de Havilland Inc.

Material Specification

TITLE:	**BALSA WOOD PANELS**
SPECIFICATION NUMBER:	**DHMS CS 8.01**
ISSUE:	**F**
AMENDMENT:	**---**
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PAGE:	**1 of 9**

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REVISION RECORD

Issue	Page	Description and Reason for Change
D	5	Page 5 has been added. QPL has been created to include Baltek Corp.
E	All	QPL: KMAI has been added to QPL. Clerical errors have been corrected.
F	All	Complete Revision. Detailed changes have have not been noted.

1 SCOPE

This specification covers the requirements for balsa wood bonded to form sheet paneling for composite structure.

1.1 Classification

The materials supplied to this specification shall cover both end-grain and flat-grain balsa panels and shall be one of the following types:

Type AA Aircraft, long fiber clear grade.

Type AL Heavier density, Select grade.

Type ALL Lighter density, Select grade.

2 APPLICABLE DOCUMENTS

The following documents shall form part of this specification to the extent specified herein. In the event of conflicting requirements between this and the specifications listed below, the requirements of this specification shall govern. Where a specific issue of a document is not specified, the current issue shall be used.

2.1 U.S. Government Specifications

2.1.1 Military Specification

MIL-S-7998A - Sandwich Construction Core Material, Balsa Wood

MIL-W-6110 - Wood, Determination of Moisture Content of

2.2 American Society for Testing and Materials

ASTM C-271 -Test Method for Density of Core Materials for Structural Sandwich Constructions

ASTM C- 273 - Standard test method for Shear Properties of Sandwich core materials

ASTM C-365 - Standard Test Method for Flatwise Compressive Properties of Sandwich cores

3 REQUIREMENTS

3.1 Balsa Panels

Balsa panels are manufactured by bonding presized individual pieces of lumber into a large block using an adhesive (as in para 3.3).

3.1.1 End-grain balsa wood panels shall be made by slicing the bonded balsa block across the grain, such that the grain of the "logs" run in the direction of the thickness, and perpendicular to the length and width. The sawn panels from the "logs" shall be sanded to a smooth finish to the thickness dimensions required by the relevant engineering drawing or purchase order with a tolerance of ± 0 .010", unless otherwise specified.

3.1.2 Flat-grain balsa wood panels are made from the above bonded block (as in 3.1), with the grain of the "logs" running parallel with the length.

3.1.3 Width and Length - Stock sizes are acceptable.

3.2 Material - The material used in the manufacture of end-grain and flat-grain balsa shall be of the genus Ochroma Lagopus. It shall be of **Selects grade** of types ALL, AL and **Firsts grade** of type AA whichever is specified on the relevant engineering document.

3.2.1 The balsa shall be kiln dried to have and average moisture content of no more than 12% or less than 5% when tested as per MIL-W-6110.

3.2.2 Density - The average density of the balsa lumber used to make these panels shall be as specified in Table 1, when tested as per ASTM C-271.

3.2.3 The compressive strength and modulus of the balsa wood when tested as per ASTM C-365 shall meet the requirements listed in Table 1.

3.2.4 The shear strength and modulus of the balsa wood when tested as per ASTM C-273 shall meet the requirements listed in Table 1.

3.2.5 Defects - Defects associated with decay, kiln drying defects, such as collapse, water heart, wane and pith, shall be considered as structural defects and are not acceptable. Specific defect limits shall be as follows:

a) Checks and, or splits shall not exceed 1/32" in width.

b) Sound, tight knots will be permitted in grades AL and ALL, but not in grade AA.

c) Honeycomb up to 1/8" in width is acceptable in grades AL and ALL, but not in grade AA, provided that, when two or more rib bands occur in individual pieces, the bands shall not be closer than 1.5" measured in a radial direction.

d) Defects that will cause panels to break or chip in the course of normal handling shall not be permitted.

Table 1: Properties of Balsa Wood

TYPE	DENSITY	SHEAR		COMPRESSIVE	
	lb. per cu. ft. (pcf)	Strength (psi) min	Modulus (ksi) min	Strength (psi) min	Modulus (ksi) min
ALL	4-9	* 120 ** 30 *** 175	* 28.2 ** 3.3 ***12.4	* 518 ** 518 --	* 166 ** 166 --
AL	9-16	* 306 ** 111 *** 410	* 38.4 ** 6.9 ***21.8	* 1620 **1620 --	* 534 ** 534 --
AA	7-10	* 248 ** 79 *** 314	* 34.3 ** 5.9 ***17.4	* 1187 ** 1187 --	* 372 ** 372 --
AA	10-14	* 335 ** 127 ***453	* 40.4 ** 7.7 ***24.4	* 1892 ** 1892 --	* 622 ** 622 --

*** Parallel to the grain (L)**
**** Parallel to the grain (W)**
***** Perpendicular to the grain**

3.2.5.1 Allowable Defects:

a) Mineral stain when not associated with decay.

b) Blue stain when not associated with decay.

c) Scattered pinworm holes.

d) Grub holes not over 1/8" in diameter, provided they do not exceed 30 per sq. ft. in number and are at least 0.5" apart in radial direction.

e) Burl, birdseye, twig specks and pin clusters.

3.3 Adhesive

The adhesive used to assemble the AL and ALL type balsa "logs" to panel size prior to cutting shall be a water resistant, fungi resistant type of sufficient strength to secure the assembled shapes during fabrication of the core parts. For AA grade, a phenol resorcinol adhesive shall be used.

3.4 Identification

Each panel shall be identified in a clear legible manner with the **grade** and **density(lb/cu ft)**. The identification may be marked directly on the panel or on a durable tag attached to the panel.

4 QUALITY ASSURANCE

4.1 Qualification

4.1.1 A supplier is responsible for the performance of all qualification testing, as specified in Table II of this specification. A three lots/batches qualification is required.

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

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

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

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

4.1.6 Requalification of the product may be requested by the purchaser if there are any changes in the method of manufacture and/or formulation.

TABLE II: Qualification and Acceptance Tests

Property	Reference	Qualification	Acceptance
Density	**Table 1**	x	x
Moisture Content	**Para.3.2.1**	x	
Defects	**Para.3.2.5**	x	x
Compressive Strength	**ASTM C-365**	x	
Compressive Modulus	**ASTM C-365**	x	
Shear Strength	**ASTM C-273**	x	
Shear Modulus	**ASTM C-273**	x	

4.2 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.

4.3 Acceptance Tests

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

4.3.2 The supplier performing acceptance tests per Para 4.3.1 shall furnish with each batch of product one copy of an Acceptance Test Report showing actual test data conformance to the acceptance tests specified in Table II. The report shall include the supplier's batch identification.

4.3.3 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

4.3.4 Batch - A batch shall be all the product produced in a single production run from the same lot of raw materials under the same fixed conditions and submitted for inspection at one time.

5 ORDERING DATA

5.1 Prerequisite

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

5.2 Procurement Documents

Procurement documents shall specify the following:

- Title, Number, Issue and Amendment Number of this Specification
- Type of balsa wood, Density
- Manufacturer's Material Designation
- Batch Number
- Total Quantity

5.3 Packaging

The furnished end grain and flat grain balsa panels shall be packaged in such a manner as to give protection from moisture absorption and damage in transit.

5.4 Shipping Documentation

5.4.1 Each shipping container shall have the exterior legibly marked with the following information in such a manner that the markings shall not smear or be obliterated during normal handling or use:

- Balsa wood panels
- DHMS CS 8.01, latest Issue & Amendment (Enter Type), Density
- Manufacturer's Material Designation
- Purchase Order Number
- Batch Number
- Quantity

5.4.2 Containers shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery.

6 Health And Safety Data

When supplying samples for qualification per Para 4.1, 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.

7 DEFINITIONS

Blue Stain - Stain produced by fungi that feed on contents of cells and do not cause appreciable cell wall destruction or breakdown of wood structure.

Birdseye - A grain irregularity consisting of a small central spot with wood fibers arranged about it in the form of an ellipse so as to give the appearance of an eye.

Burl - A hard, woody, hemispherical outgrowth on a tree.

Collapse - Collapse of cellular structure in wood caused by poor kiln drying practice.

Honeycomb - Internal checking of wood structure caused by kiln drying.

Mineral Stain - Stain produced by deposition of mineral substance in cellular structure.

Pith - Soft and spongy inner core of tree, as differentiated from Corcho.

Pinworm Holes - Holes not over 1/16" in diameter.

Twig Specks - Twig knots less than 1/4" in diameter.

Wane - Bark or a lack of wood at a corner or edge.

Water Heart - Water heart is a wet zone of pyramidal or conical shape, usually limited to the lower 5 to 8 feet of butt logs.

Corcho - Low density Balsa having a density of less than 0.08 (based on weight and volume when oven dried) as applied to any portion of the balsa wood.

QUALIFIED PRODUCTS LIST

MANUFACTURER'S NAME AND ADDRESS	MANUFACTURER'S PRODUCT IDENTIFICATION NO.	DE HAVILLAND PRODUCT QUALIFICATION SHEET NO.	DATE OF PRODUCT APPROVAL
Baltek Corporation, 10 Fairway Court Northvale, NJ 07647 Ph: (201) 767-1400 Fax: (201) 387-6631	End-grain Balsa Panels	PQS #1	August 16, 1999
Koshii Maxelum America. Inc. P.O. Box 352 Poughkeepsie, N.Y. 12602 Ph: (914) 471-0500 Fax: (914) 471-7842	End-grain Balsa Panels	PQS #2	October 19, 1999
Baltek Corporation, 10 Fairway Court Northvale, NJ 07647 Ph: (201) 767-1400 Fax: (201) 387-6631	Flat-grain Balsa Panels	PQS #3	March 23, 2000