be clad aluminum alloy per QQ-A-250-5 except for the Corrosion Resistance (Salt Spray) test panels, which shall be bare aluminum alloy per QQ-A-250/4.

4.1.3 Test panels shall be prepared using the following procedure:

4.1.3.1 Clean test panels to provide a water-break free surface, then deoxidize with Turco W.0.1, Metal Prep. 33, or equivalent.

4.1.3.2 Spray a coat of DHMS C4.01 epoxy primer to a dry film thickness of .0004"-.0006" and air dry for 1-11/2 hours. Sand to a matte finish with 180 grit silicon carbide paper and remove dust residue with compressed air. Solvent wash with MEK, then tack rag cleaned surfaces. Apply a further light coat of epoxy primer and air dry for 1-11/2 hours.

4.1.3.3 Immediately prior to application of first cover coat of DHMS C4.04 polyurethane enamel, tack rag primed surfaces. Apply a thin coat of polyurethane enamel and air dry for 15-20 minutes. Then apply a final coat of polyurethane enamel to a total enamel dry film thickness of .0018"-.0025". Air dry for 8-24 hours. Sand to a matte finish with 180 grit silicon carbide paper and remove dust residues with compressed air.

4.1.3.4 Immediately prior to application of first coat of teflon polyurethane enamel, tack rag cleaned surfaces. Apply three coats of teflon polyurethane enamel, each .002"-.0025" thick, allowing 15-20 minutes air drying between coats. Total dry film thickness shall be .006"-.008".

4.1.3.5 Air dry for 7 days (168 hours) at a temperature of $70^{o} \pm 5^{o}$ F ($21^{o} \pm 3^{o}$ C) and a relative humidity of 50 ± 20%.

4.1.3.6 Test panels are specified in each applicable paragraph as "scored" or "unscored". Scored test panels shall be prepared as follows: one face of the test film shall be scribed with a sharp instrument diagonally from corner to corner through the paint system to the base metal.

4.2 Test Methods

Tests shall be conducted in accordance with the following specified methods of Federal Test Method Standard No. 141.

Test	Federal Test Method Std. No. 141 Method No.
Solids Content	4041
Viscosity (Ford Cup)	4282
Weight Per Gallon	4184
Drying Time	4061
Adhesion (Wet) Tape Test	6301
Flexibility	6221
Salt Spray (Fog) Test	6061
Water Resistance	6011
Spraying Properties	4331.1
Colour Difference of Opaque Materials (Visual Evaluation)	4249.1
Abrasion Resistance (Taber Abraser)	6192

5 QUALITY ASSURANCE PROVISIONS

5.1 Qualification Tests

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

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

5.1.3 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.

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 failure.

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.

5.1.7 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 this qualification test report in lieu of performing a separate qualification test 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 those of this specification.

5.3 Acceptance Tests

5.3.1 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.

5.3.2 The supplier, performing batch acceptance tests per para. 5.3.1. 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.

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

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.

TABLE 1. Qualification and Batch Acceptance Tests

Test	Paragraph	Qualification	Acceptance
Solids Content	3.3.1	x	x
Weight Per Gallon	3.3.2	x	
Colour Difference Of Opaque Material (Visual Evaluation)	3.3.3		x
Viscosity	3.3.5	x	
Spraying Properties	3.4.1	x	
Pot Life	3.4.2	x	
Drying Time	3.5.2	x	x
Adhesion (Wet) Tape Test	3.6.1	x	
Corrosion Resistance (salt Spray Test)	3.6.2	x	
Phosphate Ester Fluid Resistance	3.6.3	x	
Water Resistance	3.6.4	x	
Impact Resistance	3.7.1	x	x
Flexibility	3.7.2	x	
Abrasion Resistance	3.7.3	x	

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 issuing of a Purchase Order.

6.2 Procurement Documents

Procurement documents should specify the fol1owing:

6.2 Continued

(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

(e) Acceptance Test Report (when required).

7 PREPARATION FOR DELIVERY

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 of this specification.

7.2 Packaging

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

7.3 Marking

Each container shall be legibly marked with the following information:

- Enamel, Pigmented, Abrasion Resistant Coating, Teflon
- Polyurethane (Conforms to DHMS C4.08)
- 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

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 Report (When requested)

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 Occupational Health & Safety Act, RSO 1980, Ch. 321, Section 28(1) (1) or with U.S. OSHA Regulations. The document must state all hazardous ingredients present in the material, procedures for safe handling, threshold limit values (where applicable) and procedures for disposal of surplus or damaged material. This requirement is a prerequisite to inclusion of any product on the Qualified Products List.

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

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.	DE HAVILLAND QUALIFICATION SHEET NO.	MSDS #	DATE OF PRODUCT APPROVAL
	23T3-Series			
Akzo Nobel, East Water Street Waukegan, Illinois, USA 847 623 4200	23T3-XXX Base Compound	PQS #1	2381	May, 1994
	PC-216 Hardener	PQS #1	2380	May, 1994
	66-C-28 Reducer	PQS #1	2382	May, 1994