FOREST PRODUCTS LABORATORY † FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

VENEER CUTTING AND DRYING PROPERTIES

WESTERN HEMLOCK

Western hemlock (Tsuga heterophylla) is an important timber species in the Pacific Northwest. It is a straight-grained tree that under favorable conditions will reach a diameter of 3 to 4 feet and a height in excess of 200 feet.[1]

The wood is moderately light in weight and moderately high in strength properties. It ranks somewhat below Douglas-fir and southern yellow pine as a building material for heavy construction. The heartwood and sapwood of western hemlock are almost white with a pinkish tinge. Most of the wood is moderately hard and has a uniformly fine texture. Western hemlock is nonresinous and its many small knots are generally tight.

Selection, Handling, and Preparation of Logs for Cutting

Four 32-foot logs from the vicinity of Mineral, Wash., were cut into 4-foot bolts and shipped to the Laboratory for experimental veneer cutting.[2] The 32 bolts represented a range in diameter from 33 to 55 inches. The quality ranged from bolts of peeler grade to bolts that would not ordinarily be used by a veneer mill.

From experience with the bolts tested at the Laboratory, it appears that ring shake and compression wood[3] are two of the more important defects that should be avoided when selecting peeler logs. Knots caused considerable trouble by nicking the lathe knife when unheated blocks were being cut. It was also observed that one log, which was low in density and of comparatively smooth texture, yielded smoother and tighter veneer than the other logs.

A heating treatment in water at 160° F. was found to be satisfactory for conditioning the western hemlock logs. Bolts heated at 200° F. cut well, but the veneer was streaked behind each knot by a red extractive material that is apparently soluble at this temperature. Heating at 200° F. also caused an increase in heart checks and sometimes resulted in "shelling," the separation of surface springwood from summerwood, when the veneer passed beneath the pressure bar. In general, it was possible to cut much tighter veneer from

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[1] Betts, H. S. Western Hemlock. American Woods Series. Forest Service, U. S. Dept. of Agr. 1945.

[2] Acknowledgment is made to the Douglas Fir Plywood Association, Tacoma, Wash., for cooperation on this project.

[3] Compression Wood: Importance and Detection in Aircraft Veneer and Plywood. Forest Products Laboratory Report No. 1586. 1943.

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heated than from unheated bolts. Black knots nicked the lathe knife when the bolts were cut at room temperature. Bolts heated at 120° F. gave less trouble in this respect than bolts cut at room temperature but somewhat more than those heated at 160° F. or higher.

Calculated heating schedules for logs of various diameters are given in table 1. This table shows the minimum time required to bring the temperature at a 12-inch core diameter to 120° F. in water at 160° F. or in steam at 212° F. Some of the heating periods shown in the table are so long that they would probably be considered commercially prohibitive. In these cases, the exterior portions could be cut without heating, but to reduce knife damage the inner, more knotty parts should be heated before cutting.

Veneer Cutting

All of the bolts were chucked in the geometric center and were rotary cut into 1/8-inch veneer. For this thickness, a knife angle[4] of 90° appeared to be satisfactory. A rigid nosebar, ground to give a 12° angle with the vertical, was used for the experimental cutting. For best results with 1/8-inch veneer, the horizontal distance between the leading edge of the pressure bar and the knife edges should be approximately 3/32 inch, with a vertical opening of 1/32 inch.

Veneer Drying

The moisture content of the hemlock sapwood ranged from 83 to 225 percent and averaged 148 percent. The moisture content of the heartwood ranged from 32 to 216 percent and averaged 63 percent. Because of the high moisture content, the drying time for hemlock heartwood may need to be 60 to 75 percent longer than for Douglas-fir heartwood under the same drying conditions. The drying time for hemlock sapwood, however, may need to be little, if any, longer than for Douglas-fir sapwood. Wet streaks were common in the green veneer but appeared to cause no difficulty in cutting, gluing, or sanding. The high moisture content increased the drying time for the veneer but otherwise had no effect.

Yields

Yields of dry veneer in terms of board feet from the four test logs ranged from 102 to 118 percent of the log scale. The percentage of sound face veneer ranged from 11 to 58 percent depending on the quality of the logs and the prevalence and location of defects, such as knots and shake. Reports from the industry indicate that plywood recoveries are generally not so high with western hemlock logs as with Douglas-fir logs.[5]

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[4]Fleischer, H. O. Experiments in Rotary Veneer Cutting. Proceedings, Forest Products Research Society. 1949.

[5]Industry Trends. The Lumberman, 77:3, p. 52. March 1950.

Other Factors

In general, the gluing characteristics of western hemlock are similar to those of Douglas-fir. Laboratory experiments indicate, however, that moisture moves more rapidly through hemlock than it does through Douglas-fir. Possibly for this reason, hemlock plywood made at the Laboratory was less susceptible to blistering in the hot press than Douglas-fir plywood. Hemlock plywood bonded with glues of intermediate moisture resistance delaminated more extensively when subjected to alternate soaking and drying tests than did similar plywood of Douglas-fir. In commercial operations, however, glue joints can be obtained that meet the requirements of commercial standards for interior plywood. Hemlock plywood was also found to be more subject to face staining with alkaline glues than Douglas-fir. Such staining can be controlled with proper moisture content, gluing, and drying conditions.[6]

Western hemlock panels that were exposed to alternating high and low relative humidity or to outdoor weathering developed face checks that were less numerous but larger and more prominent than those in similarly made and exposed Douglas-fir panels. Face checking was less severe in panels made of tight veneer cut from heated blocks than in panels made of loose veneer cut from unheated blocks. Checking was also less severe in panels that were made under conditions in which the moisture content changes after pressing were kept at a minimum.

Black streaks are often caused in western hemlock by the maggots of a small fly, which live under the bark and feed on the cambium. The maggot chamber may remain in the wood as an actual opening, or the chamber may grow shut. The streaks connected with this injury may be several feet long.[7] Small black streaks are permitted in western hemlock sound face veneers by the current standard, but openings in veneer intended for sound face grade must be patched.[8] It is reported that black streaks and maggot chambers have been so numerous in some hemlock veneer that patching, as a means of getting an adequate supply of sound face veneer, was not practical.

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[6] Occurrence and Removal of Glue Stains. Forest Products Laboratory Technical Note No. 146. 1936.

[7] Luxford, R. F., Wood, L. W., and Gerry, Eloise. Black Streak in Western Hemlock. Forest Products Laboratory Report No. 1500. 1943.

[8] National Bureau of Standards. Western Softwood Plywood. U. S. Dept. of Comm. Commercial Standard CS 122-49. 1949.

Table 1.--Heating schedules for hemlock veneer bolts to bring the temperature at a 12-inch core to 120° F.

Average log diameter	Required heating time	
	When heated in water at 160° F.	When heated in steam at 212° F.
Inches	Hours	Hours
24	19	11
30	35	22
36	54	35
42	75	48
48	96	66
54	120	82