de Havilland Inc.

Material Specification

TITLE:	**HEAT RESISTANT, EPOXY PRIMER**
SPECIFICATION NUMBER:	**DHMS C 4.21**
ISSUE:	**NC**
AMENDMENT:	**---**
DATE:	**June 16, 1997**
PAGE:	**1 of 11**

Prepared by: Reviewed by:

SIGNED ORIGINAL ON FILE

Adam Demczyszyn
Materials Technology

Roque Panza-Giosa
Chief, Metals Technology

Approved by:

Leonard K. John
Manager
Materials Technology

Martyn Rix
Manager
Quality Assurance

de Havilland	Material Specification	DHMS: C 4.21 ISSUE: NC AMD.: - DATE: June 16, 1997 PAGE: i of i
	HEAT RESISTANT, EPOXY PRIMER	

REVISION RECORD

Issue	Page	Description and Reason for Change
NC		Issue of the new document.

1 SCOPE

This specification establishes the requirements for heat resistant, epoxy primer. This primer is intended to provide resistance to corrosion and aircraft fluids in areas exposed to a temperature of 450°F and intermittently to a temperature of 500°F. Designation code used at de Havilland for heat resistant primer is F45.

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. Where a specific issue of a document is not stated, the current issue shall be used.

2.1 U.S. Government Specifications

QQ-A-250/4	-	Aluminum Alloy 2024, Plate and Sheet
QQ-A-250/5	-	Aluminum Alloy, Alclad 2024, Plate and Sheet
MIL-C-5541	-	Chemical Conversion Coatings for Aluminum Alloys
MIL-L-23699	-	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, Nato Code
	-	Number 0-156

2.2 Federal Specification

Federal Test Method Standard No. 141	-	Paint, Varnish, Lacquer and Related Materials and Methods of Inspection and Testing
Federal Test Method Standard No. 791	-	Lubricants, Liquid Fuels, and Related Products, Methods and Testing
TT-S-735	-	Standard Test Fluid Hydrocarbon

2.3 American Society for Testing & Materials

ASTM B117	-	Salt Spray (Fog) Testing.
ASTM D522	-	Mandrel Bend Test of Attached Organic Coatings.
ASTM D523	-	Specular Gloss.
ASTM D1200	-	Viscosity of Paints, Varnishes and Lacquers by Ford Viscosity Cup.
ASTM D1210	-	Fineness of Dispersion of Pigment-Vehicle Systems.
ASTM D1400	-	Dry Film Thickness of Nonconductive Coating, Applied to Non-Ferrous Metal Base.
ASTM D1475	-	Density of Paint, Varnish, Lacquer and Related Products.
ASTM D2369	-	Volatile Content of Coatings.

ASTM D2794	-	Resistance of Organic Coatings to the Effect of Rapid Deformation (Impact).
ASTM D2803	-	Filiform Corrosion Resistance of Organic Coatings on Metal.
ASTM D3359	-	Test Methods For Measuring Adhesion by Tape Test.
ASTM D3363	-	Test Method For Film Hardness by Pencil Test.

2.4 De Havilland Specifications

DHMS S5.01 - Slow Evaporating, Manual Wipe, Degreasing and Cleaning Compound.

2.5 Other Companies Standards

BMS 3-11G, Type IV, Class I, -Hydraulic Fluid, Fire Resistant
Grade A

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 primer 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 component 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 from the date of manufacture when stored at a temperature of 16^{o} to 30^{o}C.

3.1.5 Nonvolatile Content - The nonvolatile content of the base and catalyst component shall not vary by more than ± 2% from the value established on the material qualification report when tested per ASTM D2369. These values shall be as stated on the Qualified Product List of this specification.

3.1.6 Weight per Gallon - The weight per gallon of the base and catalyst component shall not vary by more than ± 0.20 lbs/gal from the value established on the material qualification report when tested per ASTM D1475. These values shall be as stated on the Qualified Product List of this specification.

3.2 Mixed Material 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 base and catalyst components are mixed according to manufacturer's

instructions, the mixed enamel shall exhibit satisfactory spraying characteristics with acceptable leveling properties. The catalyzed material, shall spray satisfactorily with no sagging, running or streaking.

3.2.3 Viscosity- The viscosity of the admixed material, determined 30 minutes after mixing when tested in accordance with ASTM D1200, shall be such that the enamel can be sprayed with or without the addition of a thinner. A required spraying viscosity shall be 10-14 seconds in a No.4 Ford cup (15 - 20 seconds No. 2 Zahn cup).

3.2.4 Fineness of Grind - The fineness of the grind, of the base component shall be not less than 5, when tested in accordance with ASTM D1210.

3.2.5 Pot Life - A sample of catalyzed material reduced if necessary, shall show no lumping, gelling or separation after being stored in a closed container for 8 hours at 16^{o} to 30^{o}C, and shall meet all the requirements of this specification.

3.3 Film Properties

3.3.1 Coating Thickness - When applied in accordance with the manufacturer's instructions, the dry film thickness shall be 0.0008 - 0.0012 inch when determined in accordance with ASTM D1400.

3.3.2 Drying Time - The heat resistant coating shall have the following drying characteristics under ambient drying conditions (16^{o}C to 30^{o}C minimum and relative humidity of 30% to 80%):

Table 1: Drying Times for Heat Resistant Primer

DRY CONDITIONS	DRYING TIMES[1]
TACK FREE	30 MINUTES MAXIMUM
TO RECOAT	60 MINUTES MAXIMUM
TO STACK	4 HOURS MAXIMUM
FULL CURE	7 DAYS AIR DRY

1. The primer shall also be capable of being force cured at temperatures up to 150^{o} F

3.3.3 Surface Appearance - The dried film shall be free from grit, seeds, craters, blisters or any other surface irregularities.

3.3.4 Colour - The heat resistant coating shall be metallic green. Upon qualification the colour shall be established and the colour chip provided.

3.3.5 Gloss - The specular gloss, measured in accordance with ASTM D523, 48 hours after application shall be 30 max.

3.3.6 Flexibility - The heat resistant coating shall exhibit no cracking, crazing or loss of adhesion when bent over a 0.25 inch diameter mandrel. Three test specimens B, per Table 3, shall be tested in accordance with ASTM D522 Method B.

3.3.7 Hardness - The heat resistant primer shall have a pencil hardness of F minimum. Three test specimens B, per Table 3, shall be tested in accordance with ASTM D3363.

3.3.8 Fluid Resistance - When immersed in the fluids per Table 2, the cured heat resistant primer shall show no blistering, loss of adhesion or other deleterious effects after the specified immersion time. Two test specimens B, per Table 3, shall be tested for each fluid per ASTM D3359 Method B within 30 minutes from removal from the test fluid. After a recovery period of 24 hours the coating shall have regained its pre-test hardness.

Table 2: Fluid Resistance Test

TEST FLUID	IMMERSION TIME	FLUID TEST TEMPERATURE
DISTILLED WATER	42 DAYS	ambient
LUBRICATING OIL MIL-L-23699	24 HOURS	250°F
HYDRAULIC FLUID[1]	7 DAYS	160°F

1. Hydraulic Fluid to BMS 3-11 Type IV, Class 1, Grade A

3.3.9 Salt Spray Resistance - Three test specimens A, per Table 3, scratched diagonally corner to corner through the primer to the substrate, shall exhibit no blistering, lifting of the primer or substrate corrosion, after exposure to 5% salt spray for 3000 hours in accordance with ASTM B117. (Test panels inclined at 6° from the vertical). Blistering, lifting of the primer or substrate corrosion within 0.125 inch of the scribes does not constitute a failure.

3.3.10 Filiform Corrosion Resistance - Three test specimens A, per Table 3, shall exhibit no filiform corrosion under the coating after 2000 hours exposure in accordance with ASTM D2803.

3.3.11 Impact Resistance - The heat resistant primer shall not exhibit flaking or cracking when subjected to 40 in.lb. impact from direct and reverse side. Three test specimens B, per Table 3, shall be tested in accordance with ASTM D2794.

3.3.12 Temperature Resistance - The cured primer shall show no evidence of loss of adhesion, blistering or other deleterious effects. Three test specimens C, per Table 3, shall be tested in accordance with para.5.1

4 PREPARATION OF TEST SPECIMENS

4.1 Preparation of Test Specimens - (If LAB Test Specimens are not used).

Table 3: Test Panels

Panel	Lab. Drawing	Material	Size	Pre-Treatment
A	062-11C	2024-T3 Bare QQ-A-250/4	3"x 6" x 0.032"	Chromate Conversion Coating to MIL-C-5541 Class1A
B	062-1C	2024-T3 Clad QQ-A-250/5	3"x 6" x 0.032"	Chromate Conversion Coating to MIL-C-5541 Class1A
C	062-7F	Steel 4130 (150 ksi) Mil-S-18729	3"x 6"x0.032"	Cadmium Plated to QQ-P-416 Type I

4.1.1 Application of Heat Resistant Coating (F45) - Immediately after pre-treatment application, test specimens shall be primed with a heat resistant primer to a dry film thickness of 0.0008 - 0.0012 inches and cured for 7 days air dry.

The coating shall be prepared by first thoroughly mixing each of the components separately. The mixed material shall be thinned (if applicable) according to manufacturer specifications. Allow coating to stand for 15 minutes before using. Spray the panels with one cross coat.

5 TEST METHODS

Unless otherwise specified, tests shall be conducted at 18^{o}C - 25^{o}C and at a relative humidity of 30-80%.

5.1 Heat Resistance - The test specimens shall be exposed to the temperature of 450^{o}+/- 20^{o}F for 4 hours. Allow panels to cool down to room temperature (minimum cool down time shall be 3 hours). Repeat the procedure twice. After two cycles at 450^{o}F expose the same specimens to a temperature of 500^{o}+/-10^{o}F for 1 hour. Examine visually for any coating failures and test for adhesion in accordance with ASTM D3359 Method B.

6 QUALITY ASSURANCE

6.1 Definitions

6.1.1 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.

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

6.2 Qualification

6.2.1 A supplier is responsible for the performance of all qualification testing, as specified in Table 4. Although the requirements set in this specification indicate the minimum acceptable properties performance, all the tests shall be carried out until failure and the results shall be reported.

6.2.2 A supplier desiring qualification shall submit one copy of a report showing actual qualification test data based on the five different batches of the material and a sufficient quantity of product for de Havilland evaluation tests.

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

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

6.2.5 No changes in the method of manufacture and/or formulation of primer to DHMS C4.21 shall be made without notification and prior written approval of Materials Technology and Quality Assurance Departments of de Havilland Inc.

6.2.6 Re-qualification of the product may be requested by the purchaser if there are any changes in the method of manufacture and/or formulation.

6.3 Qualification by Similarity

Where a product has been qualified to another specification, with similar requirements, the supplier may submit this qualification test report.

6.4 Acceptance Tests

6.4.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for all batch acceptance tests, as specified in Table 4.

6.4.2 The supplier, performing acceptance tests shall furnish with each batch of product, one copy of an Acceptance Test Report showing actual test data values displaying conformance to the acceptance tests specified in Table 4 and a Certificate of Compliance. The report shall include the supplier's batch identification.

6.4.3 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 Batch Acceptance Tests

Test	Paragraph	Qualification	Acceptance
Condition in Container	3.1.3	x	x
Non-Volatile Content	3.1.5	x	x
Weight per Gallon	3.1.6	x	x
Viscosity	3.2.3	x	x
Fineness of Grind	3.2.4	x	
Pot Life	3.2.5	x	x
Drying Time	3.3.2	x	x
Surface Appearance	3.3.3	x	x
Gloss	3.3.5	x	x
Flexibility	3.3.6	x	x
Hardness	3.3.7	x	x
Fluid Resistance[1]	3.3.8	x	x
Salt Spray Resistance	3.3.9	x	
Filiform Corrosion Resistance	3.3.10	x	
Impact Resistance	3.3.11	x	x
Heat Resistance	3.3.12	x	

1. For batch acceptance, immersion in hydraulic fluid only is acceptable.

7 ORDERING DATA

7.1 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.

7.2 Procurement documents shall specify the following:

- Title, Number, Issue and Amendment Number of this Specification
- Manufacturer's Name and Product Identification (Trade Name or Code Number)
- Type or Size of Containers
- Total Quantity
- Acceptance Report

- Material Safety Data Sheets

8 PREPARATION FOR DELIVERY

8.1 Preservation and Packing

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.

8.2 Packaging

The enamel shall be supplied in a kit packaged as a unit, or as separate components in bulk form as stated on the Purchase Order, consisting of base component and the required amount of catalyst and thinner to bring the enamel to spraying consistency.

8.3 Marking

Each container shall be legibly marked with the following information:

- Coating, (conforms to DHMS C4.21).
- Manufacturer's Name and Product Identification (trade Name or Code Number)
- Date of Manufacture
- Batch Number
- Net Quantity (Imperial, U.S. or Metric Measure)

8.4 Shipping Documentation

Shipping document shall show:

- De Havilland Purchase Order No.
- Specification Number
- Number of Containers
- Batch Number
- Total Quantity (Imperial, U.S. or Metric Measure)
- Acceptance Test Reports
- Material Safety Data Sheets

9 HEALTH AND SAFETY DATA

When supplying samples for qualification per Para. 4.1.2, 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
Courtaulds Aerospace. 5676 Timberlea Boulevard Mississauga, Ont. L4W 4M6 tel 905-629-7999 fax 905-629-7009	519x303 Coating Base Nonvolatile Content: 42.24 wt/% or 28.78vol% Weight per gal.: 8.76 lbs	3343	PQS # 1	June 16, 1997
	910x357 Converter Nonvolatile Content: 16.34wt/% or 13.56vol/% Weight per gal.: 7.03 lbs	3342		
	020x324 Thinner	3341		