Bombardier Aerospace (Toronto)

Material Specification

TITLE:	**MARKING INKS**
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MARKING INKS

REVISION RECORD

Issue	Page	Description and Reason for Change
A		Removed J.M. McLaren inks from QPL. Updated format throughout.

1 SCOPE

1.1 This specification establishes the requirements for the certification of inks to be used for part marking aircraft parts and assemblies as the means of providing identification during fabrication and assembly.

1.2 Classification

1.2.1 Types

Type I	Permanent marking inks
Type II	Temporary marking inks

1.2.2 Grades (denotes substrate type)

Grade A	Metallic substrates
Grade B	Plastic substrates (acrylic, polycarbonates, etc.)
Grade C	Composite substrates (aramid/epoxy, etc.)
Grade D	Organic coatings, i.e. paint
Grade X	All of the above

1.2.3 Classes (denotes applicator type)

Class 1	Rubber stamp pad inks
Class 2	Stencil inks
Class 3	Screen printing inks
Class 4	Ink jet inks
Class 5	Felt tip markers

2 APPLICABLE SPECIFICATIONS

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

2.2 Industry Specifications

A-A-208	Ink, Marking, Stencil, Opaque (Porous and Non-Porous Surfaces)
ASTM G53	Operation Light and Water Exposure Apparatus (Fluorescent UV Condensation Type) for Exposure to Non-Metallic Materials

2.3 Bombardier Aerospace Toronto Specifications

DHLP 6043	Environmental Stress Cracking of Plastics
DSC 378-2	Wiping Cloth

3 REQUIREMENTS

3.1 Marking inks qualified to this document shall meet the following requirements. The applicability of the various tests to the Types, Grades, and Classes of inks is outlined in Table 1.

TABLE 1 - Requirements for Marking Inks

Property	Applicability (Type/Grade/Class)	Requirement
User Friendliness	All Types, all Grades, all Classes	para 3.1.1
Shelf Life	All Types, all Grades, all Classes	para 3.1.2
Consistency of Material	All Types, all Grades, all Classes	para 3.1.3
Drying Time	All Types, all Grades, all Classes	para 3.1.4
Legibility	All Types, all Grades, all Classes	para 3.1.5
UV Light Resistance	Type I, all Grades, all Classes	para 3.1.6
Wear Resistance	Type I, all Grades, all Classes	para 3.1.7
Water Resistance	Type I, all Grades, all Classes	para 3.1.8
Removability	Type II, all Grades, all Classes	para 3.1.9
Effect on Metallic Materials	All Types, Grades A and X, all Classes	para 3.1.10
Effect on Plastic Materials	All Types, Grades B and X, all Classes	para 3.1.11

3.1.1 User Friendliness - Inks shall not have an offensive odour or vapours that produce headaches, drowsiness, nausea or other detrimental effects.

3.1.2 Shelf Life - The inks shall be able to meet all the requirements of this specification for a minimum period of two years from the date of delivery.

3.1.3 Consistency of Material - The inks shall be in a homogeneous state, free from foreign matter and shall conform to the levels of quality established herein. Inks shall not contain compounds or elements that may be detrimental to the properties of the substrate to which they will be applied.

3.2 Material Properties and Quality Requirements

3.2.1 User Friendliness - Inks shall not have an offensive odour or vapours that produce headaches, drowsiness, nausea or other detrimental effects.

3.2.2 Shelf Life - The inks shall meet all the requirements of this specification after a minimum storage period of two years from the date of delivery.

3.2.3 Consistency of Material - The inks shall be in a homogeneous state, free from foreign matter and shall conform to the levels of quality established herein. Inks shall not contain compounds or elements that may be detrimental to the properties of the substrate to which they will be applied.

3.2.4 Drying Time - Drying time shall be measured by marking test panels with ink and calculating the time to dry to a tack-free finish. One each of A2, all B and C panels, and D2 test panels shall be used (see

Table 2). On each panel, the ink shall be applied in three areas, each approximately 1 in^2. Drying time shall be 10 seconds maximum for Class 1 inks. Drying times for Classes 2 through 5 inks T.B.D.

3.2.5 Legibility - The ink shall be applied by the method of application for which the qualification is sought. For example, Class 1 inks will be stamped onto the samples, Class 2 will be stencilled, etc. A minimum of 50 characters is required. One each of A2, A5, A6, and all B, C and D panels shall be used (see Table 2). The characters shall be viewed without magnification at a typical reading distance and with typical daylight illumination. Part markings shall be legible and unsmeared with well defined characters of uniform appearance, sufficiently opaque to hide the substrate.

3.2.6 Wear Resistance (Type I only) - Use the same test panels from paragraph 3.2.5. A wiper cloth shall be folded to produce at least six thicknesses under the finger. The test panels shall then be rubbed 20 times (20 back-and-forth strokes) with the cloth. Rubbing shall be done at a frequency of approximately one stroke per second (1 Hz). Use a moderate amount of hand pressure for rubbing. Upon completion of testing, the part marking shall meet the requirements of paragraph 3.2.5.

3.2.7 UV Light Resistance (Type I only) - Use the same test panels from paragraph 3.2.6. The panels shall be exposed to 20 hours of ultra violet light only according to ASTM G53. Part markings must then meet the requirements of paragraph 3.2.5.

3.2.8 Water Resistance (Type I only) - Type I permanent inks shall be applied to A1, A4, and all B, C, and D panels (see Table 2). The ink shall be allowed to dry. The test panels shall be placed in a beaker of warm tap water for 30 minutes. removed, then rubbed as in paragraph 3.2.6. Upon completion of testing, the part marking shall meet the requirements of paragraph 3.2.5.

3.2.9 Effect of Temporary Marking (Type II only) - One each of A2, A4, A6, and all B, C, and D test panels is required. Prior to applying the ink, allow the primer to air dry for 7 days. The ink should be applied to the test panel in two or three isolated areas, each 1 in^2 in size, and allowed to cure. Clean test panels by wiping the area with a small amount of naphthol (plastic only) or MEK (metals, composites) and wipe dry. Upon removal of the ink, the test panel shall be visually examined. The test panels shall not display any indications of shadowing or colour change.

3.2.10 Effect on Metallic Materials - All Grade A inks shall be tested per paragraph 4.2. Testing will require four 3" x 6" specimens for each ink/base metal combination for all A test panels (see Table 2). When inspected, there shall be no evidence of pitting, end grain attack, or any other detrimental effect.

3.2.11 Effect on Acrylic, Polycarbonate, and Plastic Substrates - All Grade B inks shall be tested per paragraph 4.3. Tests require three test panels for each ink/substrate combination. Upon completion of the testing, there shall be no indication of crazing, cracks, etching effect, softening or general degradation of the polished surface of the test specimens when inspected using 10X magnification minimum.

4 TEST METHODS

4.1 To qualify a marking ink to this document, the applicable tests must be completed as outlined below. The material and required finish of each test panel is given in Table 2.

4.2 Effect on Metallic Materials - The effect of part marking inks on the properties of metallic materials shall be evaluated using the following test:

1. Saturate a filter paper with ink, and sandwich it between two specimens of the same material (see Fig. 1 below). Half of the specimen should be covered with the filter paper. Leave one pair of specimens at room temperature for 72 hours. Test another pair of specimens at 100^{o}F for 72 hours.
2. Place both pairs of specimens in a humidity chamber at 95% humidity for 96 hours.
3. Cut a sample from a corner of each specimen area exposed to ink, and another sample from the unexposed area of the specimen (see Fig.1 below). Perform metallographic inspection on the four samples, checking for pitting, end grain attack, and any other detrimental effect by comparing the sample from the area exposed to the ink to the sample from the unexposed area.

4.3 Stress Crazing of Acrylics, Plastics and Polycarbonate Substrates - The effects of inks on acrylic, plastic, and polycarbonate substrates will be determined per DHLP 6043. Ensure the plastic is always covered with wet ink. After 7 days, inspect the test panels for any evidence of cracking, crazing, softening or general degradation under appropriate light conditions using 10X magnification minimum.

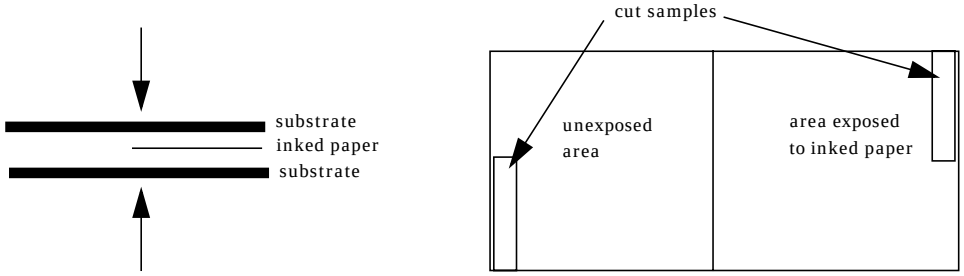

FIGURE 1 - Test for Effect on Metallic Materials

5 Quality Assurance

5.1 Qualification

5.1.1 The supplier is responsible for conducting all qualification testing as specified in Table 1 of this specification.

5.1.2 The supplier shall submit to Bombardier Aerospace Inc. a copy of a Qualification Test Report for three different batches of material showing actual qualification test data and a 1L (or quarter gallon) sample of ink from 1 batch or four markers for in-house testing.

5.1.3 Upon review of supplier's data and completion of Bombardier Aerospace tests, the supplier will be advised either of product qualification or of reasons for disqualification.

5.1.4 Qualified vendors will be listed in the Qualified Products List (QPL) of this specification.

5.1.5 No changes in the chemical or physical characteristics of the ink, or application procedure used to apply the ink to Bombardier Aerospace parts shall be made without notification and prior written approval from the Materials Technology and Quality Assurance Departments of Bombardier Aerospace Inc.

5.1.6 Requalification may be requested by the supplier if there are any changes to the chemical or physical properties of the ink or the method of application.

5.2 Qualification by Similarity

5.2.1 Where an ink has been qualified to another similar document, the supplier may submit that qualification test report in lieu of performing the qualification tests required in section 3. The similar document may be a government, company, or other specification where the requirements are similar to those in this specification.

Table 2: Test Panel Materials and Specifications

Grade	#	Substrate Material	Material Description
A	1	Aluminum (bare)	6" x 3" x 0.032" bare 2024-T3 sheet, QQ-A-250/4, cleaned per PPS 31.02
	2	Aluminum (clad)	6" x 3" x 0.032" clad 2024-T3 sheet, QQ-A-250/5, cleaned per PPS 31.02
	3	Chromic acid anodized, bare aluminum	6" x 3" x 0.032" bare 2024-T3 sheet, QQ-A-250/4, A1 per PPS 32.03
	4	Low alloy steel	6" x 3" x 0.032" 4130 Condition N, MIL-S-18729, cleaned per PPS 31.03
	5	Corrosion resistant steel	0.032" 321 sheet, AMS 5510, annealed, passivated per PPS 31.06
	6	Titanium alloys	3" x 3" x 0.032" MIL-T-9046 CP-1, cleaned to PPS 17.02 or PPS 31.11
	7	Inconel	4" x 1" x 0.040" Inconel 625, AMS 5599, annealed, cleaned per PPS 31.11
	8	Cadmium plating	6" x 3" x 0.032" 4130 Condition N, MIL-S-18729, Cd plated per PPS 33.01
B	1	Acrylic	3.100±0.020" x 1.00±0.020" x 0.060" as in DHLP 6043, per DHMS P1.09
	2	Polycarbonate	3.100±0.020" x 1.00±0.020" x 0.060" as in DHLP 6043, per DHMS P1.01
	3	Declam	3.100±0.020" x 1.00±0.020" x 0.060" as in DHLP 6043, per DHMS P1.28
	4	Tedlar	3.100±0.020" x 1.00±0.020" x 0.060" as in DHLP 6043, per DHMS P1.27
	5	Ultem	3.100±0.020" x 1.00±0.020" x 0.060" as in DHLP 6043, per DHMS P1.47
C	1	Epoxy composite	2 ply Kevlar, DHMS P1.24 Type 2 to PPS 10.35, no primer.
	2	Phenolic resin composite	3" x 6" x 2 ply glass-graphite, DHMS P1.59, Type 2 to PPS 10.48, no primer.
D	1	FR Primer, F19 Type 2	6" x 3" x 0.032" clad 2024-T3, QQ-A-250/5, C1 per PPS 32.01 + F19 Type 2 per PPS 34.08
	2	FR Primer, F19 Type 3	6" x 3" x 0.032" clad 2024-T3, QQ-A-250/5, C1 + F19 Type 3 per PPS 34.08
	3	Fuel Tank Primer, F21	6" x 3" x 0.032" clad 2024-T3, QQ-A-250/5, C1 + F21 per PPS 21.03.
	4	Topcoat, F24	6" x 3" x 0.032" clad 2024-T3, QQ-A-250/5, C1 + F19 Type 2 + F24 per PPS 34.03.

5.3 Receipt and Shelf Life Extension Testing

5.3.1 Once an ink has been qualified, there will be no receipt testing or shelf life extension testing. After two years on the shelf, the usability of the ink shall be at the discretion of the user.

6 ORDERING DATA

6.1 Prerequisite

6.1.1 Before a purchase order may be issued for an ink to be applied to Bombardier Aerospace parts according to this specification, the ink must be qualified by Bombardier Aerospace Materials

Technology and listed on the Qualified Products List (QPL).

6.2 Procurement Documents

6.2.1 Procurement documents shall specify the following:

- Title, number, issue and amendment number of this specification
- Type, Grade, and Class
- Supplier's name and product identification number

7 PREPARATION FOR DELIVERY

7.1 The ink shall be packed in a manner that ensures, during shipment and storage, it will be protected against damage from exposure to hazards which would adversely affect its property conformance to section 3 of this specification.

7.2 Packaging

7.2.1 The containers (cans, bottles, tubes, etc.) containing the ink shall be in accordance with the manufacturer's commercial practice and shall have no defects that adversely affect serviceability or appearance.

7.2.2 The outside cap, cover, or label of the container/packaging shall visually match the colour of the ink.

7.3 Marking

7.3.1 Each shipment of ink shall be legibly marked with the following information:

- Product number
- Supplier's name and batch number
- Date of manufacture
- Quantity of ink
- Purchase order number
- Expiry date

7.4 Shipping Documentation

7.4.1 The shipping documentation shall show the following:

- Bombardier Aerospace purchase order number
- DHMS F7.02, issue and amendment number
- Type, Grade and Class of ink
- Quantity of ink
- Number of containers
- Batch number
- Acceptance test reports
- Material Safety Data Sheet(s)

8 HEALTH AND SAFETY DATA

When supplying samples for qualification, 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.I.M.I.S. Regulations). The document must state all hazardous ingredients, safe-handling procedures, first-aid measures, fire and explosion data, reactivity data, physical properties, preparation information and procedures for storage and disposal.

This MSDS must then be supplied with a completed DH4339 "Application To Introduce A New Material" form to the Material Safety Data Committee.

Upon receipt of DH4340 "Recommendation" form that approves the use of the material, it can then be included on the Qualified Product List.

NOTE: Any change in the formulation of the material requires a re-submission of the MSDS.

MARKING INKS

QUALIFIED PRODUCTS LIST

Manufacturer	Product Identification	MSDS #	Product Approval	Classification	PQS #
Marsh Company Belleville, IL 62222 USA	CM-50 Non Porous Ink	2616	05/06/98	Type I Grade X Class 1	2