BOMBARDIER

de Havilland
Material Specification

TITLE:	**PRIMER INTERMEDIATE (F23)**
SPECIFICATION NUMBER:	**DHMS C 4.18**
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REVISION RECORD

Iss.	Page	Description and Reason for Change
A		This is a revised specification. Detailed changes will not be noted.
Amd. 1	7 8	Para. 4.3.11 revised. Para. 4.3.12.1 revised. Pages re-numbered.
Amd. 2	18	Note deleted on De Soto primers. MSDS numbers added to De Soto primer base 515X349 and primer curing solution 910X533. Name changed: De Soto Inc. to Courtaulds Aerospace
B		This is a completely revised issue. Detail changes have not been noted.
Amd. 1	13	QPL: Supplier address changed.
Amd. 2	13	QPL: New qualified product added.
C	14 4	QPL: New sheet and new qualified product added Added high solids viscosity requirements.
D		This is a complete revision.
Amd. 1	11	QPL: Supplier address changed.
Amd. 2	4 11	3.2.6 Pot Life, added statement "unless otherwise stated in QPL" QPL: Added PRC-Desoto primer system CA7755A/CA7755BE.
E	12	QPL: Added Axon Products Inc. primer system . Re-Paginated.
Amd. 1	11	QPL: Manufacturer name changed from Trebor Ltd. to Tristar Coating Ltd.
F		This is a revised issue. Detail changes have not been noted. Clarified acceptance testing requires for supplier and purchaser., standardize with BA specifications.
Amd. 1	13	515X336 base and CA 7000 base have been discontinued and removed from the Qualified Products List.

1 SCOPE

This specification states the requirements for a polyurethane compatible, corrosion resistant, intermediate epoxy primer. This primer is identified by Bombardier Aerospace Toronto finish code F23. This primer is to be used as an intermediate primer between F19 base primer and subsequent top coats.

1.1 Classification

This coating shall be one of the following Types, Classes and Grades:

Type I - Reserved
Type II - Reserved
Type III - Rain erosion resistant, non-splitting

Class A - For application with conventional paint equipment, including airless equipment
Class B - For application with electrostatic paint equipment

Grade A - High VOC, conventional coating
Grade B - Low VOC (380 g/L max.), high solids coating
Grade C - Low VOC (250 g/L max.), water based coating

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 on Aluminum and Aluminum Alloys

MIL-PRF-23699 - Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, Nato Code Number O-156

2.2 Federal Specifications

TT-S-735 - Standard Test Fluids, Hydrocarbon

2.3 Bombardier Aerospace Toronto Specifications

DHMS C4.01 - Primer, Fluid Resistant, Epoxy

DHMS C4.04 - Enamel, Polyurethane, for Aircraft Exterior Paint System

DHMS S5.01 - Slow Evaporating, Manual Wipe, Degreasing & Cleaning Compounds

2.4 American Society for Testing & Materials

ASTM B117	-	Operating Salt Spray (Fog) Apparatus
ASTM D522	-	Mandrel Bend Test of Attached Organic Coatings
ASTM D1200	-	Viscosity by Ford Viscosity Cup
ASTM D1210	-	Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage
ASTM D1400	-	Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to Nonferrous Metal Base
ASTM D2369	-	Volatile Content of Coatings
ASTM D2794	-	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D2803	-	Testing Filiform Corrosion Resistance of Organic Coatings on Metal
ASTM D3359	-	Measuring Adhesion by Tape Test
ASTM D3363	-	Film Hardness by Pencil Test

2.5 Other Standards

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

3 REQUIREMENTS

3.1 Component Requirements

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

3.1.2 Components - The primer shall consist of two or three 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 when stored at a temperature of 16 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 kept by Bombardier Aerospace Materials Engineering.

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 product shall exhibit satisfactory spraying characteristics with acceptable leveling properties. The catalysed material shall spray satisfactorily with no sagging, running or streaking.

3.2.3 Viscosity of Conventional Primer - The viscosity of the admixed primer determined 30 minutes after mixing when tested per ASTM D1200 shall be such that the primer can be sprayed, with or without the addition of a thinner. The required spraying viscosity shall be 5 to 10 seconds in a No. 4 Ford cup (14 to 18 seconds in a No. 2 Zahn cup).

3.2.4 Viscosity of High Solids Primer - The viscosity of the admixed primer determined 30 minutes after mixing when tested per ASTM D1200 shall be such that the primer can be sprayed, with or without the addition of a thinner. The required spraying viscosity shall be 18 to 24 seconds in a No. 2 Zahn cup.

3.2.5 Fineness of Grind - The fineness of grind of the base component shall be not less than 5 when tested per ASTM D1210.

3.2.6 Pot Life - A sample of catalysed material, reduced if necessary, shall show no lumping, gelling or separation after being stored in a closed container at 16 to 30^{o}C for 6 hours for Grade A or for 4 hours for Grade B, unless otherwise specified in the QPL, and shall meet all the requirements of this specification.

3.3 Film Properties

3.3.1 Coating Thickness - When applied according to the manufacturer's instructions, the dry film thickness shall be 0.0004 to 0.0006 inches determined per ASTM D1400.

3.3.2 Drying Time -The intermediate primer shall have the following drying characteristics under ambient drying conditions (16 to 30^{o}C minimum and 30 to 80% relative humidity).

Table 1: Drying Times for Intermediate Primer

CONDITION[1]	DRYING TIME
dust-free	30 minutes maximum
to overcoat	2 hours maximum

1. The primer shall also be capable of being force cured at temperatures up to 120^{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 intermediate primer shall be yellow (preferably) or green. Upon qualification, the colour shall be established and the colour chip provided.

3.3.5 Flexibility - The intermediate primer coating shall exhibit no cracking, crazing or loss of adhesion when bent over a 0.25 inch diameter mandrel. Two test specimens B, C and D per Table 3 shall be tested per ASTM D522 Method B.

3.3.6 Low Temperature Flexibility - The intermediate primer coating shall exhibit no cracking, crazing or loss of adhesion on two each of specimens B, C and D per Table 3 tested per para. 5.2.

3.3.7 Hardness - The intermediate primer shall have a pencil hardness of H minimum on two specimens B per Table 3 tested per ASTM D3363.

3.3.8 Dry Film Weight - The dry film weight of the intermediate primer shall not exceed 0.0080 lb/ft^2/mil. Three specimens B per Table 3 shall be tested per para. 5.3.

3.3.9 Fluid Resistance - When immersed in the fluids per Table 2, the cured intermediate primer shall show no blistering, loss of adhesion or other deleterious effects after the specified immersion time. Two each of specimens B, C and D 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 pretest hardness.

Table 2: Fluid Resistance Test

TEST FLUID	IMMERSION TIME	FLUID TEST TEMPERATURE
Distilled Water	42 days	ambient
Lubricating Oil MIL-PRF-23699	24 hours	250°F
Hydraulic Fluid[1]	7 days	160°F
TT-S-735 Type VIII	42 days	ambient

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

3.3.10 Salt Spray Resistance - Three test specimens A per Table 3, scratched diagonally corner to corner through the intermediate primer to the substrate, shall exhibit no blistering, lifting of the primer or substrate corrosion after exposure to 5% salt spray for 3000 hours per 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 cause for failure.

3.3.11 Filiform Corrosion Resistance - Three test specimens A per Table 3 shall exhibit no filiform corrosion under the coating after 3000 hours exposure per ASTM D2803.

3.3.12 Impact Resistance - The intermediate primer shall not exhibit flaking or cracking when subjected to 40 in.lbs impact from direct and reverse side. Two each of specimens B, C and D per Table 3 shall be tested per ASTM D2794.

3.3.13 Wrap Capability (Class B only) - The thickness of the primer shall not vary by more than 0.0004 inch, when tested per para. 5.3, using two specimens E per Table 3.

3.3.14 Repairability - The intermediate primer shall show no blistering, loss of adhesion or other deleterious effects when tested per para. 5.4.

3.3.15 Compatibility With DHMS C4.04 Type VI - The cured system (intermediate primer, and topcoat qualified to DHMS C4.04) shall be evaluated as a system per requirements of DHMS C4.04 Type VI.

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"	Chemical conversion coat to MIL-C-5541 Class 1A
B	062-1C	2024-T3 Clad QQ-A-250/5	3" x 6" x 0.032"	Chemical conversion coat to MIL-C-5541 Class 1A
C	062-1C2a	2024-T3 Clad QQ-A-250/5	3" x 6" x 0.032"	Chemical conversion coat to MIL-C-5541 Class 1A
D	062-1C3a	2024-T3 Clad QQ-A-250/5	3" x 6" x 0.032"	Chemical conversion coat to MIL-C-5541 Class 1A
E	071-1	any aluminum alloy	1" dia. x 16" long tube (any wall thickness)	Chemical conversion coat to MIL-C-5541 Class 1A

4.1.1 Test Specimens C shall be primed with epoxy primer to DHMS C4.01 Type 2 to a dry film thickness of 0.0004 to 0.0006 inch and cured for 7 days minimum at ambient conditions. The primer shall be then aged outdoors for not less than 6 months, or UV aged for 40 hours continuous UV (Atlas UVcon, Model UC1 using UVA-340 fluorescent lamps, or equivalent).

4.1.2 Test Specimens D shall be primed with epoxy primer to DHMS C4.01 Type 3 to a dry film thickness of 0.0004 to 0.00006 inch and cured for 7 days minimum at ambient conditions. The primer shall be then aged outdoors for not less than 6 months, or UV aged for 40 hours continuous UV (Atlas UVcon, Model UC1 using UVA-340 fluorescent lamps, or equivalent).

4.1.3 Cleaning of Stored and Primed Test Specimens - After ageing of the specimens, hand scuff sand primer using 180 grit abrasive paper to remove approximately half of the aged primer. Clean all test panels using DHMS S5.01 Class 2 and Scotch Brite and wipe dry with a clean lint free cloth.

4.1.4 Application of Intermediate Primer (F23) - Immediately after cleaning, test specimens shall be primed with a chromated epoxy intermediate primer F23, to a dry film thickness of 0.0003 to 0.0005 inches and air dried at room temperature. Specimens shall be air cured at ambient conditions for 7 days minimum before testing.

The intermediate primer shall be prepared by first thoroughly mixing each of the components separately. The components shall be thinned (if applicable) according to manufacturer's specifications. Allow the primer to stand for 15 minutes before use. Spray the panels with one cross coat.

5 TEST METHODS

5.1 Unless otherwise specified, tests shall be conducted at 18 to 25°C and 30 to 80% relative humidity.

5.2 Low Temperature Flexibility - The test specimens shall be conditioned at -65 ± 5°F for 5 ± 0.5 hours. The specimens then shall be rapidly bent over a 4 inch diameter mandrel that has been conditioned at the same temperature and time as the test panels per ASTM D522 Method B.

5.3 Dry Film Weight -The length and width of the test specimens shall be recorded. The specimens shall be cleaned, dried and weighed to the nearest 10 mg. The coating shall be applied to the panels and allowed to cure. The primed specimens shall be weighed and the thickness of the primer film shall be measured in at least five positions on each panel to the nearest 0.0001 in.

$$\text{Dry film weight} = \frac{(W_2 - W_1)}{L \times B \times T},$$

where:

W_1 = weight of bare specimen
W_2 = weight of same specimen, coated
L = length of specimen
B = width of specimen
T = thickness of primer film

5.4 Wrap Capability - The test specimens shall be mounted vertically and electrically grounded. The primer shall be applied from one direction only using electrostatic spray equipment. Determine the coating thickness variation after 7 days of air cure.

5.5 Repairability - The test specimens used in para. 3.3.10 shall be air dried for 24 hours, sanded using 220 grit aluminum oxide abrasive paper and solvent cleaned using DHMS S5.01 Class 2. The intermediate primer shall be reapplied and air dried for 7 days. The test specimens shall be immersed for seven days in the test fluids specified in Table 2. The specimens used in the repairability test shall be immersed in the same fluid used for the fluid resistance test. Test per ASTM D3359 Method B within 30 minutes of removal from the test fluid.

6 MATERIAL QUALIFICATION REQUIREMENTS

6.1 Request For Qualification

All requests for qualification to this specification shall be addressed to Bombardier Aerospace Materials and Processes Engineering Department for approval.

All material qualification shall be site specific.

An audit of the manufacturers and/or test facilities by Materials and Processes Engineering may be necessary prior to approval.

6.2 Qualification testing

Potential suppliers shall submit a written qualification test report based on 3 batches/lots of materials showing compliance with the requirements contained in section 3. The test report shall contain actual numerical test values, average test results as well as failure modes where applicable.

6.2.1 A sample shall be submitted for testing at the discretion of Bombardier Aerospace Materials and Processes Engineeing for evaluation.

6.3 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.

6.4 Process Control Document

6.4.1 The manufacturer shall develop and maintain a Process Control Document (PCD). The PCD shall define the manufacturing and quality control requirements and procedures for assuring consistent, uniform and compliant products. The PCD shall identify baseline chemical constituents, in-process test procedures and requirements, and manufacturing procedures. All specifications and test procedures employed during the process shall also be listed and issue/date controlled.

6.4.2 When qualification has been granted, the PCD shall be signed by the supplier and Bombardier Aerospace Materials and Processes Engineering and shall not be changed without prior written approval.

6.4.3 The PCD and all production data shall be available to any Bombardier Aerospace auditors when requested.

6.5 Qualification Approval

6.5.1 Upon review of supplier's data, PCD and BA tests, the supplier will be advised either of product qualification or reasons for disqualification.

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

6.5.3 Re-qualification of the product may be requested by the Bombardier Materials and Process Engineering if there are any changes in the method of manufacture and/or formulation.

7 QUALITY ASSURANCE REQUIREMENTS

7.1 Batch/Lot Acceptance Tests

7.1.1 The manufacturer/supplier is responsible for the performance of all sampling, inspection and testing of each batch/lot as specified in **Table 4.**

7.1.2 The manufacturer/supplier shall issue with each batch of product one copy of an Acceptance Test Report showing actual test data conformance to the acceptance tests specified in **Table 4**. The report shall include the supplier's batch identification, materials specification and date of testing.

7.1.3 Bombardier Aerospace Materials and Processes Engineering 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.

7.1.4 The manufacturer/supplier shall certify with a Certificate Conformance that each batch of each shipment meets the requirements of this specification.

7.2 Purchaser Batch/Lot acceptance tests

7.2.1 The purchaser is required to perform , inspection and testing of each batch/lot as specified in **Table 4**

7.2.2 **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.

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

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Table 4: Qualification And Batch Acceptance Tests

Test	Paragraph	Qualification	Acceptance[1]	
		Supplier	Supplier	Purchaser
Condition in Container	3.1.3	x	x	x
Nonvolatile Content	3.1.5	x	x	x
Viscosity	3.2.3 or 3.2.4	x	x	x
Fineness of Grind	3.2.5	x		
Pot Life	3.2.6	x	x	x
Drying Time	3.3.2	x	x	x
Surface Appearance	3.3.3	x	x	x
Colour	3.3.4	x		
Flexibility	3.3.5	x		
Low Temperature Flexibility	3.3.6	x		
Hardness	3.3.7	x	x	x
Dry Film Weight	3.3.8	x		
Fluid Resistance[2]	3.3.9	x	x	
Salt Spray Resistance	3.3.10	x		
Filiform Corrosion Resistance	3.3.11	x		
Impact Resistance	3.3.12	x	x	x
Wrap Capability (Class B only)	3.3.13	x		
Repairability	3.3.14	x		
Compatibility with DHMS C4.04	3.3.15	x		

1. For batch acceptance test, use only test panels B. For the "Impact Resistance" test, it is acceptable to use test panel D as an alternative.

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

8 ORDERING DATA

8.1 Prerequisite

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

8.2 Procurement documents

8.2.1 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
- Primer, Type, Class and Grade
- Acceptance Report
- Material Data Safety Sheets

9 PREPARATION FOR DELIVERY

9.1 Preservation and Packing

9.1.1 The product 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.

9.2 Packaging

9.2.1 The product 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 it to spraying consistency.

9.3 Marking

9.3.1 Each container shall be legibly marked with the following information:

- Primer, (conforms to DHMS C4.18), Type, Class, and Grade.
- Manufacturer's Name and Product Identification (Trade Name or Code Number)
- Date of Manufacture
- Batch Number
- Net Quantity (Imperial, U.S. or Metric Measure)

9.4 Shipping Documentation

9.4.1 Shipping document shall show:

- Bombardier Aerospace Purchase Order No.
- Specification Number
- Number of Containers
- Batch Number
- Total Quantity (Imperial, U.S. or Metric Measure)
- Primer, Type, Class and Grade
- Acceptance Test Reports
- Material Safety Data Sheets

10 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 form, "Application To Introduce A New Material", to the Material Safety Committee.

Upon receipt of DH 4340 form, “Recommendation”, 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 MSDS.

QUALIFIED PRODUCTS LIST

Classification	Manufacturer	Product Identification		Qualification	MSDS	Product Approval
Type III Class A Grade A	PRC-DeSoto Int'l 11601 United Street Mojave, CA 93501 (661)824-4532	Base Catalyst	515x349 910x533	PQS #2	2323 2322	Sep. 12, 1990
Type III Class A Grade A	Tempo Aerospace Inc. 205 Fenmar Dr. Weston, Ontario M9L 2X4 (416) 746-2233	Base Catalyst	4500-PB-60X 4500-C-60X	PQS #3	0236 0237	Jan. 14, 1991
Type III Class A Grade A	Tristar Coating Ltd. 18 Cadetta Rd. R.R. #9 Brampton, ON L6T 3Z8 (416) 794-1100	Base Catalyst Thinner	425 IP0501 420C0078 SB41 or SB43	PQS #4	1852 1630 1253	Sep. 17. 1991
Type III Class B Grade B	PRC-DeSoto Int'l	Base Catalyst Pot Life:	CA 7755A CA 7755BE 2 hour	PQS #7	3703 3704	July 22, 2005
Type III Class B Grade B	Akzo Nobel Aerospace Coatings East Water Street Waukegan, IL	Base Catalyst Thinners	10-P20-44 EC-273 TR-114	PQS #6	2421 2879 2392	Nov. 7, 2000
Type III Class B Grade B	Axon Products Inc. 307 Echelon Rd. Greenville, South Carolina 29605 (864) 299 2819	Base Hardener Reducer	EP-2-Y1 EH -12 SC - 11	PQS#8	3778 3779 3780	Aug. 27, 2007