COATINGS AND EMBOSSED PANELS
FP 2.5.1

ALBERTA RESEARCH COUNCIL
INDUSTRIAL TECHNOLOGIES DEPARTMENT
FOREST PRODUCTS PROGRAM[1]

1987

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

[1]Edmonton, Alberta

DISCLAIMER

The study on which this report is based was funded 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 the Canadian Forestry Service or the Alberta Forest Service.

ISBN 0-662-15969-1

Catalogue No. Fo 42-91/27 - 1988E

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

Regional Development
Canadian Forestry Service
5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Government of Alberta
Forestry, Lands & Wildlife
Forest Industry Development Division
Ste. 930, 9942 - 108 Street
Edmonton, Alberta, Canada T5K 2J5
403/422-7011

SUMMARY

Coatings and embossed panels provide a unique opportunity for secondary manufacture in Alberta. Secondary manufacture could expand the markets for Alberta panel products and add value to those products.

In this project, the possibility of coating and embossing Alberta produced oriented strandboard was investigated. A number of coatings were tried, and results indicated that a finish acceptable for low-end furniture manufacture can be achieved by the following method - sanding followed by an application of kraft paper overlay, two basecoats, print and top coat. However, embossing showed more immediate potential for expanding the markets for oriented strandboard. Results from a number of panels embossed in the lab indicated that an excellent finish can be achieved by using a medium density overlay and embossing at the same time that the board is made in the press. The product looks like wood. The board accepts finish well and could prove to be a very durable exterior product if the right coatings are applied.

TABLE OF CONTENTS

LIST OF FIGURES

TABLE OF CONTENTS (CONTINUED)

LIST OF APPENDICES

1. OBJECTIVES AND GOALS

The objective of this study was to investigate the possibility of coating and embossing existing Alberta produced panels.

The goal for this year was to produce examples of coated and embossed panels and determine the technical requirements for coating and embossing oriented strandboard (OSB). Work with OSB was chosen in this study because of the restricted use of OSB with coatings and embossings and because the potential market created for OSB would most benefit existing Alberta industry.

2. INTRODUCTION

2.1 General

In addition to the vast North American and international market for structural panels, in which Alberta-manufactured wood composites compete as commodities, there is a large and profitable market for specialty panels. These panels are used for wall panelling, exterior siding and furniture manufacture. They represent an important opportunity for secondary manufacturing in Alberta, with potential of high value added and job creation.

In this secondary market, appearance is all-important.

Although oriented strandboard exhibits good structural properties -- stiffness, strength and moisture resistance -- its appearance is poor, and the panel surfaces are rough. Panels of OSB readily show the pattern of flakes from which they are made. The texture of the individual surface flakes can be seen and felt. There are voids between some flakes and there are sizeable indentations. Even with sanding, the surface is not smooth. In order to achieve a smooth, presentable surface, some filling is required.

2.2 Approach

The approach in this study was to use oriented strandboard as a substrate and to attempt to produce a satisfactory surface through the use of modern prefinishing techniques, such as filling and embossing.

Considerable interest has been shown by local wood finishers in using oriented strandboard as a furniture grade substrate. One attraction of oriented strandboard is its stiffness, which allows for greater spans than particleboard and medium density fibreboard, which are commonly used in furniture manufacture. Its disadvantage is its rough surface, as furniture grade material must be very smooth.

To investigate the suitability of using oriented strandboard as a substrate in furniture grade material, the approach was to evaluate various fillers. The boards could then be sanded and wet printed.

On the other hand, in wall panelling and exterior siding, a surface which approximates rough grain is desired. As a result, the approach used to investigate the suitability of oriented strandboard in this application was embossing.

3. METHODS AND MATERIALS

3.1 Filler Study

This study proceeded in two stages:

* various fillers were applied to oriented strandboard and boards were sanded to see if a suitable surface quality could be obtained. All samples were subjected to exacting visual inspection and had to pass the Cold Check Test. (Appendix A).
* once an acceptable surface quality was obtained, the filled panel was finished with overlays, wet print and paints.

Five different systems were evaluated:

* Coating System #1

  A fibreglass-reinforced polyester filling was used, followed by light sanding.

* Coating System #2

  One coat of an ultraviolet filler was used, and then the board was sanded.

* Coating System #3

  Two coats of the ultraviolet filler were used, and then the board was sanded.

* Coating System #4

  The board from System #3 was given a base coat, printed (with ink in a wood grain pattern) and then given a top coat.

* Coating System #5

  The board was sanded and overlaid with recycled kraft paper, which is very cheap. It was then given two basecoats, printed and given a top coat.

3.2 Embossing Study

An embossing plate was prepared, with which a wood grain pattern is pressed into the oriented strandboard, so that the panel resembles rough cut lumber. These panels would be used for exterior siding,

given a weather resistant finish. Three different systems were evaluated:

* Embossing System #1

  The embossing plate was applied to an OSB panel that had already been manufactured, at a pressure that exceeded 800 psi, for 10 minutes.

* Embossing System #2

  The embossing plate was applied to the mat during the press cycle.

* Embossing System #3

  A medium density overlay (see Appendix B) was set on the mat and the embossing plate was applied during the press cycle.

4. RESULTS AND DISCUSSION

4.1 Results of Filler Studies

Coating System #1

This system -- fibreglass-reinforced polyester with light sanding -- results in a good looking finish, which would be suitable for furniture. However, the materials are too expensive and the process of coating the panels is too slow.

The finish, which looks like marble, is shown in Figure 1. Although the surface looks smooth in the photograph, there are many tiny holes (like pinholes) in the surface, which show up when the panel is painted. It would, therefore, not be possible to paint this material -- it would have to be varnished.

Coating System #2

The advantage of ultraviolet fillers is that they are 100% solid, so that there is no shrinkage when they are cured.

This system -- a single coat of ultraviolet filler, sanded -- did not give an adequately smooth surface. This sample failed the Cold Check Test.

Coating System #3

This system -- two coats of ultraviolet filler, sanded -- gave a better result than a single coat of ultraviolet filler, but still did not result in an adequately smooth surface. The individual chips are visible, and there are many voids.

There is a concern that the individual chips would swell at different rates if the panel were subject to moisture. In fact, this sample failed the Cold Check Test.

Coating System #4

This system -- two coats of ultraviolet filler, sanded, base coated, printed and top coated -- worked adequately for finer board, but the overall finish was not satisfactory. This sample failed the Cold Check Test. An example is shown in Figure 2.

Coating System #5

This system -- sanded, overlayed with recycled kraft paper, base coated, printed and top coated -- resulted in a much better finish. This sample passed the Cold Check Test.

There is still some evidence of the chip pattern beneath the overlay -- hollows that "telegraph" voids and indentations. This could be suitable for cheaper children's furniture, such as toy boxes. An example is shown in Figure 3. This sample looks "flat", i.e. two-dimensional, but this is because it received only one print coat. Normally, there would be three synchronized print coats that would achieve a realistic finish.

4.2 Results of Embossing Studies

Embossing System #1

This system -- embossing the board after it is made -- does not give a satisfactory result. The oriented strandboard is too hard for the embossing plate to make a sufficient impression, with the result that the flake pattern is still quite pronounced. Cross-flakes betray the grain pattern of the embossing plate. An example ("stockade"-type panel) is shown in Figure 4.

This system would be impractical for production, because it takes a large press a long time (approximately 10 minutes) to make a sufficiently pronounced impression.

Embossing System #2

This system -- embossing while the board is being pressed -- gives sharp definition and contrast, but the individual wafers still show distinctly. An example is shown in Figure 5. This board might be suitable for low-end products, such as tool sheds.

Embossing System #3

This system -- medium density overlay, embossing while the board is being pressed -- gives very good results. The product looks like wood, with excellent definition of the grain pattern and no evidence of the flakes. Figure 6 shows the panel as it comes form the press, without any finish. Figure 7 shows a detail of the panel displayed in Figure 6.

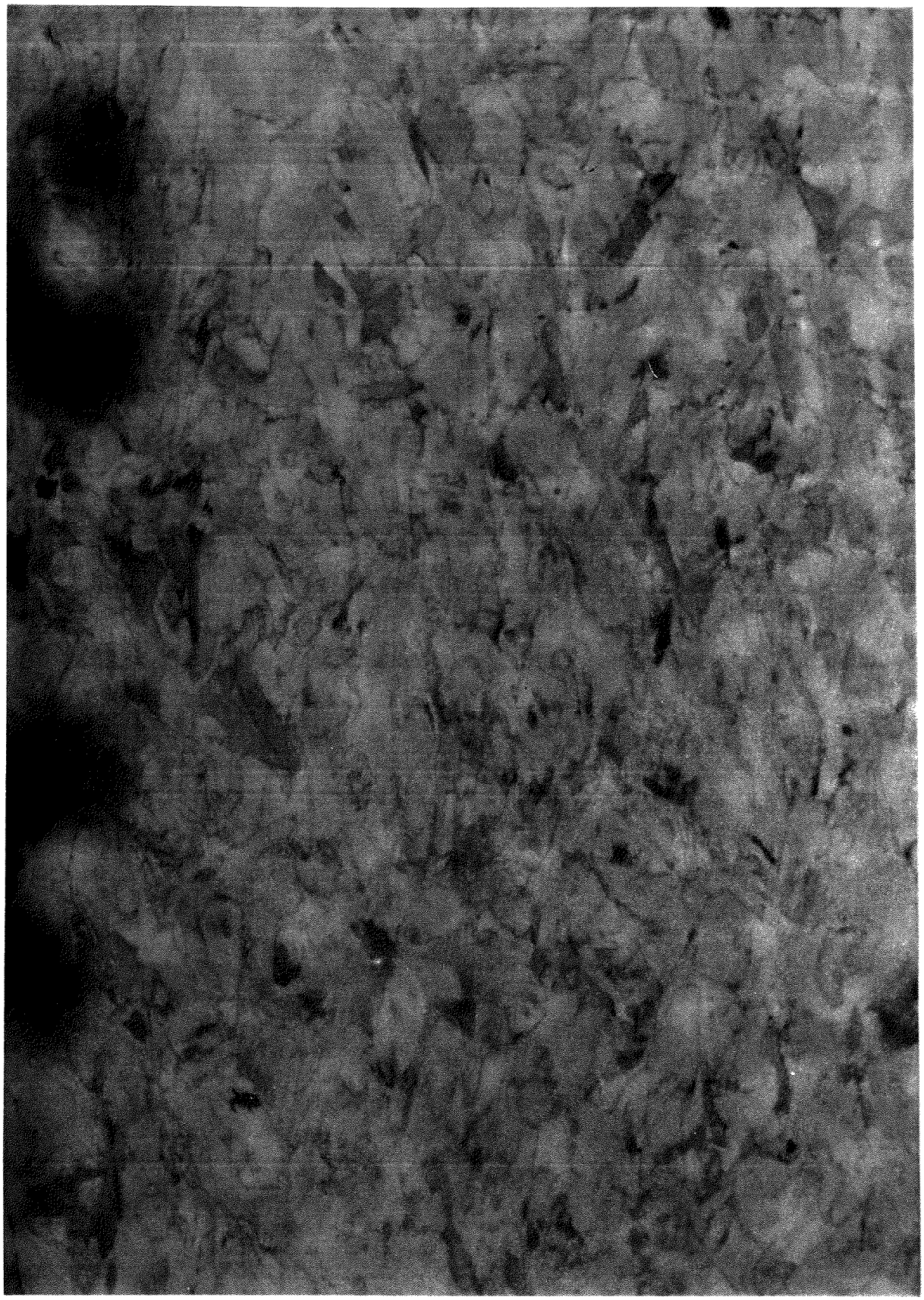

Figure 1 Coating System #1 - Fibreglass-reinforced Polyester

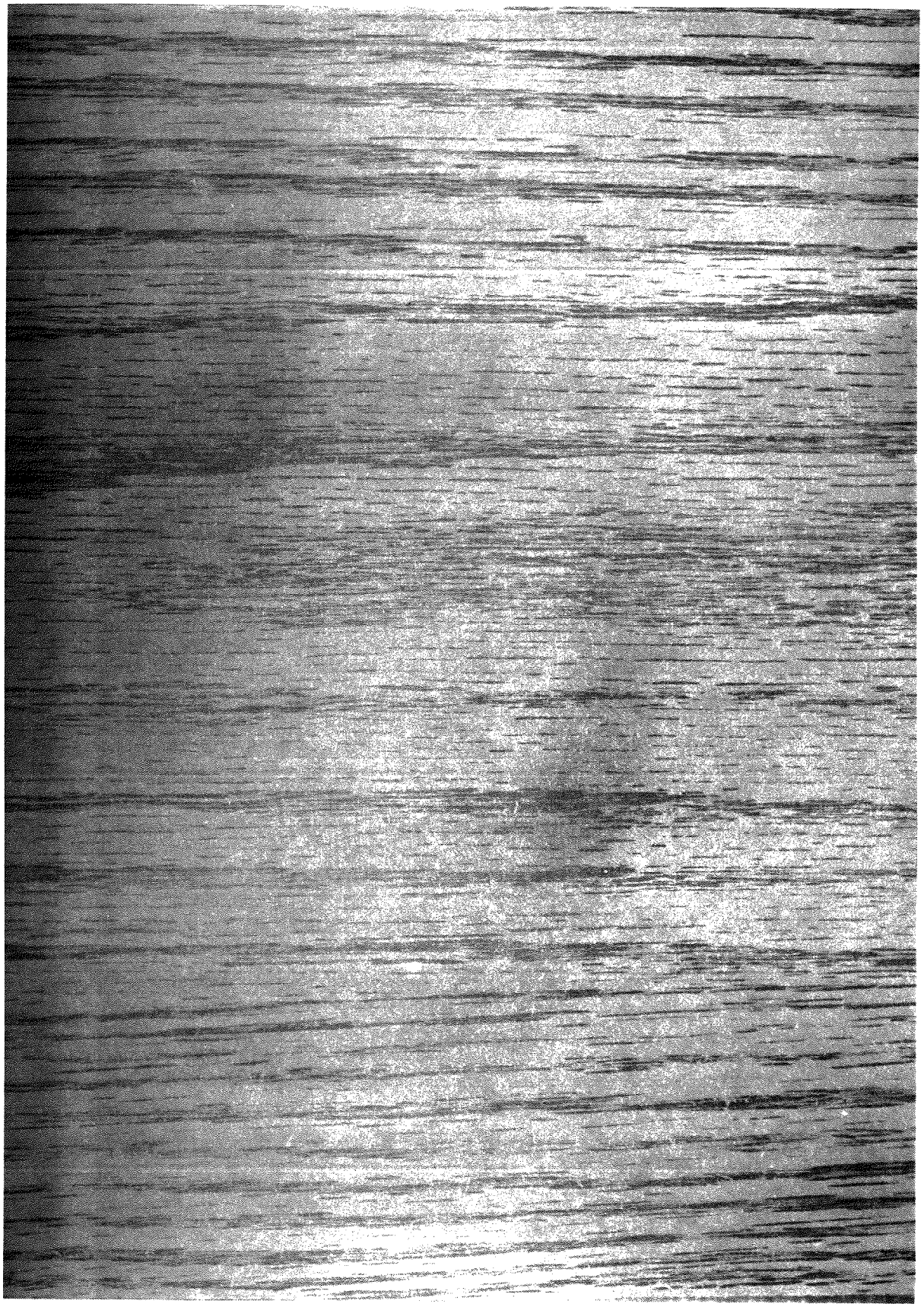

Figure 2 Coating System #4 - Ultraviolet Filler with Finish

Figure 3 Coating System #5 - Recycled Kraft Paper Overlay with Finish

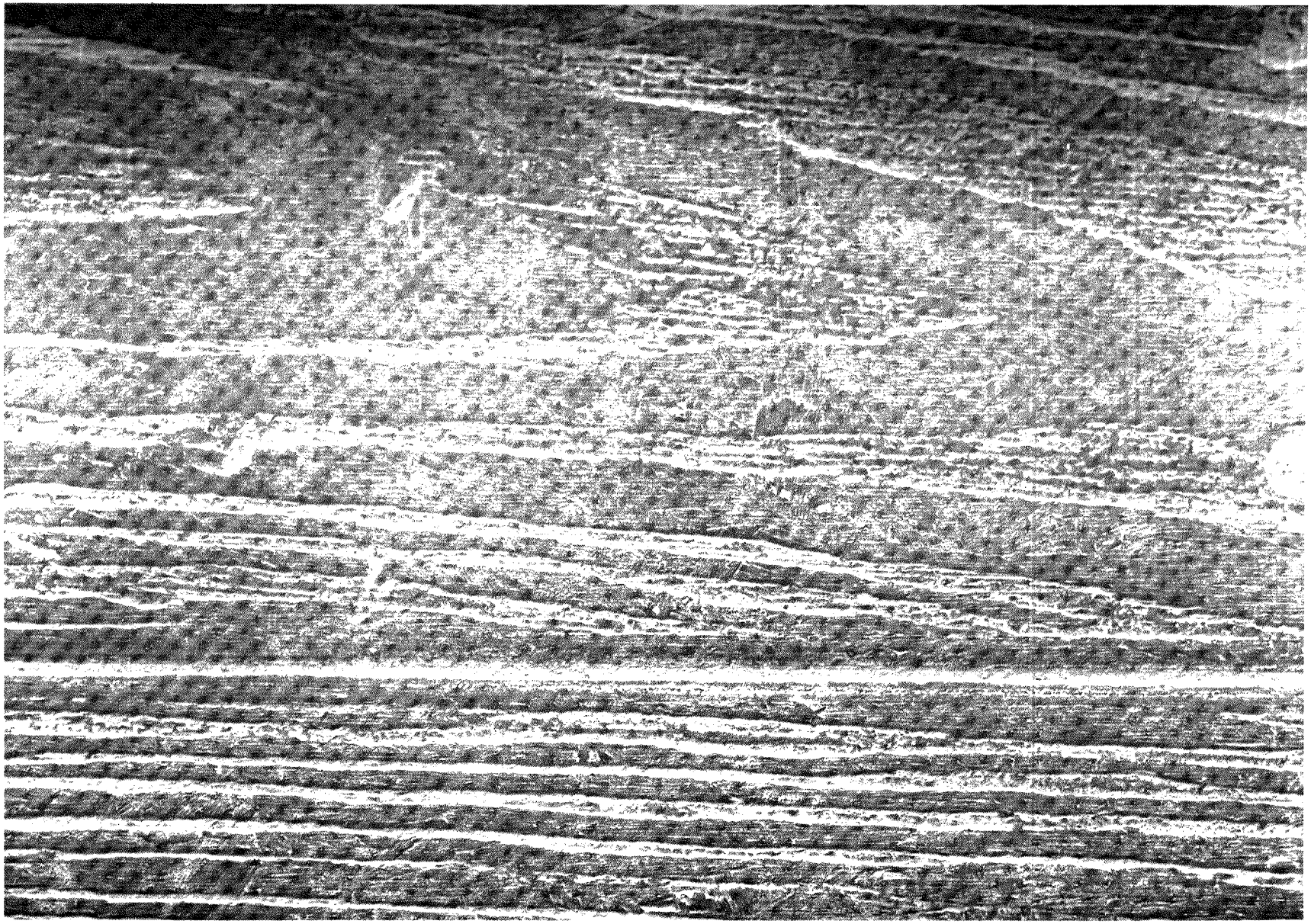

Figure 4 Embossing System #1 - Embossing Existing Board

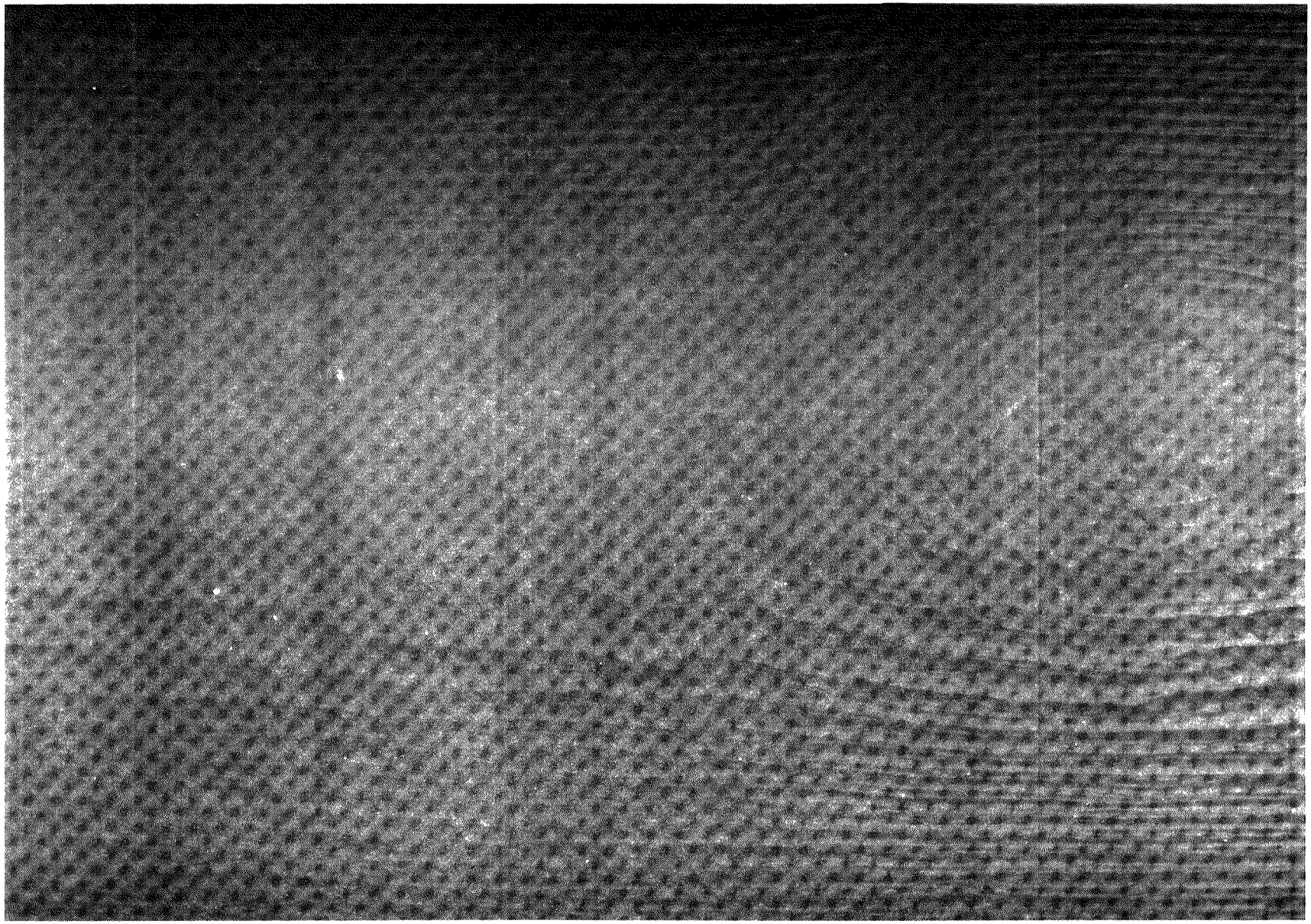

Figure 5 Embossing System #2 - Embossing During Press Cycle

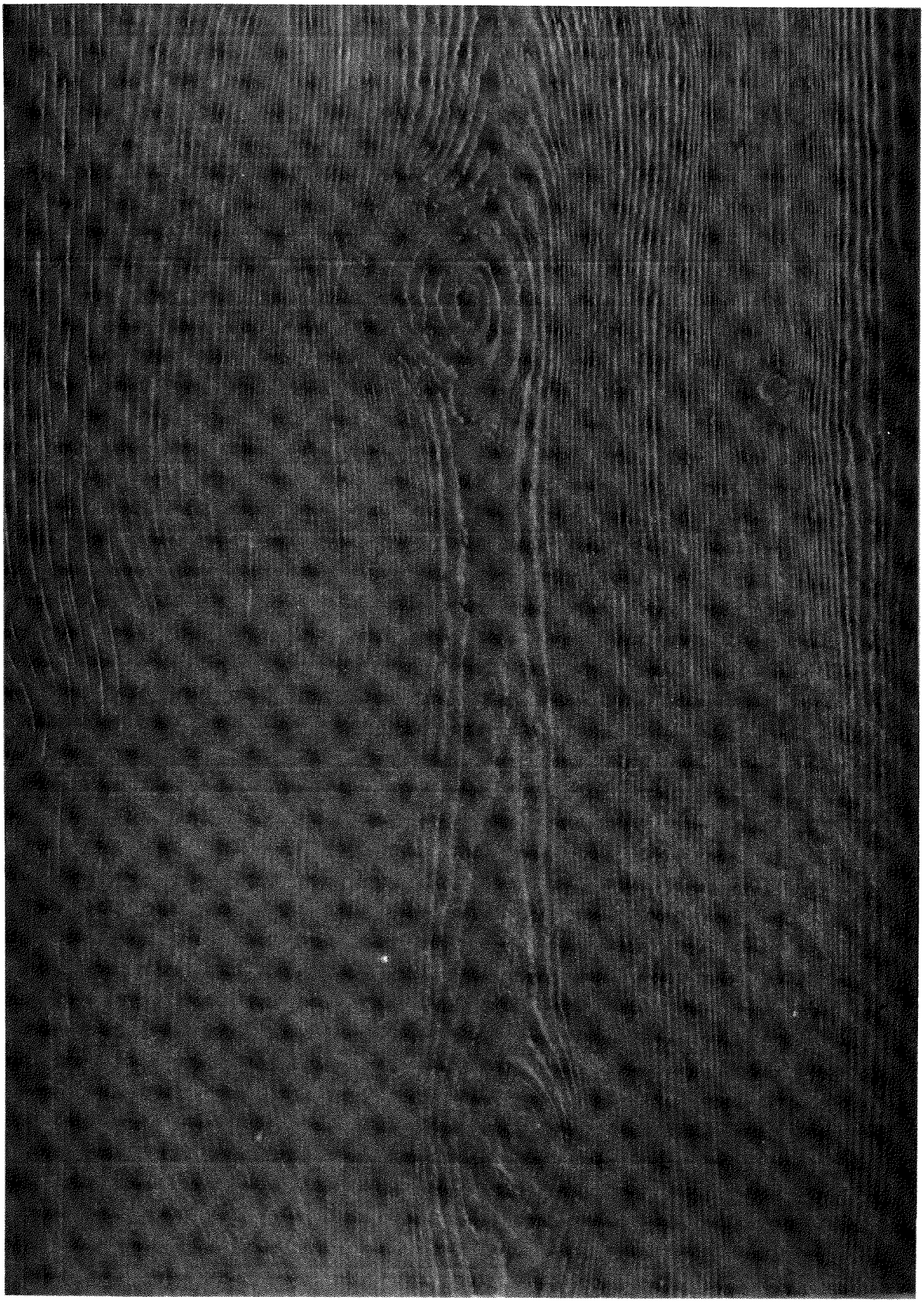

Figure 6 Embossing System #3 - Medium Density Overlay Unfinished

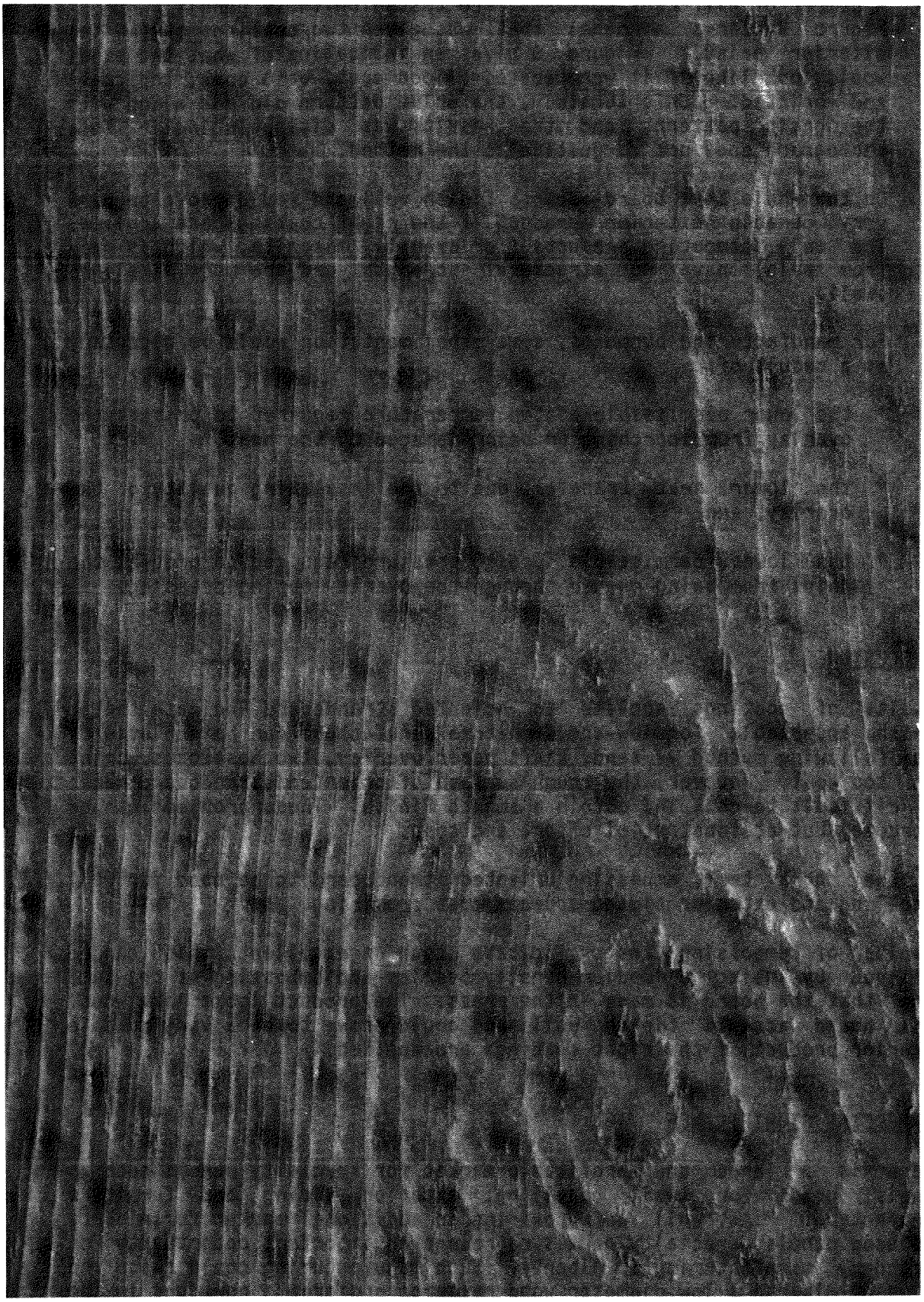

Figure 7 Embossing System #3 - Detail from Figure 6

A number of different coatings were tested on these panels. Figure 8 shows a panel that was given two coatings of (white) exterior paint. Figure 9 gives an indication of what the panel would look like if it were coated (flood coat, base coat, top coat) and printed. Unfortunately, the print pattern did not align with the grain pattern, and the result was disappointing. This photograph does not do justice to the method.

On the whole this board accepts finish well and could prove to be a very durable exterior product if the right coatings are applied. The only competing products (for example, masonite, which is made from pulp) have no structural strength and are more likely to swell.

For manufacturing purposes, some experimentation would be necessary as a result of:

* the lower permissible platen temperature required to prevent the overlay from scorching or being damaged by the heat,

* the lower heat transfer due to the insulating quality of the overlay, and

* the lower permissible press pressure required to prevent the chips from being pushed through the overlay during pressing.

5. CONCLUSION

Results of coatings applied to oriented strandboard indicate that a finish acceptable for low-end furniture manufacture can be achieved by the following method -- sand, kraft paper overlay, two basecoats, print and top coat. However, the rough surface of oriented strandboard makes it difficult to coat and obtain a smooth finish. These problems can be overcome, but at substantial effort and cost.

In the short term, embossing oriented strandboard to be used for wall panelling and exterior siding appears most promising.

Results of embossing tests indicate that an excellent finish can be achieved by using a medium density overlay and embossing at the same time that the board is made in the press. The product looks like wood. This board accepts finish well and could prove to be a very durable exterior product if the right coatings are applied.

6. COMMERCIAL SIGNIFICANCE

There is a large and profitable market for specialty panels such as panels used for wall panelling, exterior siding and furniture manufacture. As well as providing an additional market for Alberta produced panels, specialty panels represent an important opportunity for secondary manufacturing in Alberta. Such manufacturing could raise the value of Alberta's low diameter wood resource and create new jobs in the province.

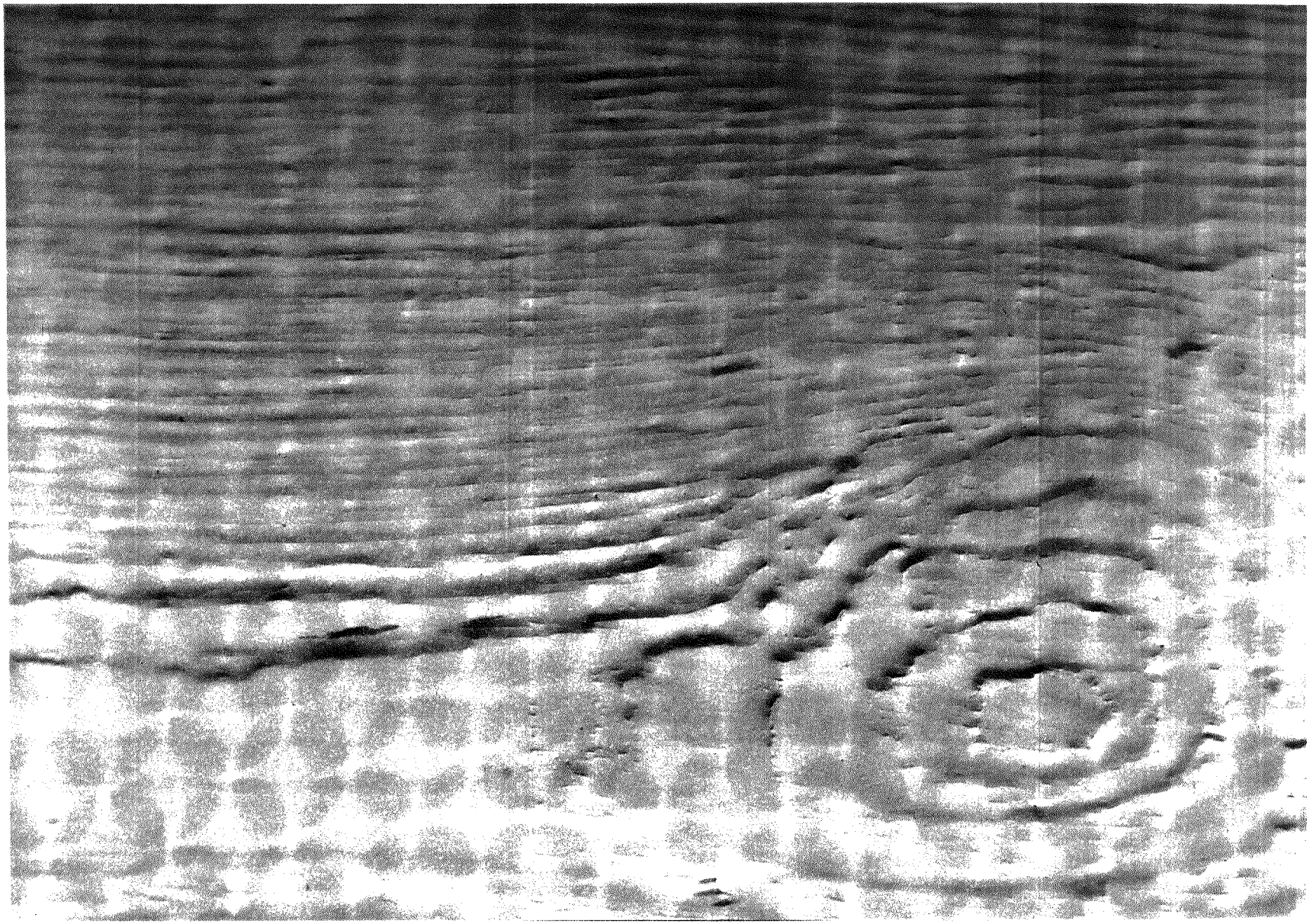

Figure 8 Embossing System #3 - Medium Density Overlay Finished with Two Coats of Exterior Paint

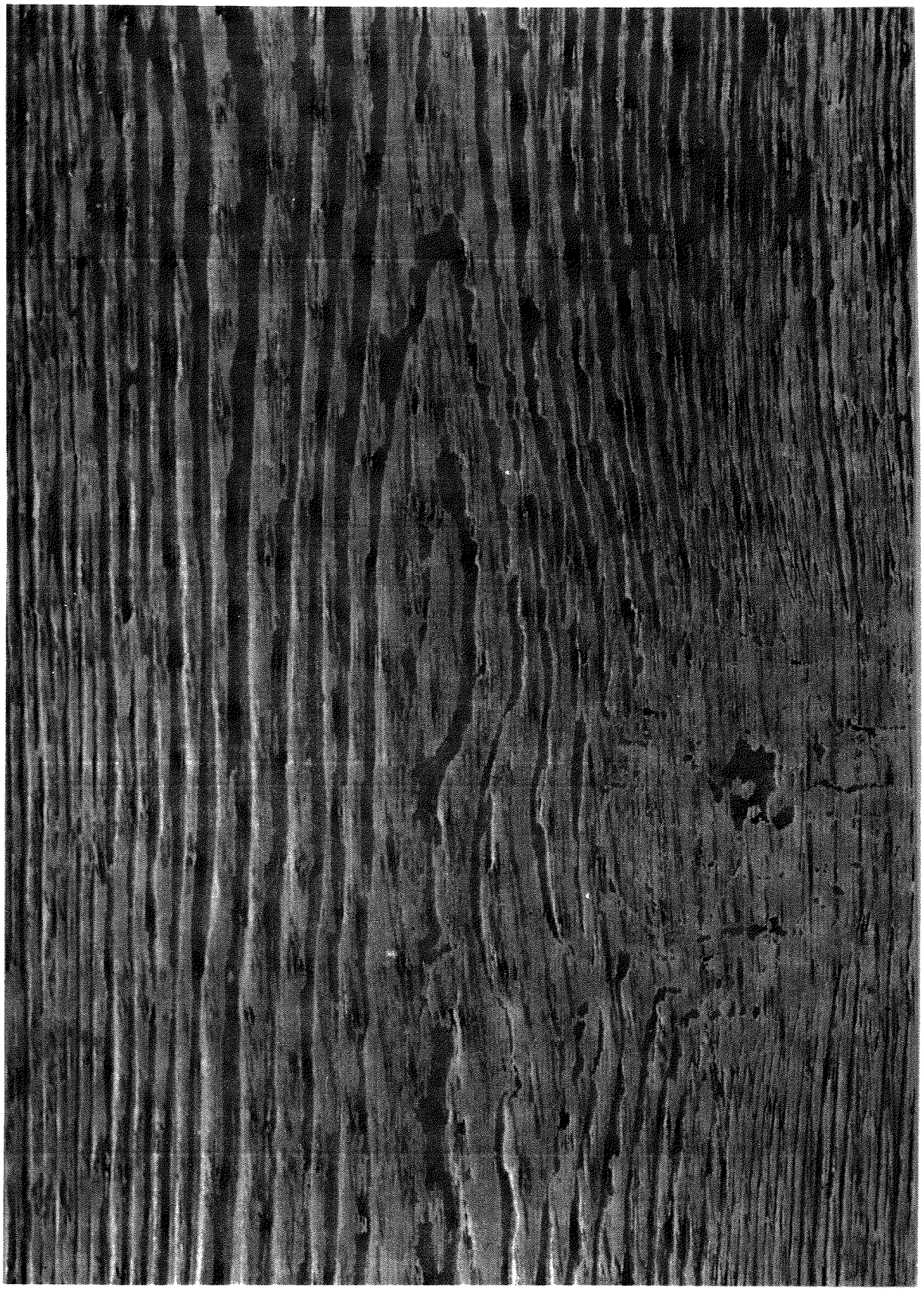

Figure 9 Embossing System #3 - Medium Density Overlay Coated and Printed

As such processes are already being used in various regions of the world, it is important that the Alberta forest products industry follow in this direction to remain competitive.

7. RECOMMENDATIONS

The results of this study indicate that coating and embossing oriented strandboard is technically feasible and thus should be pursued further. Since embossed oriented strandboard with and without overlay show the most potential in terms of suitability and marketability, it is recommended that:

1. experimental work be done with alternative binders like isocyanates which set faster and at lower temperatures allowing for a broader range of overlays to be used,

2. further work be done with new and advanced overlays and techniques in embossing to keep Alberta industry informed of new developments, and

3. incentives as well as technical and market information be provided to Alberta industry to commercially produce these products.

It is also recommended that coating and embossing trials be done on medium density fiberboard and particleboard at the ARC laboratory. These types of panels are more suited in certain applications and the Alberta forest products industry is diversifying into their production.

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

Reliance Universal Inc. 1965. Useful Facts and Figures. Louisville, Kentucky.

American Society for Testing and Materials. 1987. Annual Book of ASTM Standards. Section 6 Paints, Related Coatings, and Aromatics, Volume 06.01. ASTM D 1211-74.

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

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

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

APPENDIX A

COLD CHECK TEST

APPENDIX A

COLD CHECK TEST

PURPOSE: To determine the resistance of printed lauan to checking when exposed to alternating heat and cold.

ACCEPTABLE VALUE: Minimum of 2 cycles before any checking occurs.

REFERENCE; ASTM D-12-11-60

Test samples, 12" x 12", shall be cut from panels that have aged at least seven days. Two samples shall be cut for each specimen and placed back-to-back with masking tape placed around their periphery. These samples shall then be placed on a rack in the laboratory oven set at 125°F $\pm$ 5°F for 60 minutes. Immediately after removal from the oven, the specimens shall be placed on edge in a feezer at -5°F $\pm$ 2°F for 60 minutes. After removal from the freezer, the samples shall stand at room temperature for 30 minutes. This will complete one cycle and shall be repeated 5 times.

Samples shall be examined after each cycle, being held at an angle to the light source. The failure end point shall be when innumerable fine lines appear in the top coat, or when a total of four checks (one to two inches in length), or two checks (more than two inches in length), appear. The area of the test panel to be observed for failure shall exclude the outer ½ inch perimeter of the panel.

APPENDIX B

PRODUCT BULLETINS FOR REICHHOLD MEDIUM DENSITY OVERLAY

PRODUCT BULLETIN | **REICHHOLD** | **TREATED FIBER PRODUCTS**

Bulletin No. TFP-4 | **July 1986**

METRON® MDO Medium Density Overlay
General Use 42-580

DESCRIPTION:

METRON® MDO is a phenolic resin impregnated kraft paper that is used as a fully exterior overlay for plywood and waferboard. METRON provides a smooth, uniform surface intended for high quality exterior paint finishes. METRON has been approved by the American Plywood Association and exceeds the requirements of U.S. Product Standard PS 1-83 for Construction and Industrial Plywood.

METRON MDO has a pre-applied phenolic glue-line and is designed for hot pressing using either the one-step or two-step method (see Bulletin No. TFP 5d Press Schedule).

PERFORMANCE:

	Test Procedure	Performance Requirement	RCI Results
Water Absorption	APA Test methods for PS 1 overlays	50 grams maximum	20-29 grams
Internal Bond	Modified ASTM D1037-78	None	750 psi Avg.
Machinability	APA Test methods for PS 1 overlays	Clean sharp edges	Complies
Bond Quality	U.S. Product Standard PS 1-83	Min. wood failure 85%	85% – 100%
Paintability	APA Test methods for PS 1 overlays	No crawling, crazing peeling or flaking	Complies

These are typical physical properties based on laboratory tests performed to industry standards. Actual product specifications may vary slightly.

BENEFITS:

MASKING – Significantly reduces rough veneer and patch telegraphing, and masks small voids and splits. Also reduces pitch-bleed through and minimizes veneer checking.

PAINTABILITY – Provides an opaque, smooth surface suited for interior and exterior paint applications. See Bulletin No. TFP 4-b for additional information.

WEATHERABILITY – METRON will withstand limited exterior exposure prior to painting.

MACHINABILITY – Provides excellent machining during sawing, boring, nailing, routing, drilling and planing. METRON prevents veneer tearing and chip-out.

HARDNESS – METRON provides a densified surface with high abrasion resistance.

Continues on back . . .

REICHHOLD CHEMICALS, INC. • P.O. Box 1482, TACOMA, WASHINGTON 98401 • 206-572-5600

APPLICATIONS FOR OVERLAID PANELS:

Exterior Uses:
Smooth, or embossed siding
Commercial and Regulatory Signs
Gable Ends and Soffits
Garage Doors
Accent Panels
Flush Doorskins and Panel Door Inserts
Truck and Railroad Car Bodies
Screen Fencing
Marine Applications
Sporting Equipment
Outdoor Furniture and Toys

Interior Uses:
Cabinet Work
Doors
Book Cases
Storage Units
Industrial Wall Systems
Furniture Components
Partitions
Store Fixtures
Shelving

FINISHING RECOMMENDATIONS: See Painting Instructions Bulletin No. TFP 4-b

STORAGE RECOMMENDATIONS:

The bond quality and precure tolerance of METRON® is limited; dependent on time, storage temperature and other factors beyond the control of the manufacturer.

Optimum storage conditions are 70° F or less in a cool, dry location with orginal wrapping intact. Partial bundles and rolls must be rewrapped to assure METRON's optimum performance.

The following shelf-life warning label is affixed to each METRON roll and bundle:	
90°F ..... 30 days	60°F ..... 120 days
80°F ..... 60 days	55°F and under ..... 180 days
70°F ..... 90 days	

STANDARD SIZE BUNDLE:

Sheets Dimensions	50" x 100"
Bundle Dimensions	52"W x 102"L x 24"H
Number of Sheets	1,200
Total Square Footage	41,667
Net Weight	2,835 lbs.
Gross Weight	3,075 lbs.

Custom sheet lengths are available between 40" and 216". Lengths may vary ±1/4". Please consider this when ordering sheets.

STANDARD SIZE ROLL:

Width	50"
Square Footage	7,500
Lineal Footage	1,800
Net Weight	510 lbs.
Gross Weight	525 lbs.
Roll Diameter	24 inches (approx.)
Core I.D.	6 inches

Nominal width is 50 inches. Please consult RCI for availability of 38" and 62" widths.

AVAILABILITY:

Standard sized rolls and sheets are normally available from stock. Special size requirements can usually be met within three weeks from receipt of order.

Material Safety Data Sheets (MSDS) are available upon request.

PRODUCT BULLETIN | **REICHHOLD** | **TREATED FIBER PRODUCTS**

Bulletin No. TFP-4a | **July 1986**

METRON® MDO Medium Density Overlay SPECIFICATION SHEET

SPECIFICATIONS:

	General Use (42-580)	Concrete Form (42-585)
Nominal Weight/MSF (with glueline)*	68 lbs.	75 lbs.
Nominal Weight/MSF (without glueline)*	57 lbs.	64 lbs.
Nominal Thickness (before pressing)	0.017 inches	0.018 inches
Nominal Thickness (after pressing)	0.013 inches	0.014 inches
Resin Content (without glueline)	28% ±1	35% ±1
Color	Golden	Golden
Paper Width	50 inches	50 inches
Glueline Width	49¾ inches	49¾ inches
Weight of Glueline	11 lbs. ±1 lb.	11 lbs. ±1 lb.

*± 5% raw paper basis weight variation.

STANDARD SIZE BUNDLE:

	General Use	Concrete Form
Sheet Dimensions	50" x 100"	50" x 100"
Bundle Dimensions	52"W x 102"L x 24"H	52" W x 102"L x 24"H
Number of Sheets	1,200	1,200
Total Square Footage	41,667	41,667
Net Weight	2,835 lbs.	3,125 lbs.
Gross Weight	3,075 lbs.	3,365 lbs.

Custom sheet lengths between 40" and 216" are available. Lengths may vary ±1/4". Please consider this when ordering sheet length.

STANDARD SIZE ROLL:

	General Use	Concrete Form
Width	50 inch	50 inch
Square Footage	7,500	7,500
Lineal Footage	1,800	1,800
Net Weight	510 lbs.	565 lbs.
Gross Weight	525 lbs.	580 lbs.
Roll Diameter	24 inches (approx.)	24 inches (approx.)
Core I.D.	6 inches	6 inches

Consult with RCI regarding availability of 38" and 62" widths.

REICHHOLD CHEMICALS, INC. • P.O. BOX 1482, TACOMA, WASHINGTON 98401 • (206) 572-5600