DE HAVILLAND AIRCRAFT
OF CANADA LIMITED

De Havilland
Material Specification

TITLE:	**ETHER-BASED POLYURETHANE MOULDING MATERIALS**
SPECIFICATION NUMBER:	**DHMS P 1.32**
ISSUE:	**C**
AMENDMENT:	**-**
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DATE: June 17, 2021
PAGE: i of i

REVISION RECORD

Issue	Page	Description and Reason for Change
A		New specification.
B		Clarified product designation and colour.
		Added PCD requirement.
Amd.1	QPL	Prothane address changed
Amd. 2	6	Table 2: Clarified Acceptance testing Hardness, Finishing, colour are required for Manufacturer/Supplier/Purchaser/User.
Amd. 3	2	Classification for Type 2 changed.
		Was: " Durometer Hardness (Shore A75-80)"
		Is: " Durometer Hardness (Shore A 75-85)"
	QPL	Name change for Manufacturer of the polymer system
		Was: " Crompton Corp."
		Is: " Lanxess Solutions US Inc."
Amd. 4	2	Classification for Type 1 changed.
		Was: " Durometer Hardness (Shore A 80-84) "
		Is: " Durometer Hardness (Shore A 75-85) "
C		Revised company name change
	3	Clarify finish requirement
	8	Revised section 8 Health And Safety , standardize with other specifications

ETHER-BASED POLYURETHANE MOULDING MATERIALS

1 SCOPE

This specification covers the requirements for manufactured products (including bar and sheet stock) and casting prepolymer systems based on liquid TDI-Terminated Polyether Prepolymer.

2 CLASSIFICATION

The prepolymer shall be offered in the following types

Type:

Type 1: Durometer Hardness (Shore A 75-85)

Type 2: Durometer Hardness (Shore A 75-85)

3 APPLICABLE DOCUMENTS

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

ASTM D412	Tensile test method for Vulcanized rubber,Thermoplastic Rubber and Elastomers
ASTM D470	Tear Strength for Crosslinked Insulation
ASTM D695	Compressive Properties of Rigid Plastics
ASTM D792	Density and Specific Gravity of Plastics by Displacement
ASTM D2196	Viscosity by Brookfield Viscometer
ASTM D2240	Durometer Hardness

4 REQUIREMENTS

4.1 Physical Properties of Resin

4.1.1 Materials - Materials used in the manufacture of the prepolymer system shall be of the highest quality and suitable for the intended purpose. The prepolymer shall be of the polyether urethane type.

4.1.2 Components - The prepolymer system shall be a two-component type consisting of a polymer base component and a curative (MOCA, Methylene-bis-o-Chloroaniline) component. The curative component should not be batch oriented to the polymer base Component

4.1.3 Working Characteristics - The prepolymer system shall be capable of being mixed to a smooth, homogeneous, air and lump free consistency, suitable for pressure or free moulding parts, bar or sheet stock material.

4.1.4 Pot Life - The time for the prepolymer to achieve viscosity of 200 poises when exposed to temperature of 212^{o}C.

The product shall have a pot life of 14 minutes.

4.1.5 Viscosity - The viscosity of the prepolymer shall be as specified in **Table 1**, when tested in accordance with ASTM D2196.

4.1.6 Storage Life - Storage life of the Prepolymer shall be 24 months from date of shipment, when stored at a temperature of 77°F± 10°F in its original unopened containers .

4.2 Physical Properties of Cured Prepolymer System

4.2.1 Cure:

4.2.1.1 The Prepolymer shall meet all the requirements of this specification after curing for 16 hours at 212°F and 7 days at 75° ± 5°F.

4.2.2 Finish - The moulded or cast parts, bar and sheet stock shall be free from cracks, chipped edges, foreign inclusions and scratches which make definite indentation in the surface. All parts, sheet and bar stock shall be as dimensioned on the drawing. Parts shall be visually inspected for bubbles and surface blisters as follow:

(a) Bubbles less than 0.04 inch in diameter shall be ignored.

(b) A group of bubbles where the diameter of the group is less than 0.0625 inch shall be considered as a single defect.

(c) Bubble dimensions shall be based on the visual estimate of an experienced inspector.

The following conditions shall be cause of rejection:

(a) A single bubble or defect greater than 0.0625 inch in diameter.

(b) Three or more clusters of bubbles in the part, each cluster containing 3 or more bubbles.

4.2.3 Colour - Unless otherwise specifies in the QPL, the moulded or cast parts shall have a natural rubber colour.

4.3 Mechanical Properties

The prepolymer systems cured per Para.4.2.1, covered by this specification, shall meet all the requirements in Table 1. Unless otherwise specified, tested shall be done at 70 ± 5°F and 50 ± 5% relative humidity. No individual value shall be less than 90% of the value specified herein.

TABLE 1. Physical and Mechanical Properties

Test	Reference	Typical Values (minimum)	
		Type 1	Type 2
Viscosity (Centipoises) @86°F	ASTM D2196	7200	17000
Shore A Hardness	ASTM D2240		
Condition 1		75-85	75-85
Condition 2		80	74
Condition 3		84	82
Ultimate Tensile Strength (Psi)	ASTM D412		
Condition 1		4138	3068
Condition 2		3876	3145
Condition 3		2279	1937
Ultimate Elongation (%)	ASTM D412		
Condition 1		622	475
Condition 2		705	463
Condition 3		525	415
Tear Strength (lbs.in)	ASTM D470		
Condition 1		41	43
Condition 2		43	38
Condition 3		54	50
Compression Modulus constant deflection 25% (Psi)	ASTM D695	520	
Specific Gravity (g/cc)	ASTM D792	1.07	
Condition 1: Room temperature, 75± 5°F Condition 2: Immersed in water for 14 days@120± 5°F Condition 3: 5 weeks UV Exposure			

5 QUALITY ASSURANCE

5.1 Qualification

5.1.1 A supplier is responsible for the performance of all qualification testing, as specified in Table 2. A three lots/ batches qualification for any type is required.

5.1.2 A supplier desiring qualification shall submit one copy of a report showing actual qualification test data and a sufficient quantity of product for deHavilland evaluation tests.

5.1.3 Upon review of supplier's data and deHavilland tests, the supplier will be advised either of product qualification or reasons for failure.

5.1.4 The manufacturer of the mould product 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 precedures and requirements, and manufacturing procedures. The PCD shall be approved and signed by Materials Technology and be available for inspection by authorized representatives of Bombardier Aerospace.

5.1.5 Products that 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 Department.

5.1.7 Re -qualification of the product may be requested by Materials Technology if there are 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 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.

5.3 Acceptance Tests

5.3.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for all acceptance tests, as specified in Table 2 of this specification.

5.3.2 The supplier, performing acceptance tests per Para.5.3.1 shall furnish with each batch of product one copy 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.

5.3.3 de Havilland 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 2: Qualification and Batch Acceptance Tests

Test	Paragraph	Qualification (Manufacturer/ Supplier)	Acceptance (Manufacturer/ Supplier/Purchaser/ User)
Viscosity	Para.4.1.5	x	
Hardness	Table 1	x	x
Finish	Para.4.2.2	x	x
Ultimate Tensile	Table 1	x	
Ultimate Elongation	Table 1	x	
Tear Strength	Table 1	x	
Compression Modulus	Table 1	x	
Specific Gravity	Table 1	x	
Colour	Para.4.2.3	x	x

5.4 Definitions

Batch is defined as the end product of all the raw materials mixed and/or manufactured at the same time and place.

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

6 ORDERING DATA

6.1 Prerequisite

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

6.2 Procurement Documents

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 No.)
- Type and Size of Container/package
- Total Quantity

7 PREPARATION FOR DELIVERY

7.1 Preservation and Packing

The polyurethane system or moulded parts 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 4** of this specification.

7.2 Marking

Polymer System

Each container shall be legibly marked with the following information:

- A Polyurethane Product (Conforms to DHMS P1.32)
- Component 1 (Base)
- Component 2 (Curative)
- Manufacturer's Name and Product Identification (Trade Name or Code Number)
- Batch Number

Moulded parts

- A Polyurethane Product (Conforms to DHMS P1.32)
- Manufacturer’s Name and Product Identification (Trade Name or Code Number)
- Batch/lot Number
- Date of Manufactured

7.3 Shipping Documentation

Shipping document shall show:

- The de Havilland Purchase Order Number
- Specification Number
- Quantity
- Batch/Lot Number
- Number of containers (Imperial or U.S. measure).

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

8 HEALTH AND SAFETY DATA

When supplying samples for qualification per Para.5.2.1, 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.

8.1 Environmental Compliance

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

Cured polyurethane articles shall comply to REACH requirement.

Supplier shall notify De Havilland Materials Technology if the product contains targeted substances.

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.	MATERIALS SAFETY DATA SHEET NO.	DE HAVILLAND QUALIFICATION SHEET NO.	DATE OF PRODUCT APPROVAL
	Type 1			
Lanxess Solutions US Inc. Shelton, CT 06484 USA	Adiprene LF800A/MOCA	--	PQS 1	June 30, 2004
	Type 2			
Lanxess Solutions US Inc.	**Polymer System** Adiprene L42/MOCA	1171	PQS 2	June 30, 2004
Prothane Inc. 8219 Esquesing Line Milton, Ontario L9T 2X9	**Moulded Part:** Prothane #153 Colour Gray			