

**ASPEN VS. BLACK POPLAR DIFFERENCES
PHASE I - WAFERBOARD/OSB
FP 2.6.1**

**ALBERTA RESEARCH COUNCIL
INDUSTRIAL TECHNOLOGIES DEPARTMENT
FOREST PRODUCTS PROGRAM¹**

1987

**This is a joint publication of Forestry Canada
and the Alberta Forest Service pursuant to the
Canada-Alberta Forest Resource Development Agreement**

¹Edmonton, Alberta

Project # 2760-30

DISCLAIMER

The study on which this report is based was funded in part under the Canada/Alberta Forest Resource Development Agreement.

The views, conclusions and recommendations are those of the authors. The exclusion of certain manufactured products does not necessarily imply disapproval nor does the mention of other products necessarily imply endorsement by Forestry Canada or the Alberta Forest Service.

**(c) Minister of Supply and Services Canada 1987
Catalogue No.: FO 42-91/26-1988E
ISBN: 0-662-15968-3**

Additional copies for this publication are available at no charge from:

**Forestry Canada
Regional Development
5320 - 122nd Street
Edmonton, Alberta
T6H 3S5
Telephone: (403) 435-7210**

or

**Forestry, Lands and Wildlife
Forest Industry Development Division
108th Street Building
#930, 9942 - 108th Street
Edmonton, Alberta
T5K 2J5
Telephone: (403) 422-7011**

EXECUTIVE SUMMARY

1. Specimens

Aspen and black poplar trees were logged from the same site near Slave Lake and then waferized at Weldwood of Canada's OSB mill.

2. Analysis of Anatomical, Chemical and Physical Properties

The Department of Agricultural Engineering, University of Alberta, conducted this study. Black poplar has higher moisture content, wider vessels, coarser texture than aspen. The combination of low density and high moisture content variation in black poplar may be one of the major problems in controlling uniformity of wafer surfaces. (It is reported separately.)

3. Panels

Thirty panels were manufactured from aspen and black poplar. Experience indicates that it is technically feasible to manufacture panels from black poplar.

4. Panel Properties

At the 2.0% resin level, the properties of the panels made from these two materials are comparable.

5. Quality

Consistent product quality depends on consistent material going to the hot press. To maintain product quality when introducing significant volumes of black poplar, it may be necessary to set up a separate line and introduce dry wafers on a metered basis.

TABLE OF CONTENTS

	PAGE
DISCLAIMER	1
EXECUTIVE SUMMARY	ii
1. OBJECTIVES AND GOALS	1
2. INTRODUCTION	1
3. METHODS AND MATERIALS	2
3.1 Logging	2
3.2 Analysis of Anatomical, Chemical and Physical Differences	2
3.3 Methods for Panel Manufacture	2
3.3.1 Blending of Materials	4
3.3.2 Forming of the Mat	4
3.3.3 Pressing of the Panels	5
3.4 Methods for Panel Testing and Evaluation	7
4. RESULTS AND DISCUSSION	9
4.1 Analysis of Anatomical, Chemical and Physical Differences	9
4.2 Results and Discussion of Manufacture	9
4.3 Test Results	9
5. CONCLUSIONS	17
6. COMMERCIAL SIGNIFICANCE	17
7. RECOMMENDATIONS	17
8. ACKNOWLEDGEMENTS	17
9. REFERENCES	18
APPENDICES	19

PAGE

LIST OF APPENDICES

APPENDIX I:	Reichhold Technical Bulletin for IB-947 Phenolic Powdered Resin.....	20
APPENDIX II:	Data Summary - Aspen.....	22
APPENDIX III:	Data Summary - Black Poplar.....	50

LIST OF FIGURES IN MAIN REPORT

Figure 1:	Logging Site.....	3
Figure 2:	Typical Press Cycle.....	6
Figure 3:	Panel Cut-up Pattern.....	8
Figure 4:	Dry MOR vs Resin Content.....	11
Figure 5:	Dry MOE vs Resin Content.....	12
Figure 6:	2 Hour Boil MOR vs Resin Content.....	13
Figure 7:	Internal Bond vs Resin Content.....	14
Figure 8:	Thickness Swell vs Resin Content.....	15
Figure 9:	Linear Expansion vs Resin Content.....	16

LIST OF TABLES IN REPORT

Table 1:	Experimental Design.....	4
Table 2:	Summary Table - General and Grade Properties.....	10

LIST OF TABLES IN APPENDIX II

		<u>PAGE</u>
Table II-1:	Thickness Tolerance - Aspen 1.5% Resin	23
Table II-2:	Moisture Content and Density - Aspen 1.5% Resin	24
Table II-3:	MOR & MOE DRY - Parallel - Aspen 1.5% Resin	25
Table II-4:	MOR & MOE DRY - Perpendicular - Aspen 1.5% Resin	26
Table II-5:	Internal Bond - Aspen 1.5% Resin	27
Table II-6:	Bond Durability - MOR after 2 Hr Boil - Parallel Aspen - 1.5% Resin	28
Table II-7:	Bond Durability - MOR after 2 Hr Boil - Perp. Aspen - 1.5% Resin	29
Table II-8:	Thickness Swell - Aspen 1.5% Resin	30
Table II-9:	Linear Expansion - O.D. to Saturated - Aspen 1.5% Resin	31
Table II-10:	Thickness Tolerance - Aspen 2.0% Resin	32
Table II-11:	Moisture Content and Density - Aspen 2.0% Resin	33
Table II-12:	MOR & MOE DRY - Parallel - Aspen 2.0% Resin	34
Table II-13:	MOR & MOE DRY - Perpendicular - Aspen 2.0% Resin	35
Table II-14:	Internal Bond - Aspen 2.0% Resin	36
Table II-15:	Bond Durability - MOR after 2 Hr Boil - Parallel Aspen - 2.0% Resin	37
Table II-16:	Bond Durability - MOR after 2 Hr Boil - Perp. Aspen - 2.0% Resin	38

	<u>PAGE</u>
Table II-17: Thickness Swell - Aspen 2.0% Resin	39
Table II-18: Linear Expansion - O.D. to Saturated - Aspen 2.0% Resin	40
Table II-19: Thickness Tolerance - Aspen 2.5% Resin	41
Table II-20: Moisture Content and Density - Aspen 2.5% Resin	42
Table II-21: MOR and MOE DRY - Parallel - Aspen 2.5% Resin	43
Table II-22: MOR & MOE DRY - Perpendicular - Aspen 2.5% Resin	44
Table II-23: Internal Bond - Aspen 2.5% Resin	45
Table II-24: Bond Durability - MOR after 2 Hr Boil - Parallel Aspen - 2.5% Resin	46
Table II-25: Bond Durability - MOR after 2 Hr Boil - Perp. Aspen - 2.5% Resin	47
Table II-26: Thickness Swell - Aspen 2.5% Resin	48
Table II-27: Linear Expansion - O.D. to Saturated - Aspen 2.5% Resin	49

LIST OF TABLES IN APPENDIX III

Table III-1: Thickness Tolerance - Black Poplar 1.5% Resin	51
Table III-2: Moisture Content and Density - Black Poplar 1.5% Resin	52
Table III-3: MOR & MOE DRY - Parallel - Black Poplar 1.5% Resin	53
Table III-4: MOR & MOE DRY - Perpendicular - Black Poplar 1.5% Resin	54
Table III-5: Internal Bond - Black Poplar 1.5% Resin	55

	<u>PAGE</u>
Table III-6: Bond Durability - MOR after 2 Hr Boil - Parallel Black Poplar - 1.5% Resin	56
Table III-7: Bond Durability - MOR after 2 Hr Boil - Perp. Black Poplar - 1.5% Resin	57
Table III-8: Thickness Swell - Black Poplar 1.5% Resin	58
Table III-9: Linear Expansion - O.D. to Saturated Black Poplar 1.5% Resin	59
Table III-10: Thickness Tolerance - Black Poplar 2.0% Resin	60
Table III-11: Moisture Content and Density - Black Poplar 2.0% Resin	61
Table III-12: MOR & MOE DRY - Parallel - Black Poplar 2.0% Resin	62
Table III-13: MOR & MOE DRY - Perpendicular - Black Poplar 2.0% Resin	63
Table III-14: Internal Bond - Black Poplar 2.0% Resin	64
Table III-15: Bond Durability - MOR after 2 Hr Boil - Parallel Black Poplar - 2.0% Resin	65
Table III-16: Bond Durability - MOR after 2 Hr Boil - Perp. Black Poplar - 2.0% Resin	66
Table III-17: Thickness Swell - Black Poplar 2.0% Resin	67
Table III-18: Linear Expansion - O.D. to Saturated Black Poplar - 2.0% Resin	68
Table III-19: Thickness Tolerance - Black Poplar 2.5% Resin	69
Table III-20: Moisture Content and Density - Black Poplar 2.5% Resin	70
Table III-21: MOR & MOE DRY - Parallel - Black Poplar 2.5% Resin	71
Table III-22: MOR & MOE DRY - Perpendicular - Black Poplar 2.5% Resin	72

	<u>PAGE</u>
Table III-23: Internal Bond - Black Poplar 2.5% Resin	73
Table III-24: Bond Durability - MOR after 2 Hr Boil - Parallel Black Poplar - 2.5% Resin	74
Table III-25 Bond Durability - MOR after 2 Hr Boil - Perp. Black Poplar - 2.5% Resin	75
Table III-26: Thickness Swell - Black Poplar 2.5% Resin	76
Table III-27: Linear Expansion - O.D. to Saturated Black Poplar - 2.5% Resin	77

1. OBJECTIVES AND GOALS

The following objectives and goals for the year ended March 31, 1987, are as set out in Proposal for Basic 1986/1987 Funding of the ARC Forest Products Program to the B.4 Canada-Alberta Forest Resource Development Agreement Committee, Document No. 86-PFP-8, March 10, 1986, and as agreed to by C-A FRDA.

Project #2.6: WOOD AND WOOD QUALITY

Objective of the Project:

To identify and quantify factors affecting quality.

Study #2.6.1: ASPEN VS BLACK POPLAR DIFFERENCES: PHASE 1 - WAFERBOARD/OSB

Objective of this Study:

To explore chemical differences between species and the effect on panel quality.

Goals for this Year:

By defining differences, it may be possible to alter manufacturing procedures to overcome these differences. Basic chemical and physical analysis of species. Panel manufacture. Comparison of products. Suggestions to modify properties.

2. INTRODUCTION

This report is submitted to the B.4 Committee, Canada-Alberta Forest Resource Development Agreement (C-A FRDA) by the Forest Products Program, Industrial Technologies Department, Alberta Research Council. It covers the activities for the year 1986/1987 under Study #2.6.1: Aspen vs Black Poplar Differences: Phase 1 - Waferboard/OSB.

Results from private mill trials, and from continued use in mills outside the province, indicate that Black Poplar can be used but that there are problems of extra costs associated with logging, waferizing, drying, and panel manufacture.

At present, Aspen is the only hardwood species used in the manufacture of OSB/waferboard in Alberta. The use of Black Poplar, which is a common species in Alberta and northern Canada, would reduce logging and raw material costs. The major drawback to the use of Black Poplar is its high moisture content which creates difficulties in strand preparation -- Black Poplar gums up the waferizing knives, and the Black Poplar chips are both harder to dry and harder to dry evenly.

Where Black Poplar has been used in mills for prolonged periods, there have been reports of difficulties in waferizing and of problems with quality. These are likely related. Difficulties in waferizing would

reduce strand quality -- in terms of greater strand surface roughness and increased fines production -- which, in turn, would reduce panel properties. This study did not evaluate manufacturing problems or reductions in panel properties owing to extended use of black poplar in the plants.

The aim of this study was to analyze differences and to compare the properties of panels made from the two species.

3. METHODS AND MATERIALS

3.1 Logging

Aspen and black poplar were logged near Weldwood of Canada Ltd.'s plant near Slave Lake, Alberta in September 1986. The logs were waferized by Weldwood and delivered for Forest Products Program for drying and panel manufacture. Figure 1 shows the logging site.

The area chosen to log the aspen and black poplar showed the stand to be 80 years old. Analysis by the University of Alberta indicated the trees were 110 to 120 years old.

3.2 Analysis of Anatomical, Chemical and Physical Differences

A contract was awarded to the Department of Agricultural Engineering, University of Alberta, to study the anatomical, chemical and physical differences of aspen and black poplar wood samples collected during logging.

The report by Dr. Michael M. Micko, Research Director/Principal Investigator, is published separately.

3.3 Methods for Panel Manufacture

Thirty panels of aspen and black poplar at three resin levels were manufactured as per Table 1. Six groups with five panels per group were made.

All panels were manufactured on the 2' x 4' (610 mm x 1220 mm) press. Nominal thickness was 11.1 mm. Mats were hand-felted and random oriented, with wax at 1.2% of OD flake weight. Resin was phenol formaldehyde. Target density was 650 kg/m³.



Figure 1: Logging Site

Table 1
EXPERIMENTAL DESIGN -
PANELS MANUFACTURED FOR STUDY OF
ASPEN AND BLACK POPLAR DIFFERENCES

Species	Resin Content		
	1.5%	2.0%	2.5%
Aspen	5 panels	5 panels	5 panels
Black Poplar	5 panels	5 panels	5 panels

3.3.1 Blending of Materials

Blending of the materials was done in a 2440 mm (8 ft) diameter, 1220 mm (4 ft) deep laboratory drum blender. The rotation of the blender was maintained at approximately 23 rev/min. to provide a cascade of the furnish. The blending cycle was as follows:

- i) Melted wax was applied to the furnish through three atomizing spray nozzles at a rate of approximately 180 g/min. A sight glass on the wax pot was used to measure the quantity applied.
- ii) A weighed quantity of powder resin was added to the furnish in the drum.
- iii) The material was mixed for nine (9) minutes to allow the resin to spread evenly onto the furnish.

The material was mixed in batches of 45 kg green furnish weight.

3.3.2 Forming of the Mat

Each mat of furnish was formed by hand in a 770 x 1320 mm retaining box. The furnish was dispersed in small quantities in order to reduce stacking and bridging of the strands which alter the bulk density. The mat was continually weighed during the forming process to achieve consistent densities from panel to panel.

The mats were transported in and out of the press on top of a 685 x 1295 mm, 3.2 mm thick steel caul plate. An identical caul plate was placed over the formed mat prior to it being pressed.

3.3.3 Pressing of the Panels

The panels were pressed in a 712 x 1320 mm platen area laboratory hot press. The platens of this 500 ton capacity hydraulic press are heated electrically (maximum 70 kW of power available).

The platen temperature was set at 205 deg. C. Measurement of the coreline temperature was taken for a few panels to ensure that the core was attaining a high enough temperature for the resin to cure. The measurements were taken by a thermocouple positioned approximately at mid-thickness of the panel and 130 mm from the edges of one corner. Coreline temperature measurements were only recorded for low density panels, since the rate of temperature rise increases with increased pressure. A typical press cycle is shown in Figure 2.

All panels were pressed to metal stops positioned at the four corners of the platens. The stops equalized the panel thickness at the four corners of the panel, but did not significantly alter the total pressure on the panel. A press schedule (to pressure setpoint) was run from a programmable process controller for each press cycle in order to ensure that very little press load would be taken by the stops.

The press schedule consisted of the following four basic load stages:

- a) Compression at a high maximum pressure.
- b) Compression at an intermediate pressure to attain the target thickness.
- c) Hold at low pressure to maintain constant thickness.
- d) Decompression to nearly no press load to allow the steam to be slowly released from the core of the panel.

The pressure on the panel (assuming no load was taken by the stops) can be calculated by dividing the press load by the panel dimensional area:

$$\text{Panel Pressure [KPa]} = \frac{\text{Press Load [kN]}}{.685 \text{ m} * 1.250 \text{ m}} = 1.17 * \text{Press Load [kN]}$$

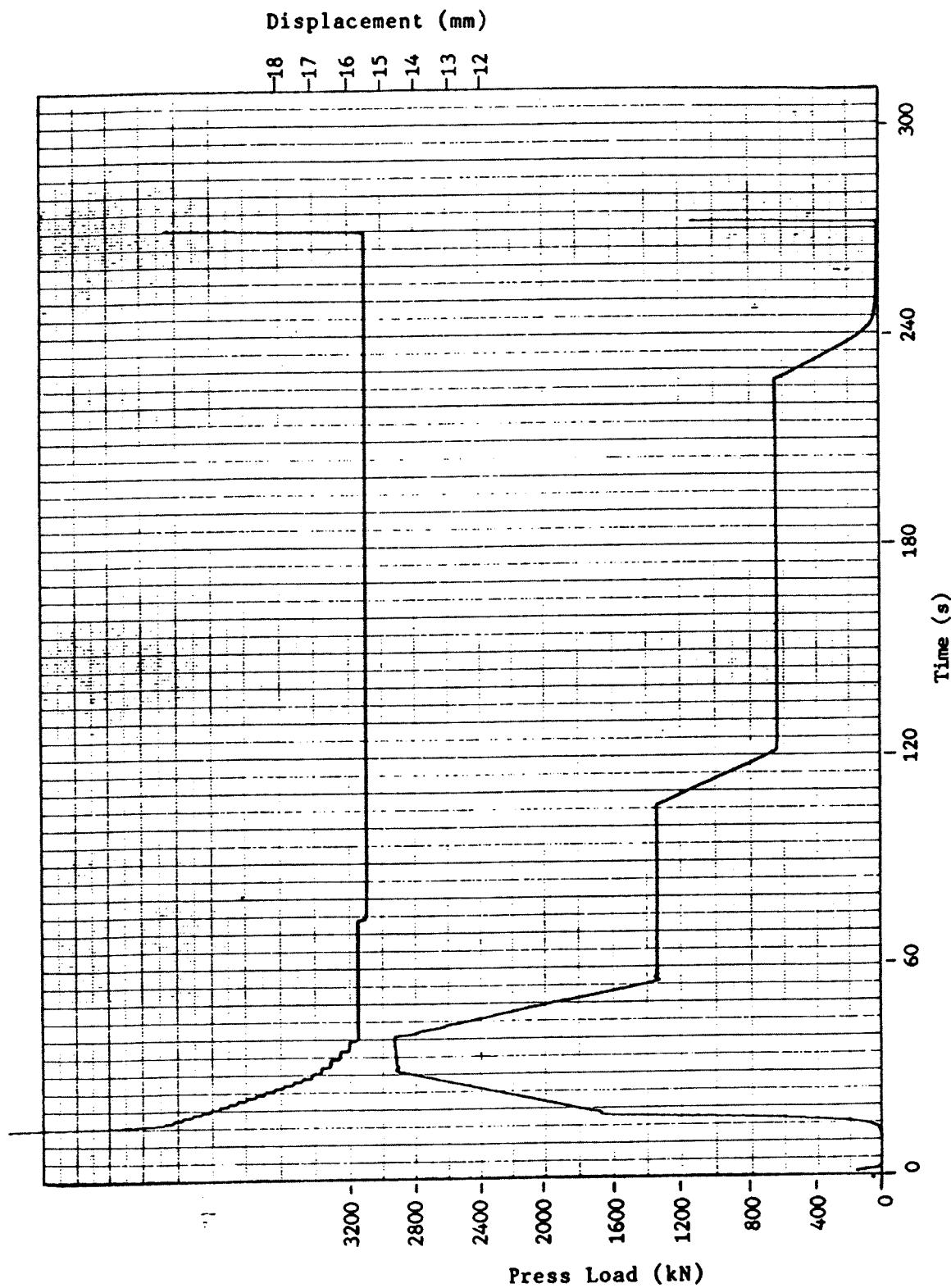


Figure 2: Typical Press Cycle

The plots of the press load also show the displacement between top and bottom platen measured by an LVDT positioned at one corner of the platens. This distance does not correspond to the actual panel thickness because of the zero offset caused by the thickness of the cauls and a small zero error. This measurement is, however, constant from panel to panel.

Panel thickness measurements with a micrometer and weight were taken after each panel was produced in order that the press cycle could be modified to attain the target thickness and density values.

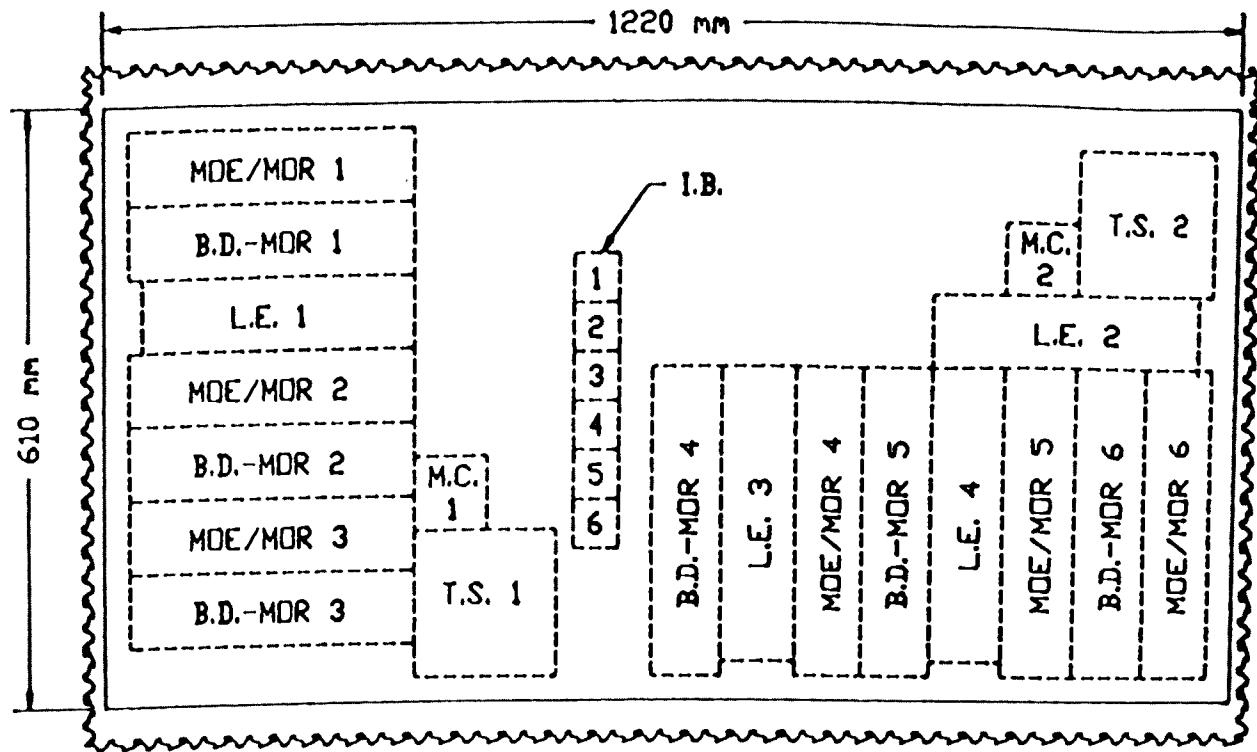
Enough panels were made to obtain at least five (5) "test" panels for each group. "Test" panels required that the density be within 10 kg/m³ (0.6 lb/ft³) of the target density and the average thickness be within 0.3 mm (0.012 in.) of the target thickness.

3.4 Methods for Panel Testing and Evaluation

Tests were conducted according to CAN3-0437.1-M, for most panel properties, and according to ASTM D1037 for moisture content and density.

Test methods are summarized in Figure 3.

Figure 3: Panel Cut-up Pattern for 610 x 1220 mm Panels



Legend	Number	Size	Test
MOE/MOR	6 (1,2,3 para. 4,5,6 perp.)	75 x 315 mm	Modulus of Elasticity and Modulus of Rupture
B.D.-MOR	6 (1,2,3 para. 4,5,6 perp.)	75 x 315 mm	Bond Durability- MOR after 2 h boil
L.E.	4 (1,2 para. 3,4 perp.)	75 x 300 mm	Linear Expansion- oven dry to saturated
I.B.	6	50 x 50 mm	Internal Bond
T.S.	2	150 x 150 mm	Thickness Swell- 24 h soak
M.C.	2	75 x 75 mm	Moisture Content and Density

4. RESULTS AND DISCUSSION

4.1 Analysis of Anatomical, Chemical and Physical Differences

This report was completed by the Department of Agricultural Engineering, University of Alberta. Significant findings include the following:

- * many Black Poplar trees have much higher moisture content in the heartwood zone than in the sapwood;
- * Black Poplar has somewhat wider vessels than aspen, which contributes to the coarser texture and lower density of Black Poplar; and
- * the combination of low density and high moisture content variation in Black Poplar may be one of the major problems in controlling uniformity of wafer surfaces.

4.2 Results and Discussion of Manufacture

Thirty panels were manufactured.

It was concluded that it is technically feasible to manufacture OSB/Waferboard from strands of Black Poplar. Manufacturing equipment used for aspen can also be used for Black Poplar.

In this study the species were run separately. Feasibility of mixing should be evaluated.

4.3 Test Results

Plots of Modulus of Rupture (MOR), Modulus of Elasticity (MOE), Bond Durability - MOR after 2 Hr. Boil, Internal Bond, Thickness Swell and Linear Expansion - Oven Dry to Saturated are shown in Figure 4 to 9 respectively. Tables of individual test results are shown in Appendix II for Aspen and in Appendix III for Black Poplar. A summary of test results is shown in Table 2. Except for Black Poplar at 1.5% resin content, all panel groups exceeded the CAN3-0437.0-M85 requirements for random panels (R-1). The thickness swell of Black Poplar panels at 1.5% resin content was 27%, whereas the maximum allowable in the standard is 25%.

The properties of the Black Poplar panels were comparable to the Aspen panels. Only internal bond and thickness swell properties of Black Poplar were significantly lower than those of Aspen. However, except for thickness swell of Black Poplar at 1.5% resin content, the internal bond and thickness swell of Black Poplar at the three resin levels exceeded CSA 0437 requirements.

10
Table 2

SUMMARY TABLE
GENERAL and GRADE PROPERTIES

Client: Alberta Research Council
Test Date: January 9 & 15, 1987
Project No.: 303261-13261

Test Material: Aspen & Black Poplar Waferboard
Nom. Thickness: 11.1 mm
Conditioning: As Received

	Units	CAN3-0437 R-1 Req.	Samples Tested (N=)	Resin Content					
				Aspen 1.5%	Aspen 2.0%	Aspen 2.5%	Black Poplar 1.5%	Black Poplar 2.0%	Black Poplar 2.5%
Modulus of rupture	MPa	17.2	15	32.8	31.0	36.8	30.8	32.5	33.0
		17.2	15	31.6	35.0	39.7	32.9	32.2	33.3
		Avg	32.2	33.0	38.3	31.9	32.4	33.2	
Modulus of elasticity	MPa	3100	15	5300	5100	5400	4800	4900	4900
		3100	15	5200	5500	5800	5100	5000	5000
		Avg	5300	5300	5600	5000	5000	5000	5000
Internal bond	MPa	0.345	30	0.567	0.640	0.719	0.470	0.487	0.459
Bond durability - MOR after 2 h boil	MPa	8.6	15	16.3	17.1	19.2	18.2	18.8	16.9
		8.6	15	19.0	19.3	20.2	17.9	17.2	18.6
		Avg	17.7	18.2	19.7	18.1	18.0	17.8	
Thickness swell									
- 24 h soak	\$	25	10	21	16	19	29	21	21
- 12.7 mm or thinner	\$								
Linear expansion - oven dry to saturated	\$	0.40	10	0.21	0.23	0.21	0.24	0.19	0.24
		0.40	10	0.24	0.23	0.21	0.21	0.19	0.19
		Avg	0.23	0.23	0.21	0.23	0.19	0.22	
Density	kg/m ³	None	10	668	665	672	657	655	682
Moisture Content	\$	Max. 8	10	3	3	3	2	2	3

FOREST PRODUCTS LABORATORY
ALBERTA RESEARCH COUNCIL

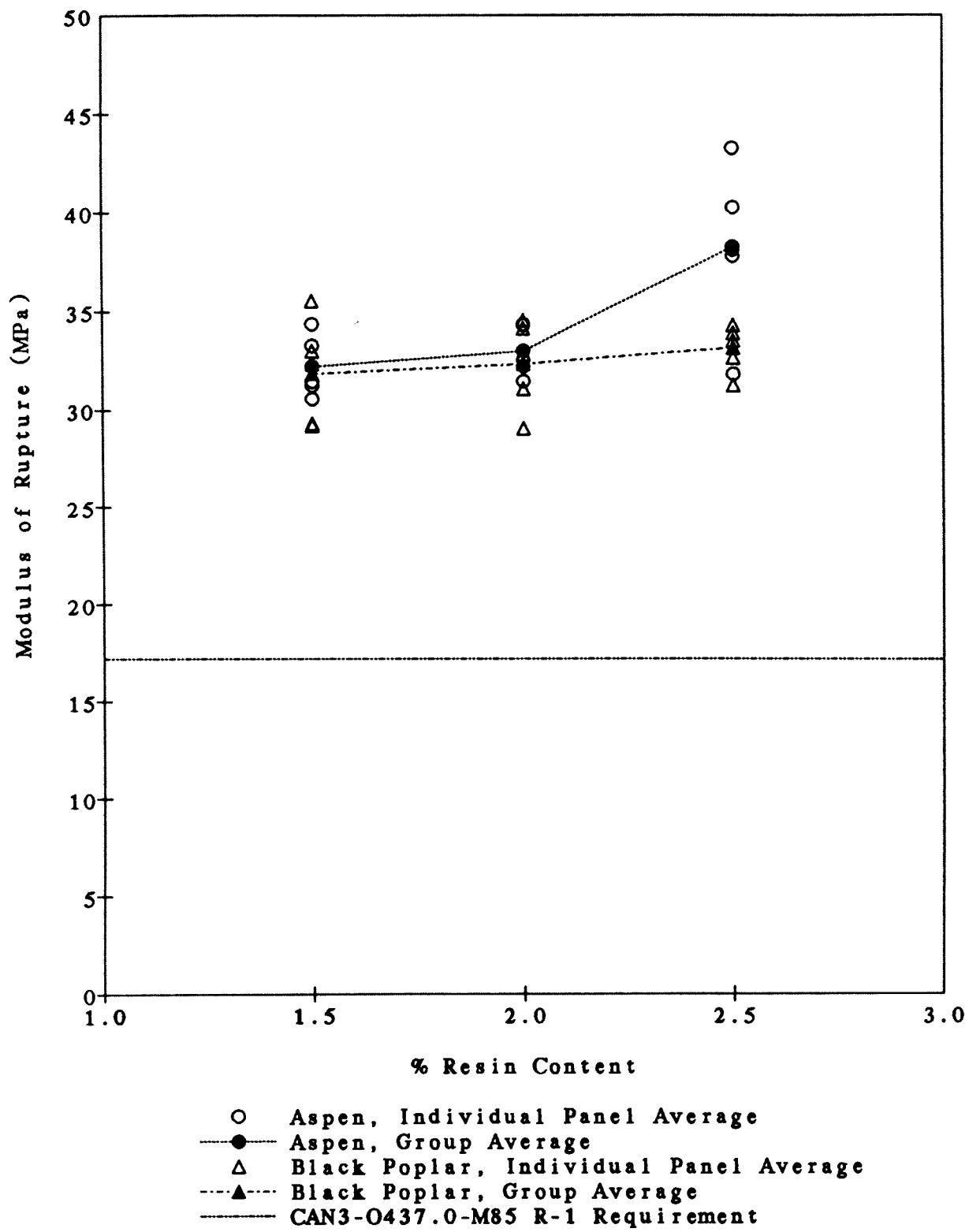


Figure 4: Dry MOR vs Resin Content
(Parallel and Perpendicular Test Combined)

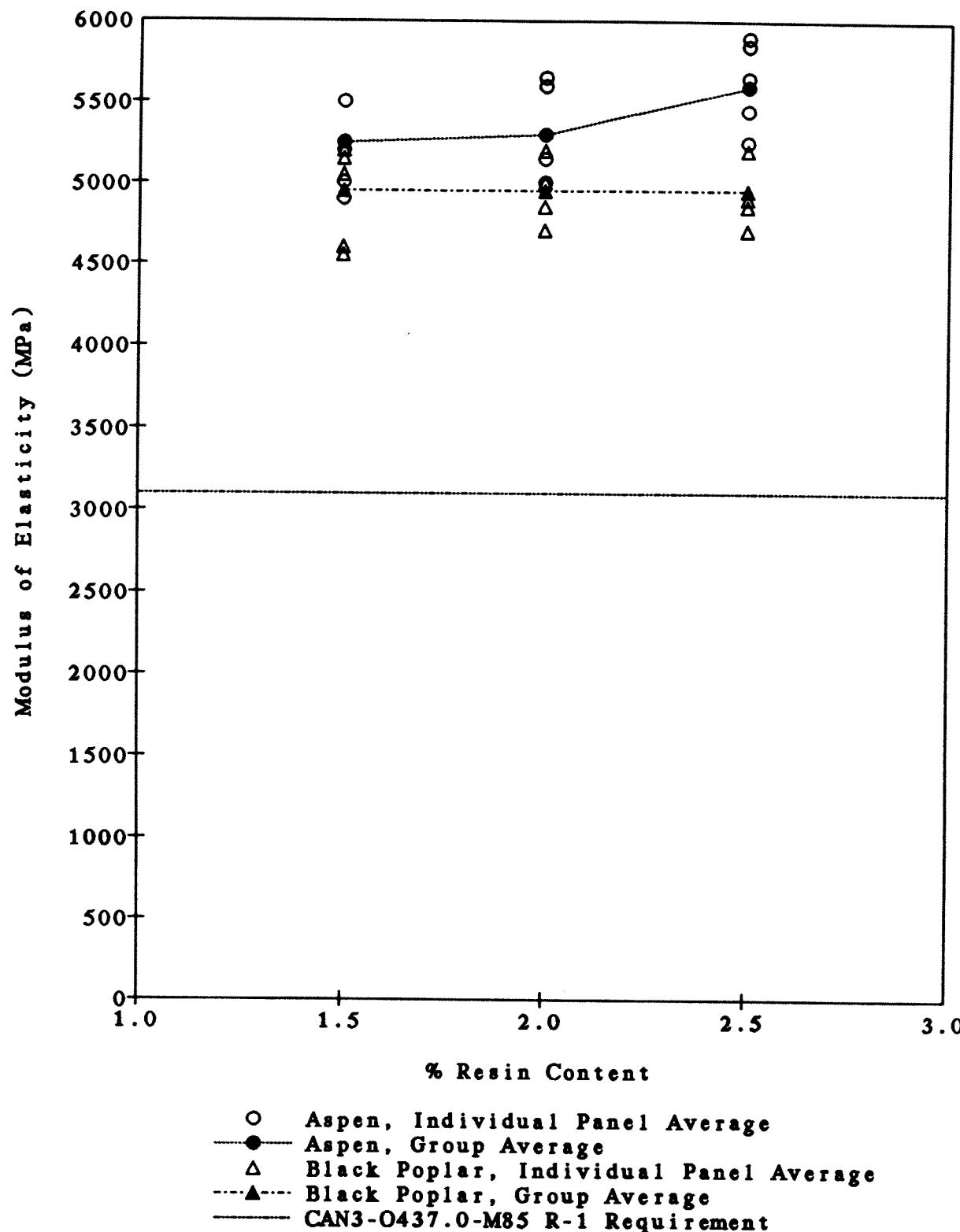


Figure 5: Dry MOE vs Resin Content
(Parallel and Perpendicular Tests Combined)

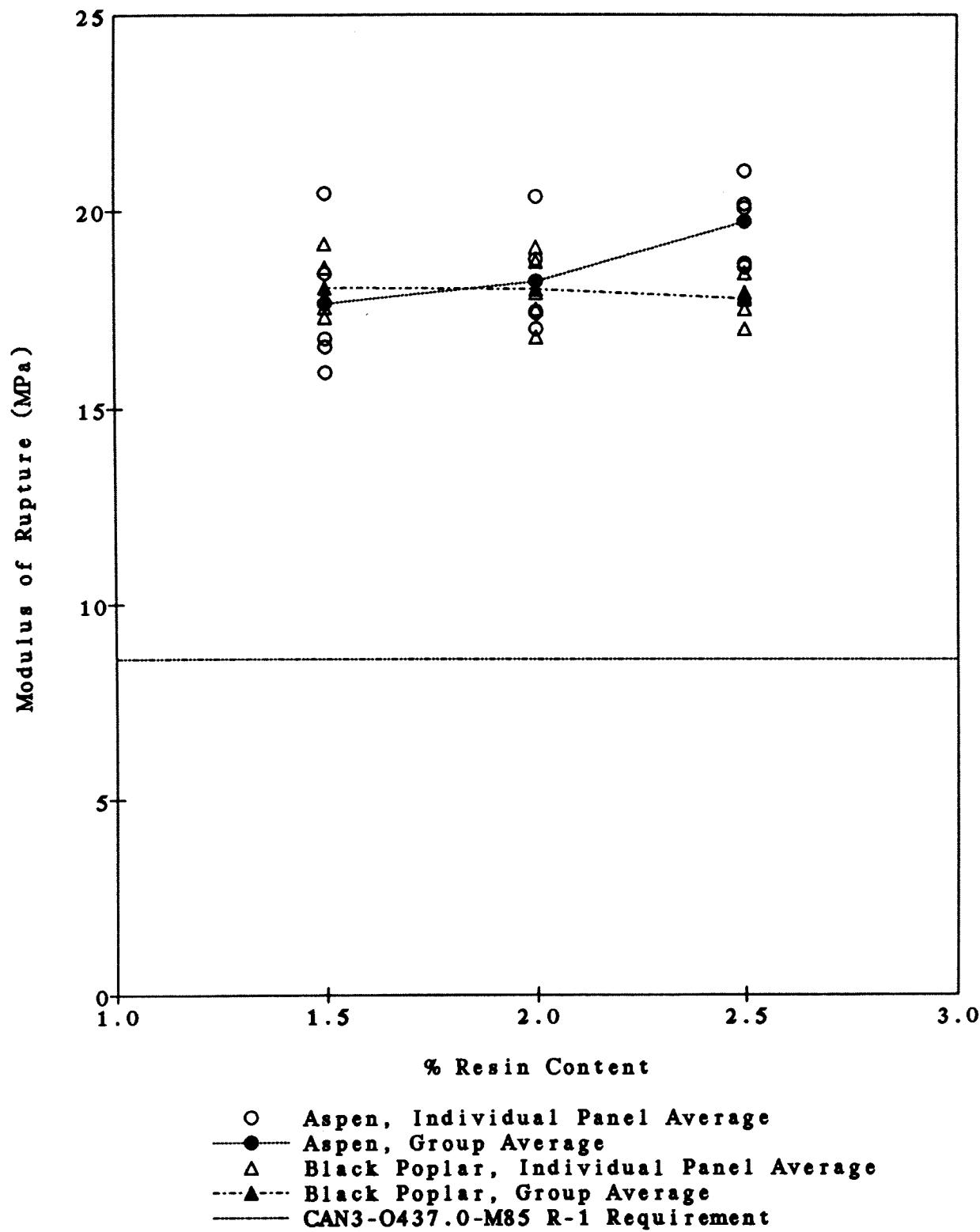


Figure 6: 2 Hour Boil MOR vs Resin Content
(Parallel and Perpendicular Tests Combined)

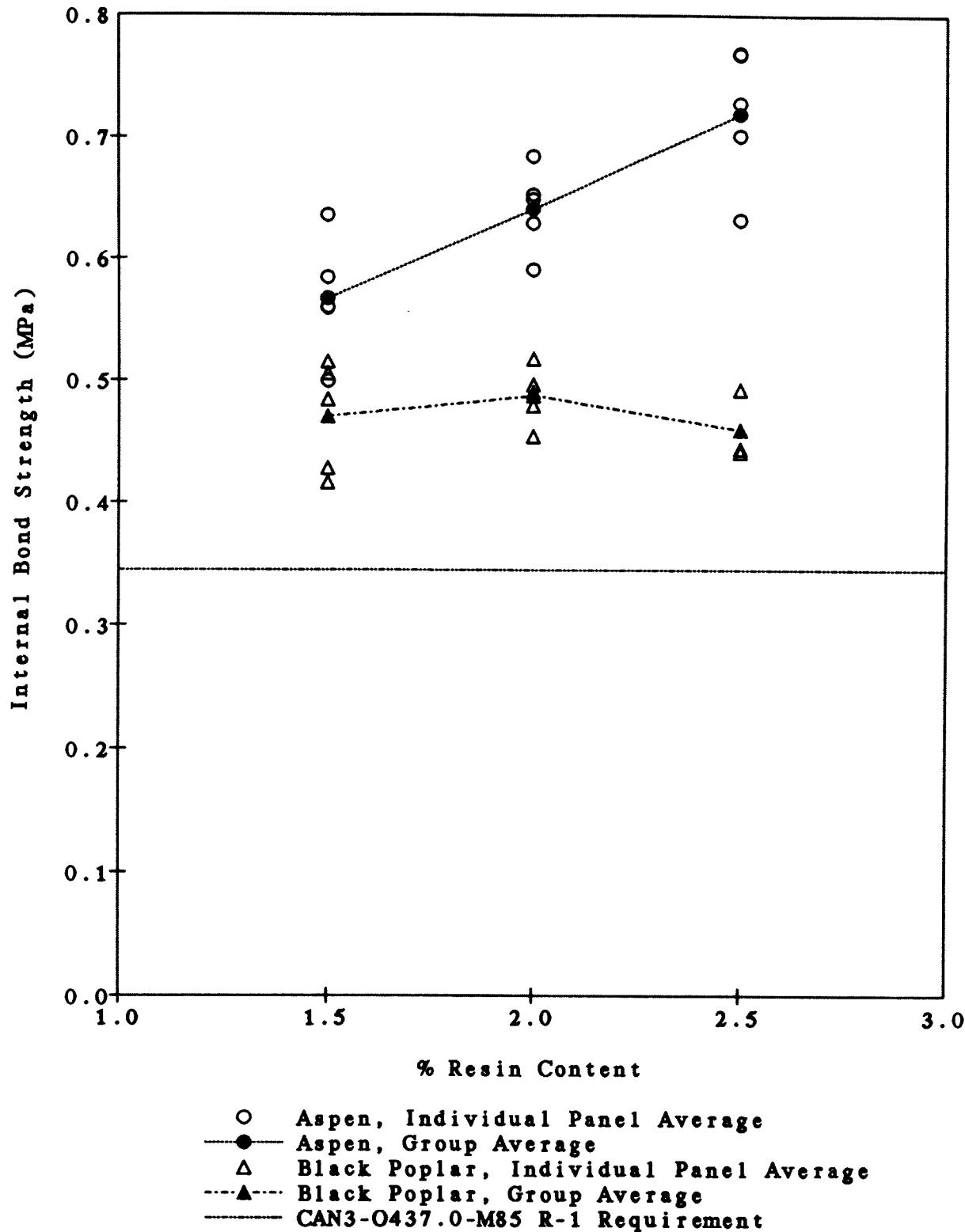


Figure 7: Internal Bond vs Resin Content

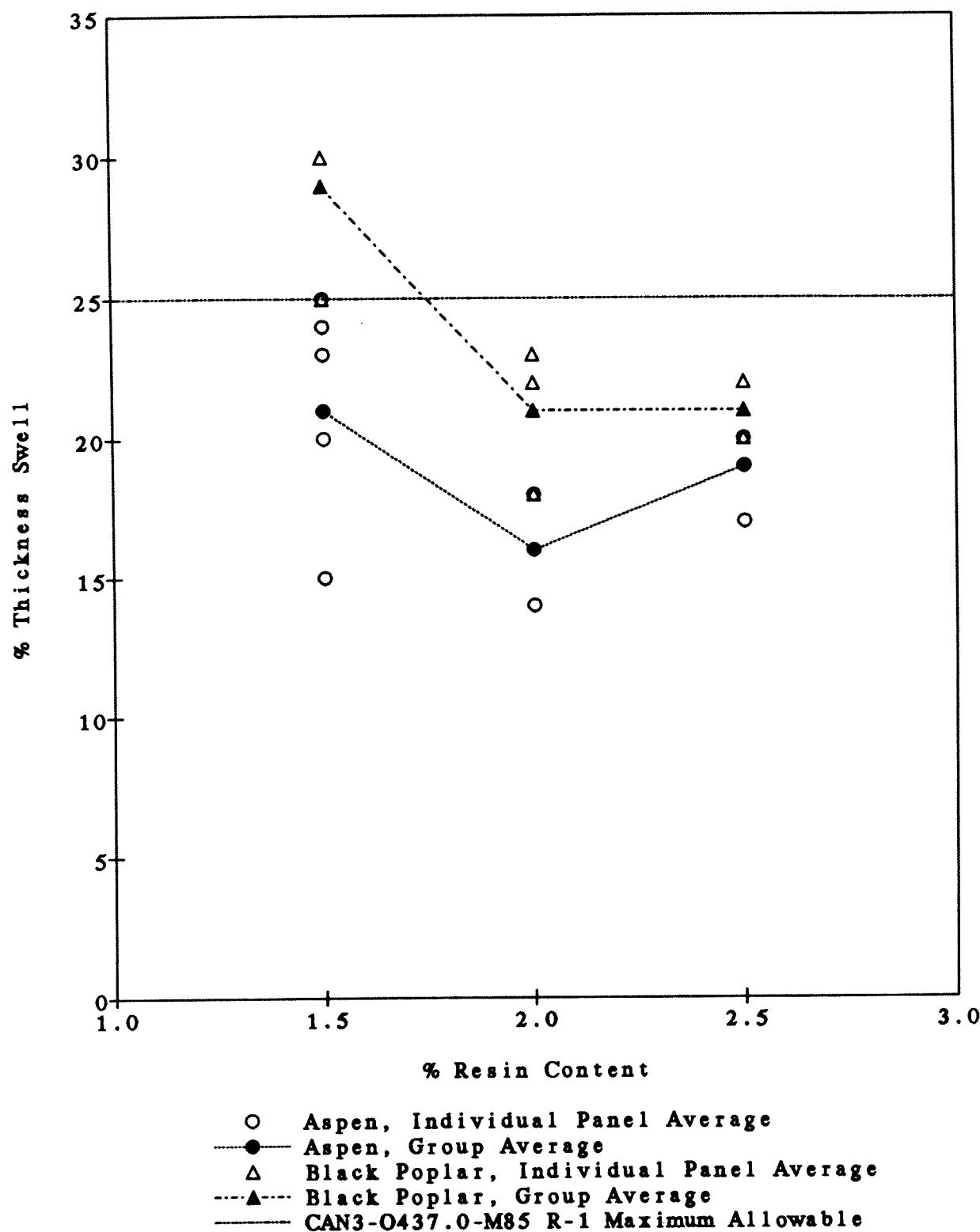


Figure 8: Thickness Swell vs Resin Content

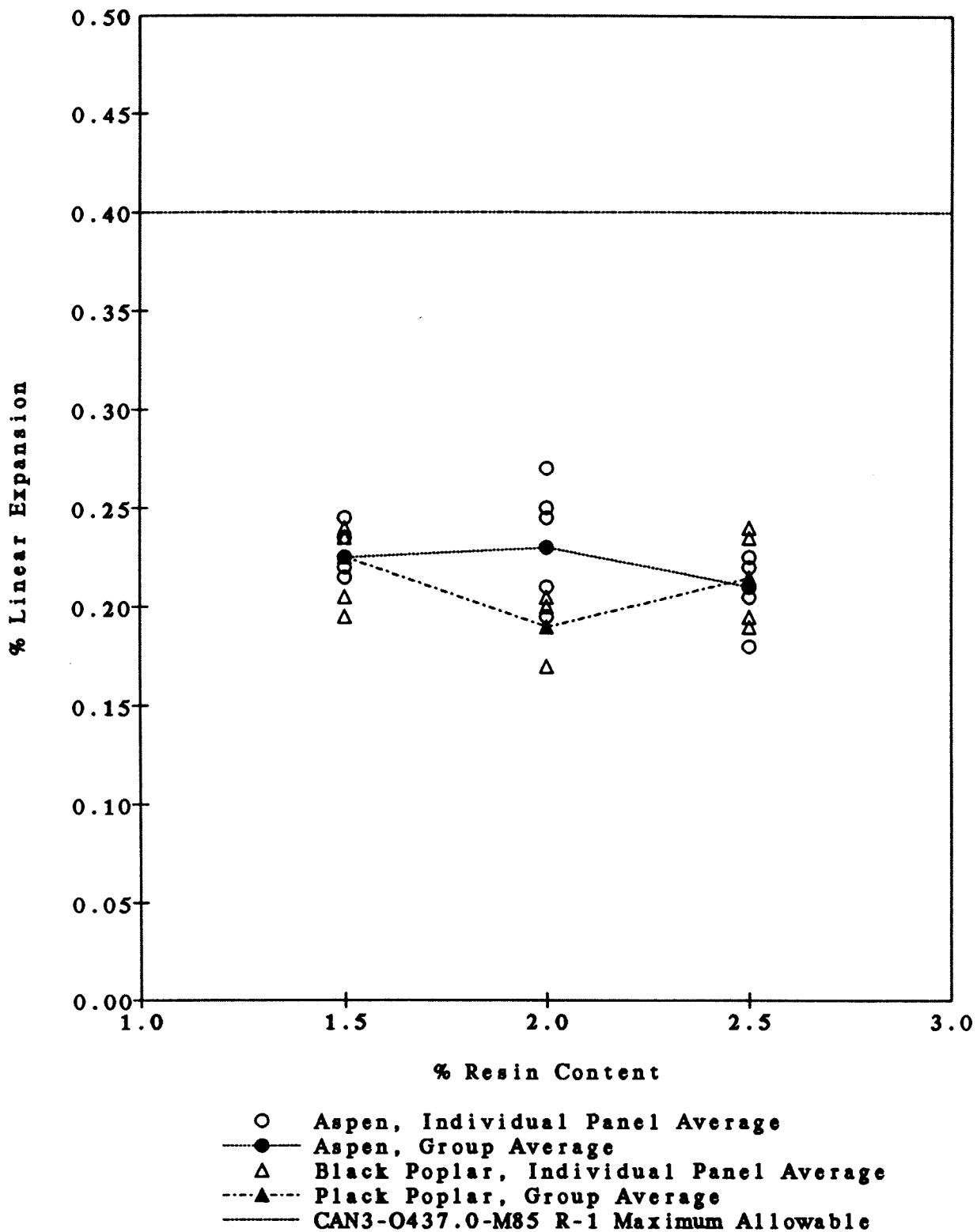


Figure 9: Linear Expansion vs Resin Content
(Parallel and Perpendicular Tests Combined)

5. CONCLUSIONS

1. High quality panels can be made using 100% Black Poplar.
2. Black Poplar increases manufacturing costs due to:
 - higher moisture content/lower density gives a higher delivered log cost per tonne of dry fiber
 - difficult to waferize - shorter knife life
 - higher drying cost
 - increased panel variability due to Aspen/Black Poplar ratio control.

Mixing Aspen and Black Poplar could cause serious product quality problems. Work funded by C-A FRDA has shown waferizing problems with Black Poplar, as well as drying problems. The Black Poplar wafers exit the dryer at a much higher moisture content. These differences indicate that a high quality product will depend on a constant ratio being maintained. With existing equipment this is only possible by separating the two species for waferizing and drying, then metering them together.

6. COMMERCIAL SIGNIFICANCE

Black Poplar forms a large portion of Alberta's hardwood resource. Solution of the technical problems associated with Black Poplar could increase hardwood utilization. Part of the operating cost increase could be offset by reduced hauling distances.

7. RECOMMENDATIONS

Further work should identify optimum waferizing conditions and use expected mixtures of Aspen and Black Poplar for panel manufacture as a mill trial. Further work should also include feasibility of modifications to existing mills for inclusion of Black Poplar lines.

8. ACKNOWLEDGEMENTS

The financial contribution to the Alberta Research Council's Forest Products Research and Development Program from the Alberta Forest Service (Alberta Forestry) and the Canadian Forestry Service (Agriculture Canada) is greatly appreciated.

9. REFERENCES

Canadian Standards Association. 1985. CAN3-0437.0-M85 Waferboard and Strandboard. Toronto, Ontario.

Canadian Standards Association. 1985. CAN3-0437.1-M85 Test Methods for Waferboard and Strandboard. Toronto, Ontario.

American Society for Testing and Materials. 1985. Standard Methods of Evaluating Properties of Wood-base Fibre and Particle Panel Materials. ASTM D1037-78. Philadelphia, Pa.

ARC, Quarterly Report, FPQR-86/87-1: Covering period April 1 - June 30, 1986.

ARC, Quarterly Report, FPQR-86/87-2: Covering period July 1 - September 30, 1986.

ARC, Quarterly Report, FPQR-86-87-3: Covering period October 1 - December 31, 1986.

University of Alberta. 1987. Alberta vs Black Poplar Phase One: Wood Quality Differences.

APPENDICES

APPENDIX I

**Reichhold Technical Bulletin for
IB-947 Phenolic Powdered Resin**

REICHHOLD

Technical Bulletin

Reichhold Limited
4 Robert Speck Parkway, Suite 700
Mississauga, Ontario L4Z 1S1
Telex: 06-960282

IB-947 PHENOLIC POWDER

IB-947 PHENOLIC POWDERED RESIN FOR THE MANUFACTURE OF WAFERBOARD/OSB

IB-947 is a fast curing, one-step powdered phenolic resin especially developed for the waferboard/OSB industry. It is most often used as a core resin in conjunction with a surface resin such as IB-948 or BD-003 but may be used in single resin systems throughout the panel.

POWDER PROPERTIES:

Colour: Pink

Form of Compound: Very Fine Powder

Screen Test (R.L. Test Method): 85% through 200 mesh

Storage Life: 3-4 months at 20°C

GENERAL SPECIFICATIONS:

Hot Plate Cure at 150°C: 10-20 seconds

Softening Point (Capillary): 85-95°C

STORAGE AND SHIPPING:

Resin being of a hygroscopic nature, it is recommended to store in cool dry place - temperature not exceeding 20°C. Shipped in multi-wall paper bags or tote bags.

SPECIAL HANDLING PRECAUTIONS:

Avoid prolonged contact with the skin. The use of goggles and dust masks are recommended when handling powdered resins.

If powder comes in contact with the skin, it should be washed off with warm water and soap. Cleanliness is important.

SAFETY BULLETIN:

Bulletins are available on request.

JUNE 1985

The information herein is to assist customers in determining whether our products are suitable for their applications. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. Nothing herein shall constitute a warranty, express or implied, including any warranty of merchantability or fitness, nor is protection from any law or patent inferred. All patent rights are reserved. The exclusive remedy for all proven claims is replacement of our materials.

APPENDIX II
Data Summary – Aspen

Table II-1

Thickness Tolerance
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 9, 1987
 Proj. Ref: 303261-13261

Test Material: A3 (1.5% Resin)
 Nom.Thickness: 11.1 mm
 Conditioning: As Received

Thickness Measurement	Panel No.				
	A3-2 mm	A3-3 mm	A3-4 mm	A3-5 mm	A3-6 mm
Position 1	10.75	10.65	10.85	10.75	10.90
Position 2	11.10	10.95	10.95	11.05	11.15
Position 3	11.10	10.95	10.80	11.20	11.20
Position 4	10.85	10.85	10.75	11.05	11.20
Position 5	10.80	10.90	10.85	11.00	11.15
Position 6	10.60	10.70	10.75	10.60	10.90
Position 7	10.55	10.70	10.85	10.70	10.90
Position 8	10.70	10.70	10.95	10.80	10.90
Avg. Panel Thickness	10.80	10.80	10.85	10.90	11.05
Dev. of Average Panel Thickness from Nominal	-0.30	-0.30	-0.25	-0.20	-0.05
Range	High	11.10	10.95	10.95	11.20
	Low	10.55	10.65	10.75	10.60
Dev. Within Panel from Average	High	0.30	0.15	0.10	0.30
	Low	-0.25	-0.15	-0.10	-0.30

ALBERTA RESEARCH COUNCIL
 FOREST PRODUCTS LABORATORY

Table II-2
Moisture Content and Density
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 10, 1987
Proj. Ref.: 303261-13261

Test Material: A3 (1.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: Oven Dry & at Test

Panel No.	Sample No.	Length	Width	Thick-	TEST	O.D.	M.C.	Avg. M.C.	Avg.	Density at Test	Density at Test
		mm	mm	ness	g	g	%	%	kg/cu.m	kg/cu.m	
A3-2	1	75.5	76.0	10.75	39.4	38.5	2		639		
	2	75.5	75.5	11.00	41.4	40.3	3	3	660	650	
A3-3	1	75.5	76.0	10.80	41.2	40.4	2		665		
	2	76.0	75.5	10.95	42.0	41.0	2	2	668	667	
A3-4	1	76.0	76.0	10.85	45.7	44.7	2		729		
	2	76.0	76.0	10.90	44.5	43.4	3	3	707	718	
A3-5	1	76.0	76.0	10.80	40.5	39.7	2		649		
	2	76.0	76.0	11.10	40.5	39.5	3	3	632	640	
A3-6	1	75.5	75.5	11.00	42.0	41.1	2		670		
	2	75.5	75.5	11.05	41.6	40.6	2	2	660	665	
No.		10	10	10	10	10	11	5	10	5	
Avg.		75.8	75.8	10.92	41.9	40.9	2	3	668	668	

Table II-3
MOR & MOE DRY-Parallel
(CAN3-0437.1-M85)

Client: ARC Test Material: A3 (1.5% Resin)
 Test Date: Jan 15, 1987 Nom. Thickness: 11.1 mm
 Proj. Ref.: 303261-13261 Conditioning: As Received
 Span: 265.0 mm

Panel No.	Sample No.	Thickness mm	Width mm	Max. Load N	MOE MPa	Avg. MOE MPa	MOR MPa	Avg. MOR MPa
A3-2	1	10.90	75.6	778	5100		34.4	
	2	10.74	75.8	606	5600	5400	27.6	32.3
	3	10.78	75.6	770	5500		34.8	
A3-3	1	10.72	75.8	790	5500		36.1	
	2	10.80	76.0	657	4500	5100	29.5	33.4
	3	10.86	76.0	785	5400		34.8	
A3-4	1	10.88	75.8	873	6500		38.7	
	2	10.98	75.8	905	6700	6000	39.4	36.8
	3	10.92	75.8	737	4900		32.4	
A3-5	1	10.76	75.8	711	4700		32.2	
	2	10.88	75.8	806	5400	5000	35.7	32.2
	3	10.80	75.8	641	4800		28.8	
A3-6	1	10.98	75.8	970	5300		42.2	
	2	11.06	75.8	435	3600	4900	18.6	29.3
	3	11.04	75.8	632	5800		27.2	
No.		15	15	15	15	5	15	5
Avg.		10.87	75.8	740	5300	5300	32.8	32.8

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table II-4

MOR & MOE DRY-Perpendicular
(CAN3-0437.1-M85)

Client: ARC Test Material: A3 (1.5% Resin)
 Test Date: Jan 15, 1987 Nom. Thickness: 11.1 mm
 Proj. Ref.: 303261-13261 Conditioning: As Received
Span: 265.0 mm

Panel No.	Sample No.	Thickness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
A3-2	4	10.92	75.8	592	5300		26.0	
	5	11.04	75.6	725	5800	5600	31.3	30.6
	6	11.02	75.8	800	5600		34.5	
A3-3	4	10.92	75.8	887	4800		39.0	
	5	10.94	75.6	885	6700	5300	38.9	35.3
	6	10.86	75.6	631	4400		28.1	
A3-4	4	10.86	76.0	832	6100		36.9	
	5	10.84	75.8	589	4700	5000	26.3	29.7
	6	10.86	75.8	586	4300		26.1	
A3-5	4	10.96	75.6	674	3700		29.5	
	5	11.10	76.0	661	5300	4800	28.1	28.9
	6	11.16	75.6	691	5300		29.2	
A3-6	4	11.10	75.8	761	5200		32.4	
	5	11.12	75.8	629	4500	5100	26.7	33.2
	6	11.22	76.0	979	5600		40.7	
No.		15	15	15	15	5	15	5
Avg.		10.99	75.8	728	5200	5200	31.6	31.6

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table II-5
Internal Bond
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 14, 1987
Proj. Ref.: 303261-13261

Test Material: A3 (1.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: As Received

Panel No.	Sample Number	Sample Length mm	Sample Width mm	Maximum Load N	Internal Bond Strength MPa	Average For Panel MPa
A3-2	1	49.8	49.4	1444	0.587	0.584
	2	49.8	49.6	1378	0.558	
	3	50.0	49.4	1456	0.589	
	4	50.0	49.6	1493	0.602	
	5	50.0	49.4	1587	0.643	
	6	50.0	49.4	1295	0.524	
A3-3	1	49.8	49.2	1634	0.667	0.635
	2	49.8	42.2	1358	0.646	
	3	49.8	49.2	1224	0.500	
	4	49.8	49.4	1570	0.638	
	5	49.8	49.4	1856	0.754	
	6	49.8	49.2	1477	0.603	
A3-4	1	49.8	49.4	1186	0.482	0.560
	2	49.8	49.6	1601	0.648	
	3	49.2	49.8	1505	0.614	
	4	49.8	49.4	1018	0.414	
	5	49.8	49.4	1680	0.683	
	6	49.8	49.4	1280	0.520	
A3-5	1	50.0	49.2	1391	0.565	0.559
	2	49.8	49.2	1292	0.527	
	3	49.8	49.2	1140	0.465	
	4	49.8	49.4	1176	0.478	
	5	50.0	49.4	1585	0.642	
	6	49.8	49.4	1662	0.676	
A3-6	1	49.6	49.4	1199	0.489	0.499
	2	49.6	49.4	1244	0.508	
	3	49.6	49.4	1020	0.416	
	4	49.6	49.4	1461	0.596	
	5	49.6	49.4	1190	0.486	
	6	49.8	49.4	1234	0.502	
No.		30	30	30	30	5
Avg.		49.8	49.2	1390	0.567	0.567

Table II-6

Bond Durability-MOR after 2 Hour Boil-Parallel
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 19, 1987
Proj. Ref.: 303261-13261
Span: 265 mm

Test Material: A3(1.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
A3-2	1	10.80	75.5	346	15.6	
	2	10.75	75.5	402	18.3	16.1
	3	10.70	75.5	313	14.4	
A3-3	1	10.80	76.0	462	20.7	
	2	10.80	76.0	382	17.1	19.1
	3	10.85	76.0	439	19.5	
A3-4	1	10.90	76.0	317	14.0	
	2	10.90	76.0	378	16.6	15.9
	3	10.80	76.0	381	17.1	
A3-5	1	10.75	76.0	356	16.1	
	2	10.80	76.0	284	12.7	14.4
	3	10.70	76.0	312	14.3	
A3-6	1	10.90	76.0	331	14.6	
	2	11.05	76.0	326	14.0	15.8
	3	11.05	76.0	443	19.0	
No.		15	15	15	15	5
Avg.		10.8	75.9	365	16.3	16.3

Table II-7

Bond Durability-MOR after 2 Hour Boil-Perpendicular
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 19, 1987
 Proj. Ref.: 303261-13261
 Span: 265 mm

Test Material: A3(1.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel
						MPa
A3-2	4	10.85	75.5	497	22.2	
	5	10.90	75.5	377	16.7	20.7
	6	10.85	76.0	524	23.3	
A3-3	4	10.90	75.5	575	25.5	
	5	10.90	76.0	528	23.2	21.8
	6	10.85	76.0	373	16.6	
A3-4	4	10.85	76.0	494	21.9	
	5	10.85	76.0	406	18.0	17.6
	6	10.80	76.0	287	12.9	
A3-5	4	10.90	75.5	426	18.9	
	5	10.95	75.5	411	18.0	17.4
	6	11.10	75.5	355	15.2	
A3-6	4	11.05	76.0	476	20.4	
	5	11.05	76.0	362	15.5	17.3
	6	11.10	76.0	375	15.9	
No.		15	15	15	15	5
Avg.		10.93	75.8	431	19.0	19.0

Table II-8

Thickness Swell
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 15, 1987
Proj. Ref.: 303261-13261

Test Material: A3 (1.5% Resin)
Nom. Thickness: 11 mm
Conditioning: 24 hr. Soak

Panel No.	Sample No.	Dry Thickness				Wet Thickness				Average Thick. Swell %	
		Position				Position					
		1	2	3	4	1	2	3	4		
		mm	mm	mm	mm	mm	mm	mm	mm	%	
A3-2	1	10.70	10.70	10.70	10.75	12.55	13.65	13.00	12.50	20	
	2	11.20	11.15	11.05	11.10	12.55	13.60	13.20	13.60		
A3-3	1	10.90	10.80	10.85	10.90	13.45	13.00	13.10	13.10	24	
	2	11.00	10.95	11.00	11.00	13.75	14.10	14.00	13.60		
A3-4	1	10.90	10.95	11.00	10.90	12.80	12.65	12.75	11.95	15	
	2	10.90	10.85	10.95	10.90	12.35	12.50	12.80	12.65		
A3-5	1	10.75	10.80	10.85	10.70	12.85	13.20	13.65	13.00	25	
	2	11.25	11.25	11.15	11.10	14.20	14.40	14.10	14.40		
A3-6	1	11.10	11.10	11.10	11.10	13.75	13.45	13.60	12.80	23	
	2	11.30	11.25	11.20	11.20	14.75	13.85	13.95	14.10		
No.		10	10	10	10	10	10	10	10	5	
Avg.		11.00	10.98	10.99	10.97	13.30	13.44	13.42	13.17	21	

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table II-9

Linear Expansion-Oven Dry to Saturated
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan. 16, 1987
Proj. Ref.: 303261-13261

Test Material: A3 (1.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: OD to Saturated

Panel No.	Sample No.		Oven Dry Gauge Length		Vac.-Pressure Gauge Length		Linear Expansion		Avg. Linear Expansion	
	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.
			mm	mm	mm	mm	%	%	%	%
A3-2	1	3	249.55	251.05	250.10	251.70	0.22	0.26	0.20	0.23
	2	4	249.30	249.20	249.75	249.70	0.18	0.20		
A3-3	1	3	249.75	248.75	250.40	249.35	0.26	0.24	0.23	0.24
	2	4	249.90	248.00	250.40	248.60	0.20	0.24		
A3-4	1	3	249.20	248.65	249.75	249.25	0.22	0.24	0.20	0.24
	2	4	249.65	251.40	250.10	252.00	0.18	0.24		
A3-5	1	3	250.70	248.65	251.10	249.30	0.16	0.26	0.20	0.25
	2	4	249.35	248.30	249.95	248.90	0.24	0.24		
A3-6	1	3	249.75	251.00	250.30	251.70	0.22	0.28	0.24	0.25
	2	4	250.80	249.40	251.45	249.95	0.26	0.22		
No.			10	10	10	10	10	10	5	5
Avg.			249.80	249.45	250.35	250.05	0.21	0.24	0.21	0.24

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table II-10
Thickness Tolerance
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan. 9, 1987
Proj. Ref: 303261-13261

Test Material: A2 (2.0% Resin)
Nom.Thickness: 11.1 mm
Conditioning: As Received

Thickness Measurement	Panel No.				
	A2-3 mm	A2-4 mm	A2-7 mm	A2-8 mm	A2-9 mm
Position 1	10.80	10.90	10.85	10.85	10.90
Position 2	11.25	11.30	11.30	10.75	10.95
Position 3	11.35	11.25	11.40	10.70	11.15
Position 4	11.45	11.20	11.25	10.60	11.05
Position 5	11.40	11.10	11.15	10.60	11.05
Position 6	10.80	10.85	10.75	10.70	11.00
Position 7	10.65	10.75	10.80	10.85	11.05
Position 8	10.60	10.85	10.80	10.90	11.05
Avg. Panel Thickness	11.05	11.05	11.05	10.75	11.05
Dev. of Average Panel Thickness from Nominal	-0.05	-0.05	-0.05	-0.35	-0.05
Range	High	11.45	11.30	11.40	10.90
	Low	10.60	10.75	10.75	10.60
Dev. Within Panel from Average	High	0.40	0.25	0.35	0.15
	Low	-0.45	-0.30	-0.30	-0.15

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table II-11
Moisture Content and Density
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 10, 1987
Proj. Ref.: 303261-13261

Test Material: A2(2.0% Resin)
Nom. Thickness: 11.1 mm
Conditioning: Oven Dry & at Test

Panel No.	Sample No.	Length	Width	Thick-	TEST	O.D.	M.C.	Avg. M.C.	Density at Test	Density at Test
		mm	mm	mm	g	g	%	%	kg/cu.m	kg/cu.m
	1	76.0	76.0	11.05	44.6	43.5	3		699	
A2-3	2	76.0	75.5	11.30	44.6	43.4	3	3	688	693
	1	76.0	76.0	10.85	39.0	38.0	3		622	
A2-4	2	76.0	75.0	11.30	44.6	43.6	2	3	692	657
	1	76.0	75.5	11.05	43.0	41.8	3		678	
A2-7	2	75.5	75.5	11.25	42.7	41.4	3	3	666	672
	1	75.5	75.5	10.80	40.8	39.8	3		663	
A2-8	2	76.0	76.0	10.80	42.6	41.6	2	3	683	673
	1	75.5	75.5	10.80	35.9	34.9	3		583	
A2-9	2	75.5	75.5	10.95	42.1	41.1	2	3	674	629
No.		10	10	10	10	10	11	5	10	5
Avg.		75.8	75.6	11.02	42.0	40.9	2	3	665	665

Table II-12

MOR & MOE DRY-Parallel
(CAN3-0437.1-M85)

Client: ARC Test Material: A2 (2.0% Resin)
 Test Date: Jan 15, 1987 Nom. Thickness: 11.1 mm
 Proj. Ref.: 303261-13261 Conditioning: As Received
 Span: 265.0 mm

Panel No.	Sample No.	Thickness mm	Width mm	Max. Load N	MOE MPa	Avg. MOE MPa	MOR MPa	Avg. MOR MPa
A2-3	1	10.76	75.8	857	5700		38.8	
	2	10.94	75.8	916	5600	5100	40.1	32.8
	3	10.84	75.8	437	4000		19.5	
A2-4	1	10.90	75.8	724	6200		32.0	
	2	10.90	75.8	695	4600	5300	30.7	30.6
	3	10.88	75.8	660	5000		29.2	
A2-7	1	10.98	75.8	798	4900		34.7	
	2	10.92	75.8	616	5100	5000	27.1	30.1
	3	10.88	75.8	640	5100		28.4	
A2-8	1	10.88	75.8	597	4600		26.4	
	2	10.98	75.8	676	5700	5200	29.4	30.7
	3	10.96	75.8	831	5400		36.3	
A2-9	1	11.02	75.6	648	5000		28.1	
	2	11.08	75.8	729	4800	4900	31.1	30.6
	3	11.00	75.6	752	4900		32.7	
No.		15	15	15	15	5	15	5
Avg.		10.93	75.8	705	5100	5100	31.0	31.0

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table II-13

**MOR & MOE DRY-Perpendicular
(CAN3-0437.1-M85)**

Client: ARC Test Material: A2 (2.0% Resin)
Test Date: Jan 15, 1987 Nom. Thickness: 11.1 mm
Proj. Ref.: 303261-13261 Conditioning: As Received
Span: 265.0 mm

Panel No.	Sample No.	Thick-ness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
A2-3	4	11.24	75.8	668	4300		27.7	
	5	11.38	76.0	814	4800	4900	32.9	31.6
	6	11.48	75.6	857	5700		34.2	
A2-4	4	11.04	75.8	825	5100		35.5	
	5	11.16	75.8	968	5800	5900	40.8	38.1
	6	11.28	75.8	922	6700		38.0	
A2-7	4	11.18	75.8	801	5200		33.6	
	5	11.26	75.8	937	5000	5000	38.8	35.0
	6	11.30	75.8	798	4900		32.8	
A2-8	4	10.82	76.0	573	5200		25.6	
	5	10.70	75.8	1001	6500	6100	45.8	37.9
	6	10.88	75.8	957	6500		42.4	
A2-9	4	11.00	75.8	688	5500		29.8	
	5	10.98	75.8	825	6100	5400	35.9	32.3
	6	11.12	75.8	738	4700		31.3	
No.		15	15	15	15	5	15	5
Avg.		11.12	75.8	825	5500	5500	35.0	35.0

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table II-14
Internal Bond
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 14, 1987
Proj. Ref.: 303261-13261

Test Material: A2 (2% Resin)
Nom. Thickness: 11.1 mm
Conditioning: As Received

Panel No.	Sample Number	Sample Length mm	Sample Width mm	Maximum Load N	Internal Bond Strength MPa	Average For Panel MPa
A2-3	1	49.8	49.4	1391	0.565	0.590
	2	49.8	49.4	1189	0.483	
	3	49.8	49.4	1528	0.621	
	4	49.8	49.4	1476	0.600	
	5	49.8	49.6	1643	0.665	
	6	49.8	49.6	1489	0.603	
A2-4	1	49.8	49.4	1774	0.721	0.648
	2	49.8	49.0	1681	0.689	
	3	50.0	49.4	1634	0.662	
	4	50.0	49.4	1263	0.511	
	5	50.0	49.4	1362	0.551	
	6	50.0	49.4	1866	0.755	
A2-7	1	49.8	49.6	1367	0.553	0.628
	2	49.8	49.6	1938	0.785	
	3	49.8	49.6	1787	0.723	
	4	49.8	49.6	1648	0.667	
	5	49.8	49.6	1480	0.599	
	6	49.8	49.2	1080	0.441	
A2-8	1	49.8	49.4	1514	0.615	0.652
	2	49.8	49.2	1734	0.708	
	3	49.8	49.4	1857	0.755	
	4	49.8	49.2	1585	0.647	
	5	49.8	49.4	1315	0.535	
	6	49.8	49.2	1603	0.654	
A2-9	1	49.6	49.4	1767	0.721	0.684
	2	49.6	49.6	1885	0.766	
	3	49.8	49.4	1387	0.564	
	4	49.4	49.4	1632	0.669	
	5	49.6	49.4	1656	0.676	
	6	49.8	49.4	1744	0.709	
No.		30	30	30	30	5
Avg.		49.8	49.4	1580	0.640	0.640

Table II-15

**Bond Durability-MOR after 2 Hour Boil-Parallel
(CAN3-0437.1-M85)**

Client: ARC
Test Date: Jan 19, 1987
Proj. Ref.: 303261-13261
Span: 265 mm

Test Material: A2(2.0% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
						MPa
A2-3	1	10.70	75.5	420	19.3	
	2	10.90	75.5	368	16.3	16.8
	3	10.75	75.5	326	14.9	
A2-4	1	10.95	75.5	413	18.1	
	2	10.75	75.5	299	13.6	17.3
	3	10.85	76.0	455	20.2	
A2-7	1	10.95	76.0	473	20.6	
	2	10.90	75.5	380	16.8	16.7
	3	10.80	76.0	279	12.5	
A2-8	1	10.90	75.5	450	19.9	
	2	10.95	75.5	423	18.6	18.5
	3	10.80	75.5	374	16.9	
A2-9	1	11.00	76.0	480	20.7	
	2	11.00	75.5	271	11.8	16.1
	3	11.00	75.5	365	15.9	
No.		15	15	15	15	5
Avg.		10.9	75.6	385	17.1	17.1

38
Table II-16

**Bond Durability-MOR after 2 Hour Boil-Perpendicular
(CAN3-0437.1-M85)**

Client: ARC
Test Date: Jan 19, 1987
Proj. Ref.: 303261-13261
Span: 265 mm

Test Material: A2(2.0% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
						MPa
A2-3	4	11.15	76.0	553	23.3	
	5	11.30	76.0	491	20.1	18.1
	6	11.30	76.0	266	10.9	
A2-4	4	10.90	75.5	329	14.6	
	5	11.05	75.5	440	19.0	16.7
	6	11.20	75.5	395	16.6	
A2-7	4	11.10	76.0	696	29.5	
	5	11.20	76.0	468	19.5	20.8
	6	11.25	75.5	322	13.4	
A2-8	4	10.80	76.0	430	19.3	
	5	10.75	76.0	560	25.3	22.2
	6	10.65	76.0	476	21.9	
A2-9	4	10.95	75.5	456	20.0	
	5	11.00	75.5	450	19.6	18.7
	6	11.05	75.5	386	16.6	
No.		15	15	15	15	5
Avg.		11.04	75.8	448	19.3	19.3

Table II-17
Thickness Swell
(CAN3-0437.1-M85)

Client: ARC Test Material: A2 (2.0% Resin)
Test Date: Jan. 12, 1987 Nom. Thickness: 11.1 mm
Proj. Ref.: 303261-13261 Conditioning: 24 hr. Soak

Panel No.	Sample No.	Dry Thickness				Wet Thickness				Average Thick. Swell %	
		Position				Position					
		1 mm	2 mm	3 mm	4 mm	1 mm	2 mm	3 mm	4 mm		
A2-3	1	10.90	10.95	10.95	10.90	13.80	13.20	12.80	12.75	18	
	2	11.40	11.35	11.30	11.35	12.90	13.65	13.05	13.20		
A2-4	1	10.85	10.90	10.90	10.85	13.00	12.50	12.60	12.95	16	
	2	11.30	11.30	11.30	11.40	13.25	13.10	12.80	13.10		
A2-7	1	11.05	11.05	11.05	11.00	12.45	12.50	12.45	12.65	16	
	2	11.45	11.40	11.40	11.45	13.30	12.45	14.40	14.20		
A2-8	1	10.90	10.90	10.85	10.80	12.05	11.95	12.15	12.60	16	
	2	10.85	10.80	10.75	10.80	13.55	12.65	12.60	12.60		
A2-9	1	10.95	11.00	11.00	11.05	12.45	12.15	12.70	11.80	14	
	2	11.25	11.10	11.05	11.15	13.20	12.70	12.75	13.25		
No.		10	10	10	10	10	10	10	10	5	
Avg.		11.09	11.08	11.06	11.08	13.00	12.69	12.83	12.91	16	

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table II-18

Linear Expansion-Oven Dry to Saturated
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 16, 1987
Proj. Ref.: 303261-13261

Test Material: A2 (2% Resin)
Nom. Thickness: 11.1 mm
Conditioning: OD to Saturated

Panel No.	Sample No.		Oven Dry Gauge Length		Vac.-Pressure Gauge Length		Linear Expansion		Avg. Linear Expansion	
	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.
			mm	mm	mm	mm	%	%	%	%
A2-3	1	3	249.70	249.50	250.30	250.20	0.24	0.28	0.29	0.25
	2	4	250.35	249.65	251.20	250.20	0.34	0.22		
A2-4	1	3	250.45	248.75	251.00	249.45	0.22	0.28	0.24	0.25
	2	4	249.50	250.20	250.15	250.75	0.26	0.22		
A2-7	1	3	250.35	249.45	250.75	249.95	0.16	0.20	0.20	0.19
	2	4	249.05	250.25	249.65	250.70	0.24	0.18		
A2-8	1	3	250.20	249.35	250.65	249.80	0.18	0.18	0.20	0.22
	2	4	248.95	249.45	249.50	250.10	0.22	0.26		
A2-9	1	3	250.20	250.35	250.80	250.95	0.24	0.24	0.24	0.26
	2	4	248.90	249.00	249.50	249.70	0.24	0.28		
No.			10	10	10	10	10	10	5	5
Avg.			249.75	249.60	250.35	250.20	0.23	0.23	0.23	0.23

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table II-19
Thickness Tolerance
(CAN3-0437.1-M85)

Client: ARC Test Material: A1 (2.5% Resin)
Test Date: Jan. 9, 1987 Nom.Thickness: 11.1 mm
Proj. Ref: 303261-13261 Conditioning: As Received

Thickness Measurement	Panel No.				
	A1-3	A1-4	A1-5	A1-8	A1-9
	mm	mm	mm	mm	mm
Position 1	10.40	11.05	10.70	11.75	10.30
Position 2	10.90	11.55	10.35	11.35	11.00
Position 3	11.10	11.50	10.25	11.10	11.05
Position 4	11.35	11.00	10.70	10.45	11.15
Position 5	11.50	10.70	11.05	10.55	11.30
Position 6	11.20	10.50	11.50	10.95	10.85
Position 7	10.95	10.50	11.50	11.05	10.70
Position 8	10.40	10.85	10.95	11.45	10.50
Avg. Panel Thickness	11.00	10.95	10.90	11.10	10.85
Dev. of Average Panel Thickness from Nominal	-0.10	-0.15	-0.20	0.00	-0.25
Range	High	11.50	11.55	11.50	11.75
	Low	10.40	10.50	10.25	10.45
Dev. Within Panel from Average	High	0.50	0.60	0.60	0.65
	Low	-0.60	-0.45	-0.65	-0.65

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table II-20

Moisture Content and Density
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 10, 1987
 Proj. Ref.: 303261-13261

Test Material: A1(2.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: Oven Dry & at Test

Panel No.	Sample No.	Length	Width	Thick-	TEST	O.D.	M.C.	Avg. M.C.	Avg. Density at Test	Density at Test
		mm	mm	ness	Weight	Weight	%	%	kg/cu.m	kg/cu.m
	1	76.0	76.0	10.75	43.1	41.7	3		694	
A1-3	2	75.5	76.0	11.05	42.8	41.0	4	4	675	685
	1	76.0	76.0	10.55	38.9	37.7	3		638	
A1-4	2	75.5	76.0	11.05	43.6	42.2	3	3	688	663
	1	76.0	76.0	10.65	39.2	38.1	3		637	
A1-5	2	75.5	76.0	10.55	41.6	40.4	3	3	687	662
	1	76.0	76.0	10.85	39.9	39.0	2		637	
A1-8	2	76.0	76.0	10.90	42.6	41.7	2	2	677	657
	1	76.0	76.0	10.55	44.9	44.0	2		737	
A1-9	2	76.0	76.0	11.05	41.6	40.3	3	3	652	694
No.		10	10	10	10	10	11	5	10	5
Avg.		75.9	76.0	10.80	41.8	40.6	3	3	672	672

Table II-21
MOR & MOE DRY-Parallel
(CAN3-0437.1-M85)

Client: ARC Test Material: A1 (2.5% Resin)
 Test Date: Jan 15, 1987 Nom. Thickness: 11.1 mm
 Proj. Ref.: 303261-13261 Conditioning: As Received
 Span: 265.0 mm

Panel No.	Sample No.	Thick-ness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
A1-3	1	10.46	75.6	748	6100		35.9	
	2	10.58	76.0	1124	6100	5800	52.5	41.5
	3	10.72	75.6	790	5100		36.1	
A1-4	1	11.12	75.8	762	4700		32.3	
	2	10.54	75.8	802	5400	5200	37.9	35.8
	3	10.50	75.8	783	5500		37.2	
A1-5	1	10.84	75.8	904	5500		40.3	
	2	10.92	76.0	928	5700	5600	40.7	39.3
	3	11.08	76.0	862	5500		36.7	
A1-8	1	11.66	75.8	1003	6200		38.7	
	2	11.06	75.6	711	5600	5400	30.6	32.2
	3	10.90	75.6	620	4300		27.4	
A1-9	1	10.46	75.8	870	6000		41.7	
	2	10.34	75.6	643	4900	5200	31.6	35.2
	3	10.48	75.8	676	4800		32.3	
No.		15	15	15	15	5	15	5
Avg.		10.78	75.8	815	5400	5400	36.8	36.8

Table II-22
MOR & MOE DRY-Perpendicular
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 15, 1987
Proj. Ref.: 303261-13261

Test Material: A1 (2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: As Received
Span: 265.0 mm

Panel No.	Sample No.	Thick-ness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
A1-3	4	11.16	75.8	971	5900		40.9	
	5	11.20	75.8	931	5300	5100	38.9	34.1
	6	11.34	75.8	555	4100		22.6	
A1-4	4	10.78	75.8	1119	5500		50.5	
	5	10.70	75.8	1035	6500	6500	47.4	50.7
	6	11.08	75.8	1271	7500		54.3	
A1-5	4	10.96	75.8	637	4800		27.8	
	5	10.62	75.8	1093	6500	5700	50.8	41.2
	6	10.60	75.8	961	5700		44.9	
A1-8	4	10.68	76.0	686	5000		31.5	
	5	10.46	75.8	683	5400	5100	32.7	31.4
	6	10.52	75.8	636	4900		30.1	
A1-9	4	10.98	75.8	862	6000		37.5	
	5	10.98	75.6	1243	7900	6600	54.2	41.0
	6	11.10	75.8	736	5900		31.3	
No.		15	15	15	15	5	15	5
Avg.		10.88	75.8	895	5800	5800	39.7	39.7

Table II-23

Internal Bond
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 14, 1987
Proj. Ref.: 303261-13261

Test Material: A1 (2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: As Received

Panel No.	Sample Number	Sample Length mm	Sample Width mm	Maximum Load N	Internal Bond Strength MPa	Average For Panel MPa
A1-3	1	49.6	49.6	1621	0.659	
	2	49.8	49.4	1699	0.691	
	3	49.8	49.4	1450	0.589	0.701
	4	49.8	49.6	1748	0.708	
	5	49.8	49.4	1913	0.778	
	6	49.8	49.4	1921	0.781	
A1-4	1	49.8	49.4	1580	0.642	
	2	49.8	49.4	1841	0.748	
	3	49.8	49.4	1854	0.754	0.728
	4	49.8	49.4	1985	0.807	
	5	49.6	49.4	1524	0.622	
	6	49.6	49.4	1946	0.794	
A1-5	1	49.8	49.6	2134	0.864	
	2	50.0	49.6	1948	0.785	
	3	49.8	49.4	1756	0.714	0.769
	4	49.8	49.6	1840	0.745	
	5	49.8	49.6	1943	0.787	
	6	50.0	49.6	1787	0.721	
A1-8	1	50.0	49.4	1724	0.698	
	2	50.0	49.4	1559	0.631	
	3	50.0	49.4	1495	0.605	0.631
	4	50.0	49.4	1688	0.683	
	5	50.0	49.4	1314	0.532	
	6	50.0	49.4	1565	0.634	
A1-9	1	50.0	49.4	1888	0.764	
	2	49.8	49.4	1936	0.787	
	3	49.8	49.6	1893	0.766	0.768
	4	49.6	49.4	1839	0.751	
	5	49.8	49.4	2178	0.885	
	6	49.8	49.4	1607	0.653	
No.		30	30	30	30	5
Avg.		49.8	49.5	1770	0.719	0.719

Table II-24

Bond Durability-MOR after 2 Hour Boil-Parallel
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 19, 1987
 Proj. Ref.: 303261-13261
 Span: 265 mm

Test Material: A1 (2.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
A1-3	1	10.45	75.5	512	24.7	
	2	10.60	75.5	529	24.8	21.2
	3	10.95	75.5	320	14.1	
A1-4	1	10.75	76.0	377	17.1	
	2	10.45	75.5	401	19.3	18.2
	3	10.50	75.5	381	18.2	
A1-5	1	10.75	76.0	415	18.8	
	2	10.85	76.0	326	14.5	17.8
	3	11.30	76.0	494	20.2	
A1-8	1	11.30	75.5	425	17.5	
	2	10.90	75.5	512	22.7	18.7
	3	10.85	75.5	356	15.9	
A1-9	1	10.30	75.5	285	14.1	
	2	10.40	75.5	587	28.6	20.0
	3	10.65	75.5	374	17.4	
No.		15	15	15	15	5
Avg.		10.73	75.6	420	19.2	19.2

Table II-25

Bond Durability-MOR after 2 Hour Boil-Perpendicular
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 19, 1987
 Proj. Ref.: 303261-13261
 Span: 265 mm

Test Material: A1 (2.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
A1-3	4	11.00	76.0	445	19.2	
	5	11.10	75.5	551	23.5	20.8
	6	11.20	75.5	465	19.5	
A1-4	4	10.70	76.0	400	18.3	
	5	10.70	76.0	525	24.0	19.1
	6	10.75	76.0	335	15.2	
A1-5	4	10.85	76.0	474	21.1	
	5	10.85	76.0	463	20.6	19.3
	6	10.55	76.0	346	16.3	
A1-8	4	10.85	76.0	402	17.9	
	5	10.60	76.0	486	22.6	21.4
	6	10.45	76.0	498	23.9	
A1-9	4	10.70	75.5	349	16.0	
	5	10.90	75.5	489	21.7	20.3
	6	11.05	76.0	539	23.1	
No.		15	15	15	15	5
Avg.		10.82	75.9	451	20.2	20.2

Table II-26

Thickness Swell
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 11, 1987
Proj. Ref.: 303261-13261

Test Material: A1 (2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 24 hr. Soak

Panel No.	Sample No.	Dry Thickness				Wet Thickness				Average Thick. Swell	
		Position				Position					
		1	2	3	4	1	2	3	4		
		mm	mm	mm	mm	mm	mm	mm	mm	%	
A1-3	1	11.10	10.85	10.85	10.90	12.85	13.35	12.15	12.55	17	
	2	11.05	11.05	11.15	11.10	12.80	12.65	13.05	13.20		
A1-4	1	10.70	10.70	10.65	10.70	12.45	13.15	13.05	12.45	19	
	2	11.35	11.55	11.50	11.25	13.40	14.05	13.65	13.25		
A1-5	1	11.25	11.10	10.80	11.05	13.30	12.80	13.20	12.80	20	
	2	10.35	10.35	10.45	10.35	13.10	12.10	11.80	13.50		
A1-8	1	11.00	11.00	10.85	10.85	12.40	13.35	12.25	13.80	19	
	2	11.10	10.95	11.05	11.20	13.15	13.15	12.95	13.70		
A1-9	1	10.75	10.70	10.55	10.60	11.85	12.25	12.70	12.60	20	
	2	10.95	10.05	11.00	11.00	12.55	13.50	12.45	14.40		
No.		10	10	10	10	10	10	10	10	5	
Avg.		10.96	10.83	10.89	10.90	12.79	13.04	12.73	13.23	19	

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table II-27

Linear Expansion-Oven Dry to Saturated
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 16, 1987
 Proj. Ref.: 303261-13261

Test Material: A1 (2.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: OD to Saturated

Panel No.	Sample No.		Oven Dry Gauge Length		Vac.-Pressure Gauge Length		Linear Expansion		Avg. Linear Expansion	
	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.
		mm	mm	mm	mm	%	%	%	%	%
A1-3	1	3	250.00	250.45	250.55	251.05	0.22	0.24	0.21	0.24
	2	4	250.70	249.25	251.20	249.85	0.20	0.24		
A1-4	1	3	249.35	249.75	249.90	250.25	0.22	0.20	0.18	0.18
	2	4	249.25	250.30	249.60	250.70	0.14	0.16		
A1-5	1	3	251.20	249.75	251.70	250.30	0.20	0.22	0.23	0.19
	2	4	250.90	250.40	251.55	250.80	0.26	0.16		
A1-8	1	3	250.35	249.95	251.00	250.45	0.26	0.20	0.24	0.17
	2	4	249.80	249.45	250.35	249.80	0.22	0.14		
A1-9	1	3	250.30	249.40	250.75	249.95	0.18	0.22	0.19	0.25
	2	4	249.40	250.05	249.90	250.75	0.20	0.28		
No.			10	10	10	10	10	10	5	5
Avg.			250.15	249.90	250.65	250.40	0.21	0.21	0.21	0.21

ALBERTA RESEARCH COUNCIL
 FOREST PRODUCTS LABORATORY

APPENDIX III
Data Summary - Black Poplar

Table III-1

Thickness Tolerance
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 15, 1987
 Proj. Ref: 303261-13261

Test Material: BP3 (1.5% Resin)
 Nom.Thickness: 11.1 mm
 Conditioning: As Received

Thickness Measurement	Panel No.				
	B3-1 mm	B3-2 mm	B3-3 mm	B3-4 mm	B3-5 mm
Position 1	11.15	11.05	11.35	10.30	10.65
Position 2	10.80	10.60	11.25	10.45	10.40
Position 3	11.00	10.60	11.70	10.95	10.65
Position 4	11.00	10.60	11.55	11.00	10.50
Position 5	11.25	10.65	11.65	11.20	10.30
Position 6	10.90	10.65	11.25	10.75	10.50
Position 7	11.50	11.00	11.20	10.50	10.65
Position 8	11.30	11.00	11.30	10.35	10.55
Avg. Panel Thickness	11.10	10.75	11.40	10.70	10.55
Dev. of Average Panel Thickness from Nominal	0.00	-0.35	0.30	-0.40	-0.55
Range	High	11.50	11.05	11.70	11.20
	Low	10.80	10.60	11.20	10.30
Dev. Within Panel from Average	High	0.40	0.30	0.30	0.50
	Low	-0.30	-0.15	-0.20	-0.40
					-0.25

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-2

Moisture Content and Density
(CAN3-0437.1-M85)Client: ARC
Test Date: January 26, 1987
Proj. Ref.: 303261-13261Test Material: BP3 (1.5% Resin)
Nom. Thickness: 11.1
Conditioning: Oven Dry & at Test

Panel No.	Sample No.	Length	Width	Thick-	TEST	O.D.	M.C.	Avg. M.C.	Avg. Density at Test	Density at Test
		mm	mm	mm	g	g	%	%	kg/cu.m	kg/cu.m
BP3-1	1	76.0	76.0	10.90	39.5	38.7	2		627	
	2	76.0	76.0	10.80	38.3	37.4	2	2	614	621
BP3-2	1	76.0	76.0	10.70	42.4	41.4	2		686	
	2	76.0	76.0	10.50	39.9	38.9	3	3	658	672
BP3-3	1	76.0	76.0	11.20	45.0	44.3	2		696	
	2	76.0	76.0	11.50	44.1	43.3	2	2	664	680
BP3-4	1	76.0	76.0	10.60	41.7	41.1	1		681	
	2	75.5	76.0	10.85	39.8	39.1	2	2	639	660
BP3-5	1	76.0	76.0	10.55	40.3	39.7	2		661	
	2	76.0	76.0	10.50	39.1	38.4	2	2	645	653
No.		10	10	10	10	10	10	5	10	5
Avg.		76.0	76.0	10.81	41.0	40.2	2	2	657	657

Table III-3

**MOR & MOE DRY-Parallel
(CAN3-0437.1-M85)**

Client: ARC **Test Material:** BP3 (1.5% Resin)
Test Date: Jan 22, 1987 **Nom. Thickness:** 11.1 mm
Proj. Ref.: 303261-13261 **Conditioning:** As Received
Span: 265.0 mm

Panel No.	Sample No.	Thick-ness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
B3-1	1	11.00	75.8	544	4400		23.6	
	2	11.06	75.8	560	3900	4200	24.0	24.7
	3	11.12	75.8	622	4300		26.4	
B3--2	1	10.82	75.8	808	5300		36.2	
	2	10.84	75.8	498	4000	4700	22.2	28.1
	3	10.90	75.8	589	4700		26.0	
B3-3	1	11.30	75.8	583	3400		23.9	
	2	11.28	75.8	771	5100	4500	31.8	29.6
	3	11.24	75.8	799	4900		33.2	
B3-4	1	10.44	75.8	691	4700		33.2	
	2	10.46	75.8	703	5200	5100	33.7	34.7
	3	10.54	75.8	787	5400		37.2	
B3-5	1	10.60	75.8	772	5500		36.0	
	2	10.62	75.8	924	6400	5300	43.0	37.0
	3	10.60	75.6	684	4000		32.0	
No.		15	15	15	15	5	15	5
Avg.		10.85	75.8	689	4800	4800	30.8	30.8

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-4
 MOR & MOE DRY-Perpendicular
 (CAN3-0437.1-M85)

Client: ARC Test Material: BP3 (1.5% Resin)
 Test Date: Jan 22, 1987 Nom. Thickness: 11.1 mm
 Proj. Ref.: 303261-13261 Conditioning: As Received
 Span: 265.0 mm

Panel No.	Sample No.	Thickness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
B3-1	4	10.92	75.6	842	5300		37.1	
	5	10.96	75.8	762	4800	5000	33.3	33.9
	6	11.12	75.8	735	4900		31.2	
B3-2	4	10.60	75.8	809	5100		37.8	
	5	10.50	75.8	822	6000	5400	39.1	36.6
	6	10.62	75.8	708	5200		32.9	
B3-3	4	11.30	75.8	810	5300		33.3	
	5	11.42	75.8	692	4600	4600	27.8	28.8
	6	11.60	75.8	648	4000		25.3	
B3-4	4	10.84	75.8	626	4800		27.9	
	5	11.00	75.8	791	5200	5200	34.3	31.3
	6	11.10	75.8	747	5500		31.8	
B3-5	4	10.52	75.8	665	4700		31.5	
	5	10.58	75.6	793	5400	5100	37.2	34.1
	6	10.58	75.8	718	5300		33.6	
No.		15	15	15	15	5	15	5
Avg.		10.91	75.8	745	5100	5100	32.9	32.9

Table III-5
Internal Bond
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 22, 1987
Proj. Ref.: 303261-13261

Test Material: BP3 (1.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: As Received

Panel No.	Sample Number	Sample Length mm	Sample Width mm	Maximum Load N	Internal Bond Strength MPa	Average For Panel MPa
B3-1	1	49.6	49.8	966	0.391	
	2	49.8	49.4	1046	0.425	
	3	49.6	49.8	1044	0.423	0.428
	4	49.8	49.4	1211	0.492	
	5	50.0	49.6	1019	0.411	
	6	49.8	49.6	1048	0.424	
B3-2	1	49.8	49.4	1250	0.508	
	2	49.8	49.2	1075	0.439	
	3	49.8	49.4	1382	0.562	0.505
	4	49.8	49.4	1254	0.510	
	5	49.4	49.6	1290	0.526	
	6	49.6	49.4	1189	0.485	
B3-3	1	49.8	49.4	1130	0.459	
	2	49.8	49.4	1174	0.477	
	3	49.8	49.4	1060	0.431	0.484
	4	49.8	49.4	1340	0.545	
	5	49.6	49.4	1350	0.551	
	6	49.6	49.4	1083	0.442	
B3-4	1	49.4	49.8	1256	0.511	
	2	49.4	49.6	1212	0.495	
	3	49.4	49.8	1378	0.560	0.515
	4	49.2	49.6	1265	0.518	
	5	49.2	49.8	1089	0.444	
	6	49.2	49.6	1367	0.560	
B3-5	1	49.4	49.8	1047	0.426	
	2	49.4	49.8	1097	0.446	
	3	49.6	49.8	867	0.351	0.416
	4	49.4	49.8	704	0.286	
	5	49.4	49.8	1145	0.465	
	6	49.4	49.6	1284	0.524	
No.		30	30	30	30	5
Avg.		49.6	49.6	1150	0.470	0.470

Table III-6

Bond Durability-MOR after 2 Hour Boil-Parallel
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 22, 1987
 Proj. Ref.: 303261-13261
 Span: 265 mm

Test Material: BP3 (1.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel
						MPa
B3-1	1	10.98	75.6	329	14.3	
	2	11.08	75.8	504	21.5	18.5
	3	11.24	75.8	471	19.6	
B3-2	1	10.88	75.8	433	19.2	
	2	10.86	75.8	398	17.7	18.6
	3	10.94	75.8	431	18.9	
B3-3	1	11.30	75.8	417	17.1	
	2	11.28	76.0	506	20.8	17.9
	3	11.24	75.8	381	15.8	
B3-4	1	10.32	75.8	384	18.9	
	2	10.46	75.6	312	15.0	16.7
	3	10.52	75.8	342	16.2	
B3-5	1	10.62	75.6	351	16.4	
	2	10.56	75.6	462	21.8	19.3
	3	10.46	75.6	414	19.9	
No.		15	15	15	15	5
Avg.		10.85	75.7	409	18.2	18.2

Table III-7

Bond Durability-MOR after 2 Hour Boil-Perpendicular
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 21, 1987
 Proj. Ref.: 303261-13261
 Span: 265 mm

Test Material: BP3 (1.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
B3-1	4	10.90	75.8	409	18.1	
	5	10.88	75.8	421	18.7	18.6
	6	10.98	75.8	440	19.1	
B3-2	4	10.62	75.8	320	14.9	
	5	10.62	75.8	419	19.5	16.5
	6	10.56	75.6	324	15.3	
B3-3	4	11.20	76.0	359	15.0	
	5	11.32	75.8	446	18.3	16.7
	6	11.46	76.0	421	16.8	
B3-4	4	11.04	76.0	454	19.5	
	5	10.86	76.0	405	18.0	18.9
	6	10.70	76.0	420	19.2	
B3-5	4	10.48	75.8	385	18.4	
	5	10.52	75.8	352	16.7	19.0
	6	10.56	75.8	466	21.9	
No.		15	15	15	15	5
Avg.		10.85	75.9	403	17.9	17.9

Table III-8
Thickness Swell
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 22, 1987
Proj. Ref.: 303261-13261

Test Material: BP3 (1.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 24 hr. Soak

Panel No.	Sample No.	Dry Thickness				Wet Thickness				Average Thick. Swell %	
		Position				Position					
		1	2	3	4	1	2	3	4		
		mm	mm	mm	mm	mm	mm	mm	mm	%	
B3-1	1	11.00	11.00	10.90	10.90	14.40	13.70	14.15	13.85	29	
	2	10.95	10.85	10.85	10.90	14.35	14.00	13.65	14.30		
B3-2	1	10.80	10.75	10.70	10.60	14.60	13.75	13.75	13.15	30	
	2	10.60	10.50	10.45	10.55	14.20	13.95	13.30	14.00		
B3-3	1	11.20	11.15	11.15	11.20	14.20	13.25	13.75	13.50	25	
	2	11.65	11.50	11.50	11.60	15.50	13.90	13.90	15.55		
B3-4	1	10.50	10.55	10.55	10.55	13.40	13.55	13.00	13.75	29	
	2	10.90	10.85	10.90	10.95	14.40	14.00	14.40	14.40		
B3-5	1	10.45	10.45	10.45	10.50	13.35	13.35	13.50	14.00	30	
	2	10.60	10.55	10.55	10.55	13.90	14.00	13.60	13.85		
No.		10	10	10	10	10	10	10	10	5	
Avg.		10.87	10.82	10.80	10.83	14.23	13.75	13.70	14.04	29	

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table III-9

Linear Expansion-Oven Dry to Saturated
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan 26, 1987
Proj. Ref.: 303261-13261

Test Material: BP3 (1.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: OD to Saturated

Panel No.	Sample No.		Oven Dry Gauge Length		Vac.-Pressure Gauge Length		Linear Expansion		Avg. Linear Expansion	
	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.
			mm	mm	mm	mm	%	%	%	%
B3-1	1	3	249.10	249.30	249.55	249.85	0.18	0.22	0.20	0.21
	2	4	250.25	250.20	250.80	250.70	0.22	0.20		
B3-2	1	3	249.65	249.00	250.35	249.45	0.28	0.18	0.25	0.22
	2	4	249.45	248.65	250.00	249.30	0.22	0.26		
B3-3	1	3	249.30	249.25	250.10	249.75	0.32	0.20	0.28	0.19
	2	4	249.90	249.50	250.50	249.95	0.24	0.18		
B3-4	1	3	249.85	249.55	250.45	250.10	0.24	0.22	0.25	0.23
	2	4	248.45	249.35	249.10	249.95	0.26	0.24		
B3-5	1	3	249.60	250.40	250.00	250.90	0.16	0.20	0.20	0.19
	2	4	250.00	250.90	250.60	251.35	0.24	0.18		
No.			10	10	10	10	10	10	5	5
Avg.			249.55	249.60	250.15	250.15	0.24	0.21	0.24	0.21

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table III-10

Thickness Tolerance
(CAN3-0437.1-M85)

Client: ARC
 TestDate: Jan. 15, 1987
 Proj. Ref: 303261-13261

Test Material: BP2 (2.0% Resin)
 Nom.Thickness: 11.1 mm
 Conditioning: As Received

Thickness Measurement	Panel No.				
	BP2-2 mm	BP2-3 mm	BP2-4 mm	BP2-5 mm	BP2-6 mm
Position 1	10.55	10.65	10.85	11.00	10.90
Position 2	10.60	10.45	10.40	11.05	10.70
Position 3	11.15	10.80	10.60	11.75	11.20
Position 4	11.10	10.65	10.60	11.65	11.10
Position 5	11.35	10.90	10.95	11.80	11.35
Position 6	10.85	10.65	10.85	11.15	11.00
Position 7	10.80	10.85	11.05	11.10	11.10
Position 8	10.60	10.70	10.90	11.00	10.90
Avg. Panel Thickness	10.90	10.70	10.80	11.30	11.05
Dev. of Average Panel Thickness from Nominal	-0.20	-0.40	-0.30	0.20	-0.05
Range	High	11.35	10.90	11.05	11.80
	Low	10.55	10.45	10.40	11.00
Dev. Within Panel from Average	High	0.45	0.20	0.25	0.50
	Low	-0.35	-0.25	-0.40	-0.30

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-11

Moisture Content and Density
(CAN3-0437.1-M85)

Client: ARC
Test Date: January 26, 1987
Proj. Ref.: 303261-13261

Test Material: BP2 (2.0% Resin)
Nom. Thickness: 11.1
Conditioning: Oven Dry & at Test

Panel No.	Sample No.	Length	Width	Thick-	TEST	O.D.	M.C.	Avg. M.C.	Density at Test	Avg. Density at Test
		mm	mm	ness	Weight g	Weight g	%	%	kg/cu.m	kg/cu.m
	1	76.0	76.0	10.70	41.1	40.1	2		665	
BP2-2	2	75.5	75.5	10.90	41.0	40.1	2	2	660	662
	1	75.5	76.0	10.65	40.4	39.8	2		661	
BP2 -3	2	76.0	76.0	10.55	37.6	36.8	2	2	617	639
	1	76.0	76.0	10.60	40.9	40.2	2		668	
BP2-4	2	75.5	75.5	10.55	41.8	41.1	2	2	695	682
	1	76.0	76.0	11.00	42.2	41.5	2		664	
BP2-5	2	76.0	76.0	11.35	41.2	40.5	2	2	628	646
	1	76.0	76.0	10.85	39.6	38.8	2		632	
BP2-6	2	76.0	76.0	10.85	41.1	40.3	2	2	656	644
No.		10	10	10	10	10	10	5	10	5
Avg.		75.9	75.9	10.80	40.7	39.9	2	2	655	655

Table III-12

**MOR & MOE DRY-Parallel
(CAN3-0437.1-M85)**

Client: ARC **Test Material:** BP2 (2.0% Resin)
Test Date: Jan. 21, 1987 **Nom. Thickness:** 11.1 mm
Proj. Ref.: 303261-13261 **Conditioning:** As Received
Span: 265.0 mm

Panel No.	Sample No.	Thick-ness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
BP2-2	1	10.48	75.8	674	4800		32.2	
	2	10.60	76.0	736	5200	5100	34.3	32.3
	3	10.60	75.8	651	5300		30.4	
BP2-3	1	10.48	75.8	504	3700		24.1	
	2	10.66	75.6	769	4800	4600	35.6	29.5
	3	10.56	75.8	614	5300		28.9	
BP2-4	1	10.54	75.8	633	4400		29.9	
	2	10.62	75.6	737	5100	4900	34.4	34.8
	3	10.86	75.6	904	5300		40.3	
BP2-5	1	10.88	75.6	766	4500		34.0	
	2	10.92	75.8	669	4600	4900	29.4	32.0
	3	10.94	75.6	743	5500		32.6	
BP2-6	1	10.74	75.8	839	4800		38.1	
	2	10.82	75.8	713	5100	5000	31.9	33.7
	3	10.94	75.8	709	5000		31.1	
No.		15	15	15	15	5	15	5
Avg.		10.71	75.7	711	4900	4900	32.5	32.5

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-13

MOR & MOE DRY-Perpendicular
(CAN3-0437.1-M85)

Client: ARC Test Material: BP2 (2.0% Resin)
 Test Date: Jan 22, 1987 Nom. Thickness: 11.1 mm
 Proj. Ref.: 303261-13261 Conditioning: As Received
 Span: 265.0 mm

Panel No.	Sample No.	Thick-ness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
B2-2	4	10.92	75.8	870	6300		38.3	
	5	10.94	75.8	699	4600	5300	30.6	36.0
	6	11.16	75.8	927	5000		39.0	
B2-3	4	10.62	75.8	511	4500		23.8	
	5	10.74	75.6	692	4900	4800	31.5	28.6
	6	10.72	75.6	669	4900		30.6	
B2-4	4	10.66	75.6	766	5300		35.4	
	5	10.66	75.6	719	4900	5100	33.3	34.3
	6	10.74	75.8	754	5000		34.3	
B2-5	4	11.22	75.8	1013	5600		42.2	
	5	11.50	75.8	766	4500	5000	30.4	33.6
	6	11.70	75.8	736	4800		28.2	
B2-6	4	10.94	75.4	538	4900		23.7	
	5	11.02	75.6	579	4200	4700	25.1	28.4
	6	11.18	75.6	865	5100		36.4	
No.		15	15	15	15	5	15	5
Avg.		10.98	75.7	740	5000	5000	32.2	32.2

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-14

Internal Bond
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan. 20, 1987
Proj.Ref.: 303261-13261

Test Material: BP2 (2.0% Resin)
Nom. Thickness: 11.1 mm
Conditioning: As Received

Panel No.	Sample Number	Sample Length	Sample Width	Maximum Load	Internal	Average For Panel
					Bond Strength	
BP2-2	1	50.0	49.4	1305	0.528	
	2	49.2	49.8	1030	0.420	
	3	49.4	49.8	1010	0.411	0.490
	4	49.4	49.8	1357	0.552	
	5	49.4	49.8	1188	0.483	
	6	49.4	49.8	1347	0.548	
BP2-3	1	49.6	49.4	1342	0.548	
	2	49.6	49.6	1064	0.432	
	3	49.8	49.6	1258	0.509	0.517
	4	50.0	49.6	1432	0.577	
	5	49.6	50.0	1256	0.506	
	6	49.6	50.0	1305	0.526	
BP2-4	1	49.4	49.2	1239	0.510	
	2	49.4	49.4	1029	0.422	
	3	49.4	49.4	1099	0.450	0.496
	4	49.2	49.8	1308	0.534	
	5	49.4	49.8	1385	0.563	
	6	49.8	49.4	1219	0.496	
BP2-5	1	49.4	50.0	1005	0.407	
	2	50.0	49.4	1262	0.511	
	3	49.4	50.0	1169	0.473	0.479
	4	49.4	49.8	1171	0.476	
	5	49.4	49.8	1301	0.529	
	6	49.8	49.6	1179	0.477	
BP2-6	1	49.8	49.2	951	0.388	
	2	49.4	49.8	1050	0.427	
	3	49.4	49.6	1068	0.436	0.454
	4	49.2	49.6	1026	0.420	
	5	49.4	49.6	1236	0.504	
	6	49.2	49.4	1334	0.549	
No.		30	30	30	30	5
Avg.		49.5	49.6	1200	0.487	0.487

Table III-15

Bond Durability-MOR after 2 Hour Boil-Parallel
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 26, 1987
 Proj. Ref.: 303261-13261
 Span: 265 mm

Test Material: BP2 (2.0% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
BP2-2	1	10.52	75.8	344	16.3	
	2	10.64	75.8	399	18.5	18.0
	3	10.66	75.8	418	19.3	
BP2-3	1	10.52	75.8	412	19.5	
	2	10.62	75.6	427	19.9	18.5
	3	10.64	75.6	345	16.0	
BP2-4	1	10.60	75.6	460	21.5	
	2	10.76	75.6	423	19.2	19.1
	3	10.80	75.6	369	16.6	
BP2-5	1	10.86	75.6	362	16.1	
	2	10.96	75.6	477	20.9	19.2
	3	11.04	75.6	475	20.5	
BP2-6	1	10.80	75.8	477	21.4	
	2	10.88	75.8	417	18.5	19.2
	3	11.00	75.8	407	17.6	
No.		15	15	15	15	5
Avg.		10.74	75.7	414	18.8	18.8

Table III-16

Bond Durability-MOR after 2 Hour Boil-Perpendicular
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan 23, 1987
 Proj. Ref.: 303261-13261
 Span: 265 mm

Test Material: BP2 (2.0% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel
						MPa
BP2-2	4	10.80	75.8	465	20.9	
	5	10.96	75.8	415	18.1	17.8
	6	11.04	75.8	332	14.3	
BP2-3	4	10.60	75.8	496	23.1	
	5	10.60	75.8	390	18.2	19.6
	6	10.68	75.8	382	17.6	
BP2-4	4	10.56	75.8	299	14.1	
	5	10.62	76.0	362	16.8	15.9
	6	10.60	76.0	364	16.9	
BP2-5	4	11.12	75.8	479	20.3	
	5	11.32	75.8	483	19.8	18.2
	6	11.52	75.8	370	14.6	
BP2-6	4	10.90	75.6	386	17.1	
	5	10.92	75.6	290	12.8	14.4
	6	11.08	75.6	312	13.4	
No.		15	15	15	15	5
Avg.		10.90	75.8	388	17.2	17.2

Table III-17

Thickness Swell
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan. 20, 1987
Proj. Ref.: 303261-13261

Test Material: BP2(2.0% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 24 hr. Soak

Panel No.	Sample No.	Dry Thickness				Wet Thickness				Average Thick. Swell	
		Position				Position					
		1	2	3	4	1	2	3	4		
		mm	mm	mm	mm	mm	mm	mm	mm	%	
BP2-2	1	10.70	10.70	10.70	10.75	13.20	13.35	12.25	13.40	22	
	2	11.05	11.00	10.90	11.00	13.60	12.95	13.45	14.05		
BP2-3	1	10.60	10.65	10.60	10.60	12.40	12.95	13.00	12.95	22	
	2	10.60	10.65	10.60	10.65	13.00	13.65	12.55	13.55		
BP2-4	1	10.75	10.70	10.55	10.65	12.90	12.50	12.15	12.35	18	
	2	10.45	10.50	10.40	10.55	12.90	12.25	11.95	13.10		
BP2-5	1	11.10	11.00	11.00	11.10	13.80	13.00	13.85	13.25	23	
	2	11.60	11.50	11.45	11.55	14.20	14.00	14.25	14.35		
BP2-6	1	10.95	10.90	10.90	10.90	13.20	12.95	12.70	12.90	21	
	2	11.00	10.95	10.90	11.05	13.95	13.35	13.20	13.75		
No.		10	10	10	10	10	10	10	10	5	
Avg.		10.88	10.86	10.80	10.88	13.32	13.10	12.94	13.37	21	

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table III-18

Linear Expansion-Oven Dry to Saturated
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan. 26, 1987
Proj. Ref.: 303261-13261

Test Material: BP2 (2.0% Resin)
Nom. Thickness: 11.1 mm
Conditioning: OD to Saturated

Panel No.	Sample No.		Oven Dry Gauge Length		Vac.-Pressure Gauge Length		Linear Expansion		Avg. Linear Expansion	
	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.
			mm	mm	mm	mm	%	%	%	%
BP2-2	1	3	249.50	249.60	249.90	249.95	0.16	0.14	0.17	0.17
	2	4	249.55	249.10	250.00	249.60	0.18	0.20		
BP2-3	1	3	249.90	250.05	250.50	250.55	0.24	0.20	0.21	0.20
	2	4	250.00	249.20	250.45	249.70	0.18	0.20		
BP2-4	1	3	250.35	249.80	250.80	250.30	0.18	0.20	0.16	0.18
	2	4	249.35	249.00	249.70	249.40	0.14	0.16		
BP2-5	1	3	249.10	249.80	249.55	250.25	0.18	0.18	0.19	0.21
	2	4	250.40	250.00	250.90	250.60	0.20	0.24		
BP2-6	1	3	250.05	248.70	250.40	249.10	0.14	0.16	0.20	0.20
	2	4	249.30	249.35	249.95	249.95	0.26	0.24		
No.			10	10	10	10	10	10	5	5
Avg.			249.75	249.45	250.20	249.95	0.19	0.19	0.19	0.19

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table III-19

Thickness Tolerance
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan. 15, 1987
 Proj. Ref: 303261-13261

Test Material: BP1 (2.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: As Received

Thickness Measurement	Panel No.					
	BP1-1 mm	BP1-2 mm	BP1-3 mm	BP1-4 mm	BP1-5 mm	
Position 1	10.50	10.85	10.70	11.15	10.75	
Position 2	10.60	11.10	11.00	11.05	11.00	
Position 3	10.45	11.00	10.75	10.55	11.00	
Position 4	10.75	10.90	10.80	10.65	11.00	
Position 5	11.45	11.20	11.05	11.10	11.45	
Position 6	11.60	11.30	11.30	11.70	11.65	
Position 7	11.40	11.25	11.25	11.95	11.55	
Position 8	10.85	10.95	10.80	11.40	11.15	
Avg. Panel Thickness	10.95	11.05	10.95	11.20	11.20	
Dev. of Average Panel Thickness from Nominal	-0.15	-0.05	-0.15	0.10	0.10	
Range	High	11.60	11.30	11.30	11.95	11.65
	Low	10.45	10.85	10.70	10.55	10.75
Dev. Within Panel from Average	High	0.65	0.25	0.35	0.75	0.45
	Low	-0.50	-0.20	-0.25	-0.65	-0.45

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-20

Moisture Content and Density
(CAN3-0437.1-M85)

Client: ARC
 Test Date: January 26, 1987
 Proj. Ref.: 303261-13261

Test Material: BP1 (2.5% Resin)
 Nom. Thickness: 11.1
 Conditioning: Oven Dry & at Test

Panel No.	Sample No.	Length	Width	Thick-	TEST	O.D.	M.C.	Avg. M.C.	Density at Test	Density at Test	Avg.
		mm	mm	mm	g	g	%	%	kg/cu.m	kg/cu.m	
BP1-1	1	76.0	76.0	10.95	42.8	41.5	3		677		
	2	76.0	76.0	10.60	41.4	39.8	4	4	676	676	
BP1-2	1	76.0	76.0	10.60	40.1	39.1	3		655		
	2	76.0	76.0	10.90	47.4	46.1	3	3	753	704	
BP1-3	1	76.0	76.0	10.55	40.4	39.4	3		663		
	2	76.0	76.0	10.70	42.8	41.5	3	3	693	678	
BP1-4	1	76.0	76.0	10.90	42.2	41.1	3		670		
	2	76.0	76.0	10.65	40.3	39.2	3	3	655	663	
BP1-5	1	75.5	76.0	10.80	40.4	39.0	4		652		
	2	76.0	76.0	11.05	46.4	44.6	4	4	727	689	
No.		10	10	10	10	10	10	10	10	10	5
Avg.		76.0	76.0	10.77	42.4	41.1	3	3	682	682	5

ALBERTA RESEARCH COUNCIL
 FOREST PRODUCTS LABORATORY

Table III-21

MOR & MOE DRY-Parallel
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan. 21, 1987
 Proj. Ref.: 303261-13261

Test Material: BP1 (2.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: As Received
 Span: 265.0 mm

Panel No.	Sample No.	Thick-	Width	Max.	MOE	Avg.	MOR	Avg.
		ness	mm	Load	MPa	MOE	MPa	MOR
BP1-1	1	10.50	75.8	732	5300		34.8	
	2	10.80	75.8	670	4900	5100	30.1	33.1
	3	11.06	75.8	804	5200		34.5	
BP1-2	1	10.82	75.6	757	4300		34.0	
	2	10.64	75.6	708	5500	4800	32.9	31.3
	3	10.88	75.6	608	4500		27.0	
BP1-3	1	10.76	75.8	818	4400		37.1	
	2	10.62	75.6	656	5400	4800	30.6	32.7
	3	10.76	75.6	674	4500		30.6	
BP1-4	1	11.06	75.8	736	4500		31.6	
	2	11.02	75.8	676	4900	4800	29.2	30.5
	3	11.28	75.8	746	4900		30.7	
BP1-5	1	10.82	75.6	868	5200		39.0	
	2	10.78	75.6	757	4400	4800	34.3	37.4
	3	11.04	75.6	902	4800		38.9	
No.		15	15	15	15	5	15	5
Avg.		10.86	75.7	741	4800	4900	33.0	33.0

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-22

**MOR & MOE DRY-Perpendicular
(CAN3-0437.1-M85)**

Client: ARC
Test Date: Jan. 22, 1987
Proj. Ref.: 303261-13261

Test Material: BP1 (2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: As Received
Span: 265.0 mm

Panel No.	Sample No.	Thick-ness	Width	Max. Load	MOE	Avg. MOE	MOR	Avg. MOR
		mm	mm	N	MPa	MPa	MPa	MPa
BP1-1	4	11.24	75.8	644	4600		26.7	
	5	11.16	75.8	844	4300	4600	35.5	32.2
	6	11.10	75.8	808	5000		34.4	
BP1-2	4	10.92	75.4	772	4900		34.1	
	5	10.82	75.6	643	5700	5600	28.9	35.7
	6	11.06	75.6	1027	6100		44.1	
BP1-3	4	10.84	75.8	891	5100		39.8	
	5	10.70	75.6	630	4800	5100	28.9	35.1
	6	10.80	75.8	815	5400		36.6	
BP1-4	4	10.98	75.6	717	4700		31.3	
	5	10.76	75.8	792	5300	5000	35.9	32.0
	6	10.82	75.8	646	5100		28.9	
BP1-5	4	11.18	75.8	730	4100		30.6	
	5	10.98	75.8	625	4800	4600	27.2	31.2
	6	11.04	75.8	834	5000		35.9	
No.		15	15	15	15	5	15	5
Avg.		10.96	75.7	761	5000	5000	33.3	33.3

ALBERTA RESEARCH COUNCIL

FOREST PRODUCTS LABORATORY

Table III-23

Internal Bond
(CAN3-0437.1-M85)

Client: ARC
 Test Date: Jan. 20, 1987
 Proj. Ref.: 303261-13261

Test Material BP1 (2.5% Resin)
 Nom. Thickness: 11.1 mm
 Conditioning: As Received

Panel No.	Sample Number	Sample Length mm	Sample Width mm	Maximum Load N	Internal Bond Strength MPa	Average For Panel MPa
BP1-1	1	49.4	49.8	1200	0.488	
	2	49.2	49.6	1364	0.559	
	3	49.4	49.8	1342	0.546	0.492
	4	49.4	49.8	1223	0.497	
	5	49.2	49.6	1123	0.460	
	6	49.6	49.4	984	0.402	
BP1-2	1	49.4	49.8	1122	0.456	
	2	49.4	49.8	1152	0.468	
	3	49.8	49.4	1281	0.521	0.441
	4	49.6	49.2	873	0.358	
	5	49.4	49.6	1011	0.413	
	6	49.6	49.4	1060	0.433	
BP1-3	1	49.8	49.6	1265	0.512	
	2	49.6	49.8	1345	0.545	
	3	49.4	49.6	1026	0.419	0.459
	4	49.6	49.6	1044	0.424	
	5	49.6	49.6	985	0.400	
	6	49.8	49.4	1118	0.454	
BP1-4	1	49.8	49.6	1059	0.429	
	2	49.6	49.8	1091	0.442	
	3	49.6	49.8	1391	0.563	0.444
	4	49.8	49.6	914	0.370	
	5	49.8	49.6	1140	0.462	
	6	49.8	49.6	987	0.400	
BP1-5	1	50.0	49.6	1334	0.538	
	2	50.0	49.6	1153	0.465	
	3	49.4	49.8	1054	0.428	0.460
	4	50.0	49.4	987	0.400	
	5	49.8	49.4	994	0.404	
	6	49.4	49.8	1287	0.523	
No.		30	30	30	30	5
Avg.		49.6	49.6	1130	0.459	0.459

Table III-24

**Bond Durability-MOR after 2 Hour Boil-Parallel
(CAN3-0437.1-M85)**

Client: ARC
Test Date: Jan 26, 1987
Proj. Ref.: 303261-13261
Span: 265 mm

Test Material: BP1 (2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
						MPa
BP1-1	1	10.60	75.6	366	17.1	
	2	10.92	75.6	375	16.5	16.8
	3	11.24	75.6	402	16.7	
BP1-2	1	10.74	75.6	322	14.7	
	2	10.76	75.8	356	16.1	16.8
	3	11.12	75.6	463	19.7	
BP1-3	1	10.70	75.6	452	20.8	
	2	10.64	75.6	357	16.6	16.8
	3	11.06	75.6	307	13.2	
BP1-4	1	11.00	75.8	373	16.2	
	2	11.10	75.8	364	15.5	16.9
	3	10.66	75.8	413	19.1	
BP1-5	1	10.72	75.6	381	17.4	
	2	10.92	75.4	433	19.1	17.0
	3	11.28	75.6	348	14.4	
No.		15	15	15	15	5
Avg.		10.90	75.6	381	16.9	16.9

75
Table III-25

**Bond Durability-MOR after 2 Hour Boil-Perpendicular
(CAN3-0437.1-M85)**

Client: ARC
Test Date: Jan 23, 1987
Proj. Ref.: 303261-13261
Span: 265 mm

Test Material: BP1 (2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 2 Hour Boil

Panel No.	Sample No.	Sample Thickness mm	Sample Width mm	Maximum Load N	MOR MPa	Average MOR for Panel MPa
						MPa
BP1-1	4	11.16	75.8	468	19.7	
	5	11.14	76.0	437	18.4	20.0
	6	11.08	75.8	514	22.0	
BP1-2	4	10.88	75.6	363	16.1	
	5	10.86	75.4	508	22.7	18.2
	6	10.92	75.6	359	15.8	
BP1-3	4	10.76	75.8	494	22.4	
	5	10.70	75.8	329	15.1	19.0
	6	10.70	75.8	430	19.7	
BP1-4	4	10.98	75.8	390	17.0	
	5	10.94	75.8	369	16.2	18.7
	6	10.78	75.8	508	22.9	
BP1-5	4	11.10	75.8	454	19.3	
	5	11.10	75.8	330	14.0	17.0
	6	11.00	75.8	408	17.7	
No.		15	15	15	15	5
Avg.		10.94	75.8	424	18.6	18.6

Table III-26
Thickness Swell
(CAN3-0437.1-M85)

Client: ARC
Test Date: Jan. 19, 1987
Proj. Ref.: 303261-13261

Test Material: BP1(2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: 24 hr. Soak

Panel No.	Sample No.	Dry Thickness				Wet Thickness				Average Thick. Swell %	
		Position				Position					
		1	2	3	4	1	2	3	4		
		mm	mm	mm	mm	mm	mm	mm	mm	\$	
BP1-1	1	11.30	11.15	11.10	11.25	13.50	13.75	12.95	13.35	20	
	2	10.80	10.75	10.75	10.75	13.00	13.30	13.00	12.50		
BP1-2	1	10.95	11.15	10.80	10.70	13.20	13.95	12.75	12.65	22	
	2	10.95	10.95	10.95	11.05	13.80	12.90	13.25	13.90		
BP1-3	1	11.10	10.75	10.60	10.80	13.25	13.40	12.50	13.25	22	
	2	10.80	10.70	10.75	10.70	13.10	13.15	13.15	13.65		
BP1-4	1	11.45	11.20	11.00	11.20	13.90	13.05	13.15	13.30	20	
	2	10.60	10.60	10.60	10.60	13.35	12.30	12.85	12.85		
BP1-5	1	11.30	11.00	10.95	11.15	13.80	13.30	12.50	13.40	20	
	2	10.95	11.00	10.90	10.95	13.00	13.50	13.50	12.75		
No.		10	10	10	10	10	10	10	10	5	
Avg.		11.02	10.93	10.84	10.92	13.39	13.26	12.96	13.16	21	

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY

Table III-27

Linear Expansion-Oven Dry to Saturated
(CAN3-0437.1-M85)Client: ARC
Test Date: Jan. 26, 1987
Proj. Ref.: 303261-13261Test Material: BP1 (2.5% Resin)
Nom. Thickness: 11.1 mm
Conditioning: OD to Saturated

Panel No.	Sample No.		Oven Dry Gauge Length		Vac.-Pressure Gauge Length		Linear Expansion		Avg. Linear Expansion	
	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.	Par.	Perp.
			mm	mm	mm	mm	%	%	%	%
BP1-1	1	3	249.80	250.40	250.20	250.75	0.16	0.14	0.22	0.17
	2	4	249.20	248.80	249.90	249.30	0.28	0.20		
BP1-2	1	3	249.95	249.85	250.55	250.30	0.24	0.18	0.28	0.20
	2	4	249.15	248.20	249.95	248.75	0.32	0.22		
BP1-3	1	3	249.15	249.10	249.55	249.55	0.16	0.18	0.20	0.19
	2	4	250.05	248.75	250.65	249.25	0.24	0.20		
BP1-4	1	3	249.30	249.20	249.90	249.70	0.24	0.20	0.25	0.22
	2	4	249.25	250.00	249.90	250.60	0.26	0.24		
BP1-5	1	3	249.65	249.30	250.25	249.65	0.24	0.14	0.23	0.15
	2	4	248.90	250.15	249.45	250.55	0.22	0.16		
No.			10	10	10	10	10	10	5	5
Avg.			249.45	249.40	250.05	249.85	0.24	0.19	0.24	0.19

ALBERTA RESEARCH COUNCIL
FOREST PRODUCTS LABORATORY