DE HAVILLAND AIRCRAFT OF CANADA LIMITED

BOMBARDIER

De Havilland
Material Specification

TITLE:	**ROOM TEMPERATURE CURING ADHESIVE NITRILE RUBBER BASED**
SPECIFICATION NUMBER:	**DHMS A 6.10**
ISSUE:	**D**
AMENDMENT:	**--**
DATE:	**March 8, 2021**
TOTAL PAGES:	**13**

Prepared by:	**Approved by:**	**Approved by:**
SIGNED ORIGINAL ON FILE		
Shiraz Haniff	**Hai Yen Tran**	**Kenneth Quon**
Materials & Processes	Materials & Processes	Materials & Processes
De Havilland Canada	De Havilland Canada	Bombardier Inc.

THIS DOCUMENT IS CO-OWNED BY DE HAVILLAND AIRCRAFT OF CANADA LIMITED AND BOMBARDIER INC.

De Havilland **Material Specification**	**DHMS:** A6.10 **ISSUE:** D **AMD.:** -- **DATE:** March 8, 2021 **PAGE:** i of ii
ROOM TEMPERATURE CURING ADHESIVE NITRILE RUBBER BASED	

REVISION RECORD

Issue	Page	Description and Reason for Change
D		This is a complete revised issue. Company name changed Updated section 9 Health and Safety Added Environmental Compliance Product 847L is now obsoleted. Replaced with 847 Added 3M France location

De Havilland **Material Specification**	**DHMS:** A6.10 **ISSUE:** D **AMD.:** -- **DATE:** March 8, 2021 **PAGE:** ii of ii
ROOM TEMPERATURE CURING ADHESIVE NITRILE RUBBER BASED	

INTENTIONALLY LEFT BLANK

De Havilland **Material Specification**	**DHMS:** A6.10 **ISSUE:** D **AMD.:** -- **DATE:** March 8, 2021 **PAGE:** 1 of 10
ROOM TEMPERATURE CURING ADHESIVE NITRILE RUBBER BASED	

1. SCOPE

This specification covers the requirements for room temperature curing, one component, nitrile rubber (NBR) based contact cements for bonding thermoplastic and elastomeric materials.

1.1 Classification

The adhesives shall be supplied in one of the following types:
Types:
Type I For bonding NBR seals and gaskets and decorative films
Type II For bonding thermoplastics, cork and velcro

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

2.1. Military Specifications

MIL-C-5541 Chemical Conversion Coating for Aluminum Alloys
MIL-C-27725 Coatings, Corrosion-Preventive, for Aircraft Integral Fuel Tanks
MIL-R-6855 Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes

2.2 Federal Specification

MMM-A-189 Adhesive, Synthetic Rubber, Thermoplastic, General Purpose

2.3 American Society for Testing and Materials

ASTM D903 Peel or Stripping Strength of Adhesive Bonds
ASTM D1002 Strength Properties of Adhesive in Shear by Tension Loading

2.4 De Havilland Specification and Standards

DHLP 3051 180 Degree Peel Test

3. REQUIREMENTS

3.1. General

The Type I and Type II adhesives noted shall meet the requirements specified in **Table 1**.

3.1.1 Material: The basic ingredient used in the manufacture of the adhesives shall be synthetic rubber of the butadiene acrylonitrile type. The cure of the adhesives shall result from the evaporation of carrier solvents and subsequent crystallization if the elastomer component. It shall be possible to reactivate the adhesive by the application if the appropriate solvent (e.g. toluene).

3.2 Physical Properties

3.2.1 Colour: Unless otherwise specified, the adhesive shall be the characteristic yellow colour furnished by the manufacturer.

3.2.2 Appearance: The adhesive shall be of uniform blend and shall be free of skins, lumps, and jelled or coarse particles. There shall be no separation of ingredients which cannot be readily dispersed by mechanical agitation or by hand mixing.

3.2.3 Non-volatile Content: The minimum percent non-volatile content of the Type I and Type II adhesive blends, when tested as specified in **Para. 4.1** shall be 18% and 25% respectively.

3.2.4 Curing Time: The adhesives shall display the properties shown in **Table 1** when cured for 96 hours at 25˚ ± 2˚ C and 50 ± 10% relative humidity.

Table 1

Properties*	Test Method	Requirements
180 degree peel (lb/in.), 180 degree peel, after 24 hours in Jet fuel	DHLP 3051 or ASTM D903	10 minimum 8 minimum

* Test temperature 25±2˚C

3.2.5 Peel Strength: The cured adhesives shall be tested and meet the peel strength requirement as shown in **Table 1**. Test specimens shall be prepared as described in **Para.4.2**.

3.2.6 Resistance to Jet Fuel: Following exposure to Jet A1 (or JP-4) fuel as described in **Para.4.3**, the cured adhesive shall exhibit a reduction in peel strength of no more than 20%.

3.2.7 Storage Life: The storage life of the adhesives shall be a minimum of 15 months from the date of manufacture, when stored at a temperature of 16˚ - 26˚C (60˚ - 80˚F).

3.2.8 Workmanship: Workmanship shall be in accordance with high grade practice for this type of material. It shall be suitable for its intended purpose and free of defects which may affect its performance.

4. TEST METHOD

Note: Prior to sampling preparation, thoroughly mix the adhesive to ensure the homogeneity of the test sample and to exclude lumps etc.

4.1. Nonvolatile Content

Five to ten grams of the adhesive compound shall be poured into a pre weighed dish, approximately 8 centimeters in diameter. A tight fitting pre weighed cover shall immediately be placed over the dish and the weight determined to the nearest milligram. The cover shall then be removed and the dish heated for 24 ± 1 hours at 70˚ ± 1˚ C (158˚ ± 2˚F). At the conclusion of the heated period, the dish shall be transferred to a desiccator, cooled to room temperature and the cover replaced. The final weight shall be determined to the nearest milligram and the percent nonvolatile content calculated as follows:

$$\%\ \text{Non} - \text{Volatile} = \frac{\text{Final Weight} - (\text{Weight of Dish} + \text{Cover})}{\text{Initial Weight} - (\text{Weight of Dish} + \text{Cover})}\ \text{X}\ 100\%$$

4.2. Peel Test

A minimum of three specimens shall be prepared as outlined in either Method A or Method B, as follows:

Method A

1. Apply a chemical conversion film per MIL-C-5541 to a 2024 T3 Clad aluminum panel, 8" x 6" x 0.06".

2. Prime the test panel with fuel tank primer per MIL-C-27725B, Type II, and allow to cure per manufacturer’s instructions.

3. Cut three (3) sections, 8" x 1", of MIL-R-6855, Class 1, 50-60 durometer, nitrile rubber sheet (0.06"T). Lightly abrade the bonding surfaces with 180 grit paper and solvent wipe with MEK or suitable solvent.

4. Apply/brush a light coat of adhesive to both primer and elastomer bonding surfaces. Allow a 1" length of the 8" dimension of the elastomer to remain uncoated (tab length).

Locate the mating surfaces and manually apply pressure to the bonded rubber by means of a 1" paint roller. Allow the specimens to cure under a 1-2 pound weight.

5. Remove the weight after 24 hours cure and attach the tab end of the rubber strip to a test fixture and conduct the peel strength test per **Table 1**.

6. Average the peel loads and record as the peel load per inch width.

Method B - Type I

1. Solvent wipe a 20 gauge CR Steel panel with a cheese fabric soaked in MEK.

2. Brush/apply three heavy coats of adhesive to 6 inches of an 8 inch length of 1 inch wide No.10 cotton duck and two coats to the Steel panel, allowing 10 minute intervals between coats and 10 minutes after the final coat.

3. Position the bonding surface of the cotton duck over the CR steel panel and using a 2 pound roller, apply firm manual pressure while rolling 5 times over the bond length. No pressure is required during adhesive cure.

4. On completion of cure, conduct peel test as described in Method A, para. 5 and 6.

Method B - Type II

1. Solvent wipe a 2024 T3 Clad Aluminum panel with a cheese fabric soaked in naphtha.

2. Brush/apply two coats of adhesive to 6 inches of an 8 inch length of 1 inch wide No.10 cotton duck and one coat to the Aluminum panel, allowing 10 minute intervals between coats and 10 minutes after the final coat.

3. Position the bonding surface of the cotton duck over the Aluminum panel and using a 2 pound roller, apply firm manual pressure while rolling 5 times over the bond length. No pressure is required during adhesive cure.

4. On completion of cure, conduct peel test as described in Method A, para. 5 and 6.

4.3. Resistance to Jet A-1 Fuel

1. Prepare a minimum of three peel test specimens as described in **Para.4.2**.

2. Place the specimens in a one liter beaker containing fuel, ensuring that the bond area is completely immersed. Cover the beaker and allow to stand for 24 hours at ambient temperature.

3. Test the specimens per **Table 1**.

5. MATERIAL QUALIFICATION REQUIREMENTS

5.1 Requests for Qualification

All requests for qualification to this specification shall be addressed to De Havilland Materials Technology Engineering department for approval

All material qualification shall be site specific.

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

5.2 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.

A sample shall be submitted for testing at the discretion of De Havilland Materials Technology.

5.3 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.

5.4 Process Control Document

5.4.1 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.

5.4.2 When qualification has been granted, the PCD shall be signed by the supplier and De Havilland Materials Technology Engineering and shall not be changed without prior written approval of Materials Technology.

5.4.3 The PCD and all production data shall be available to any De Havilland auditors when requested.

5.5 Qualification Approval

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

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

No changes in the method of manufacture and/or formulation shall be made without notification and prior written approval of De Havilland Materials Technology Department.

Re-qualification of the product may be requested by the De Havilland Materials Technology if there are any changes in the method of manufacture and/or formulation.

6. QUALITY ASSURANCE REQUIREMENTS

6.1 Manufacture/Supplier Batch/Lot Acceptance Tests

6.1.1 The manufacturer/supplier is responsible for the performance of all sampling, inspection and testing of each batch/lot as specified in **Table 2.**

6.1.2 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 2**. The report shall include the supplier's batch identification, materials specification and date of testing.

6.1.3 De Havilland Materials Technology 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.

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

6.2 Purchaser/User Batch/Lot acceptance tests

The purchaser/User is required to perform of all sampling, inspection and testing of each batch/lot as specified in **Table 2.**

Table 2: Qualification and Batch Acceptance Tests

Properties	Paragraph	Qualification (Manufacturer/Supplier)	Acceptance (Manufacturer/Supplier/ Purchaser/User)
Non-Volatile Content	Para.3.2.3	X	
Curing Time	Para.3.2.4	X	
Peel Strength	Para.3.2.5	X	X
Resistance to Jet Fuel	Para.3.2.6	X	
Storage Life	Para.3.2.7	X	
Workmanship	Para.3.2.8	X	

6.3 Definitions

6.3.1 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.

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

7. ORDERING DATA

7.1 Prerequisite

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

7.2 Procurement Documents

Procurement documents should specify the following:

- Title, Number, Issue and Amendment Number of this Specification
- Size of Container (Imperial or U.S. measure)
- Total Quantity (Imperial or U.S. measure)
- Acceptance Test Report/Supplier C of C

8. PREPARATION FOR DELIVERY

8.1 Preservation and Packing

The adhesive 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.

8.2 Marking

Each container shall be legibly marked with the follow information:

Adhesive, Nitrile Rubber Base

DHMS A6.10, Type I or Type II

Manufacturer's Name and Product Identification

Date of Manufacture

Date of Mixing

Container Date

Expiry Date

Batch Number

Net Quantity (Imperial or U.S. measure)

8.3 Shipping Documentation

The shipping document shall show:

De Havilland Purchase Order No.

DHMS A6.10, Type I or Type II

Number of Containers

Batch Number

Total Quantity (Imperial or U.S. measure)

Acceptance Test Reports/Supplier C of C

Each shipment shall contain a copy of the Material Safety Data Sheet.

9. HEALTH AND SAFETY DATA

When supplying samples for qualification per Para. 4.2 the supplier shall submit a Safety Data Sheet (SDS) complying with Workplace Hazardous Material Information System (WHMIS) 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 (SDS) must then be supplied with a completed EHS-FO-025 "Application To Introduce A New Material" form to the Material Safety Review Committee.

Upon receipt of EHS-FO-025 "Recommendation" form that approves the use of the material, it can then be included on the Qualified Products List.

9.1 ENVIRONMENTAL COMPLIANCE

Materials and ingredients used in manufacturing the product shall comply to environmental regulations such as REACH, EPA, CPA. Prohibited substances or restricted from certain uses under an Environmental Regulation shall not be used for the specified prohibited applications.

Supplier shall notify De Havilland Aircraft of Canada Limited Materials Technology Engineering department if the product contains targeted substances.

De Havilland **Material Specification**	**DHMS:** A6.10 **ISSUE:** D **AMD.:** -- **DATE:** March 8, 2021 **PAGE:** 10 of 10
ROOM TEMPERATURE CURING ADHESIVE NITRILE RUBBER BASED	

QUALIFIED PRODUCTS LIST

MANUFACTURER NAME AND ADDRESS	MANUFACTURER PRODUCT IDENTIFICATION NO.	DE HAVILLAND QUALIFICATION SHEET NO.	DATE OF PRODUCT APPROVAL
	Type I		
3M Springfield 3211 Chestnut Expy, Springfield, MO 65802 USA	847L (Obsolete) 847	PQS#1	Sept 30, 1996
3M Tilloy Plant, Route de Sancourt, 59554 Tilloy-lez-Cambrai, France			
	Type II		
3M Springfield 3211 Chestnut Expy, Springfield, MO 65802 USA	1099	PQS#2	Sept, 30, 1996

NOTE

MATERIALS CAN ALSO BE PROCURED CERTIFIED TO 3M'S C OF C.

PURCHASER TO PERFORM ACCEPTANCE TESTING AS PER TABLE 2