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# The Seasoning of One-inch Tanoak Lumber

By

Leif D. Espenas



OREGON FOREST PRODUCTS LABORATORY

State Board of Forestry and School of Forestry,
Oregon State College Cooperating
Corvallis

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## SUMMARY

Several groups of 1-inch, random width, mill run tanoak boards 6 feet long were dried using various procedures, and the results were compared. The procedures included kiln drying green material, kiln drying material that had previously been air dried to different levels of moisture content at different seasons of the year, and kiln drying material that had been air dried following a pre-seasoning treatment with sodium chloride.

The loss in grades provided one means of comparing results from the different drying procedures. Another comparison was made on the basis of the deduction of any previously clear area of 36 square inches or more that acquired any visible seasoning defects during the drying. Shrinkage in width and thickness also was determined; the results provided an additional factor in evaluating the different drying procedures.

The loss in grade and in areas previously free from visible seasoning defects was greatest in material kiln dried from the green condition and least in material that was well air dried prior to kiln drying. The salt treatment did not appear to be markedly beneficial. Shrinkage of the kiln dried green material was roughly twice as great as that of material that had been well air dried prior to kiln drying.

The results lead to the conclusion that tanoak can be dried successfully by thorough air drying followed by kiln drying, and that commercial producers of tanoak lumber should contemplate this procedure. The commercial possibilities of kiln drying green tanoak are not promising.

# The Seasoning of One-inch Tanoak Lumber

by

Leif D. Espenas

There are approximately 870 million board feet of tanoak sawtimber in the State of Oregon, roughly one-fifth of the total stand of hardwood sawtimber. Tanoak ranks third in volume in the state, being exceeded only by red alder and Oregon maple. Practically all of this tanoak resource is concentrated in the southwest corner of the state, principally in Curry County.

Tanoak trees have been cut in the past chiefly to obtain the bark, which contains a relatively high percentage of tannin, and the peeled logs have been left in the woods as unmarketable. A few operators have attempted to produce tanoak lumber, but have soon discontinued its manufacture, because of the many difficulties encountered. If these difficulties can be overcome, the potentialities of the tanoak resource are great, probably greater than those of any other hardwood species in the state. Since the tanoak trees grow taller and straighter and are of a greater diameter than the other native hardwood species, the quality of the lumber from the trees should be better. In addition, tanoak wood possesses many desirable properties. Its hardness, strength, and pleasing color make it an excellent flooring material. The sapwood, which constitutes the major portion of the log, is a very light color and this, together with its pleasant figure and good mechanical properties, make the wood suitable for furniture, especially in view of the present market trends towards blond and bleached woods. The wood should also find application in the boat and ship building trades and in the manufacture of many small articles, such as brush handles, wedges, and woodenware. Data are still lacking on many of the physical properties of tanoak, but the work that is being conducted at the Laboratory to supply these gaps in information may point to some specialized uses for the wood.

Seasoning has been one of the major obstacles in the path towards greater utilization of the tanoak resource. The wood is subject to practically all defects that can develop in seasoning; checks, splits, honeycomb, collapse, and warping. It is even claimed by some that the wood beneath the stickers in an air seasoning pile will rot before it has a chance to dry—this, however, is unjust.

The seasoning of tanoak has been studied by a few investigators, chiefly for the purpose of deriving a kiln schedule for green material.

Their work has been most helpful and essential. The studies, however, indicate schedules demanding conditions at the limit of kiln performance and, even then, anticipate considerable loss of product. The past work need be considered neither encouraging nor entirely discouraging for the prospect of seasoning tanoak. Quantitative information is lacking on how much loss may be expected by using these schedules. In addition, past studies have not given adequate consideration to the possibility of preliminary air seasoning. In view of the generally poor results obtained by the few producers of tanoak lumber who have attempted to air dry it, quantitative information on losses from this method of seasoning also seems desirable. The study described in this report has been undertaken in an attempt to supply some of this needed information and also to improve the kiln drying schedules.

## SCOPE AND PLAN OF THE STUDY

Although the primary purpose of this study was to compare the results of drying boards by different procedures, some preliminary runs with sample boards were made to procure additional information on kiln schedules for green stock. These runs were confined to variations in the intermediate steps of the kiln schedule designed by the U. S. Forest Products Laboratory. Since the initial conditions of 105° F. dry bulb temperature and 102° F. wet bulb temperature arrived at by Torgeson of the U.S. Forest Products Laboratory are in substantial agreement with those arrived at by William J. Baker in some unpublished experiments at Oregon State College, it did not seem necessary to investigate the initial conditions further. The preliminary runs consisted of drying two groups of sample boards in the same kiln for the first step in the schedule and then continuing the drying in different kilns—one group being dried according to the United States Forests Products Laboratory schedule, while the other was dried at the same temperatures but with lower relative humidities in another kiln. After drying to a moisture content of about 8 per cent, samples from the two groups were cut, examined for internal defects, and compared. This procedure was repeated with two more groups of samples. In this case, the best equilibrium moisture content schedule, as determined in the previous run, was used for both groups; but one group was exposed to higher temperatures.

To obtain quantitative information on seasoning losses, several groups of boards were dried by different procedures to a moisture content of approximately 8 per cent. Each board was then carefully examined and the following data were noted:

1. Dry width to nearest 1/16 inch at a place marked on the board where the green width had previously been measured.
2. Dry thickness, to nearest 0.01 inch on the line where width had been measured. Measurements were made with a 1-inch or 2-inch micrometer as far in from the edge of the board as the instrument would reach.
3. Grade on the basis of present appearance and dry dimensions.*
4. The number of cuttings and the number of cutting units in the board that governed its grade.
5. The number of surplus cutting units, which comprised all clear face areas, not included in 4. but measuring 36 square inches or more, and in the case of grade No. 3B common, all sound areas 36 square inches or more.
6. Grade and total cutting units, on the basis of the dry dimensions, as it might have been had no seasoning defects developed. This is comparable to the sum of 4. and 5. but rests on the basis of no grade reduction for seasoning defects.

In addition to these data, a 1-inch cross sectional piece was cut from each board for photographing. These sections were cut from the boards at approximately the same location as if the stock were to be cut for manufacture. In some groups, an additional section was cut from every fourth board to determine moisture content.

The following experimental procedures were used in drying the several groups of boards:

1. Kiln dried from green condition;
2. Air dried to 30 per cent average moisture content, starting in May, and then kiln dried;
3. Air dried to 20 per cent maximum moisture content, starting in May and then kiln dried;

* The grades were established according to the "Standard Grades" given on pages 19 to 23 of the *Rules for the Measurement and Inspection of Hardwood Lumber, Cypress, Veneers and Thin Lumber,* (National Hardwood Lumber Association, January 1, 1943). These grades were modified slightly in two respects for the purpose of the study. The size of the experimental kilns made it necessary to limit the length of the boards to slightly over 6 feet. Therefore, in order to have boards in the *Firsts* and *Seconds* grades, and more boards in the *Selects* grade, the length limitations for these grades were omitted, although the minimum size of cuttings allowed was not reduced. The second revision dealt with seasoning checks which are permitted in clear face cuttings according to the rules. Since the purpose of this study was to determine to what extent the effects of seasoning and seasoning checks might impair the use of the lumber, seasoning checks were not admitted in clear face cuttings except on the reverse side.

4. Solid piled with salt (NaCl) until salt dissolved, air dried to 20 per cent maximum moisture content, starting in May, and then kiln dried;
5. Air dried to 20 per cent maximum moisture content, starting in October, and then kiln dried;
6. Air dried to 20 per cent maximum moisture content, starting in January, and then kiln dried.

## MATERIAL FOR THE STUDY

Approximately 1200 board feet of mill run, random width, nominal 1-inch tanoak lumber was obtained for the study by arrangement with E. J. Woodburn, Jr., of Eureka, California. The trees were cut and milled in Curry County, Oregon, and then delivered to the Laboratory in a closed truck. The lumber was received in excellent, green condition with practically no indications that the ends or surfaces had dried. In order to facilitate later inspection of the material, and, also because of nonuniform thickness, the lumber was sent to a planing mill to be surfaced two sides to a thickness of 1⅛ inches.

After being surfaced, the stock was returned to the Laboratory where it was cut to a length of 6′ 3″. The boards were numbered, a line was marked across the width of the board near its center, and the width was measured to the nearest 1/16 inch along this line. The boards were sorted into groups of matched widths. The 3-foot lengths remaining from the original 9-foot long boards were cut into 30-inch samples, leaving suitable moisture content sections for calculating the oven dry weight of the samples. These samples also were sorted into five groups of matched widths and were used for the preliminary kiln schedule runs.

Two groups of the 6′ 3″ boards were piled immediately for air seasoning, starting in May, while a third group was treated with salt and then piled for air seasoning. Three remaining groups were stored for later use in a cold room maintained at 33° F. Of these three groups, one was to be kiln dried from the green condition, and the other two were to be air seasoned, starting in the following October and January.

The average moisture content, determined from the sections cut at the same time as the 30-inch samples, was 86.9 per cent, though the range was from 43.6 per cent to 106.3 per cent. The specific gravity, determined from some of the moisture content sections, was based on green volume and oven dry weight, and ranged from 0:48 to 0.62, with an average of 0.56.

# PROCEDURE AND RESULTS

## Preliminary kiln schedule runs

Two groups of 30-inch samples were dried as shown in Figure 1 and, for convenience, are designated as Group A and Group B. Group A was dried according to the United States Forest Products Laboratory schedule; Group B was dried by the same dry bulb temperature schedule, but at lower wet bulb temperatures, after the first step in the schedule. An equalization period was included in both runs because of the wide range in moisture content. Cross sections of samples taken at the conclusion of drying are shown in Figure 2.

A careful study of the sections and drying data for the individual pieces indicated that the lower, intermediate wet bulb temperatures gave somewhat better results, in addition to a saving in drying time.

Two more groups of samples (Groups C and D) were dried according to the schedule given in Figure 3; cross sections of the samples cut after drying are shown in Figure 4. The equilibrium moisture content conditions in the schedules were the same as used in drying Group B, but one schedule used higher temperatures after the initial step than the other.

## Drying of boards

As already mentioned, two groups of boards 6′ 3″ in length were piled immediately for air seasoning, and a third group was treated with salt (sodium chloride) before air seasoning. The salt treatment consisted of spreading a layer of salt on the floor, then a layer of boards over the salt, a layer of salt on the boards, then another layer of boards, and so on. Salt was applied at the rate of 175 pounds per thousand board feet. After two days in the solid pile, examination showed that while the tops of the layers were well covered with a salt solution, the bottoms were not. Each board was, therefore, turned over to get a better coating of salt. A total of three days was required for the salt treatment. During this treating period, the other two groups of boards were kept covered with a canvas.

These three groups were piled together in the same pile. (See Figures 5, 6, and 7.) The pile foundation was constructed of 4″ x 4″ timbers resting on creosoted railroad ties bedded into the ground. The foundation sloped 1 inch per foot of length from the front to the back; the rear of the foundation was 20 inches from the ground. The foundation was 8 feet long by 4 feet wide.

In piling the lumber, the stickers were placed approximately 2 feet apart and followed the forward pitch of the pile which was 1 inch per foot of height. The stickers were nominal 1" x 2" dressed, dry Douglas-fir. No chimney or flue was provided in the pile because of its narrow width, but a space of up to 3 inches was left between individual boards in all layers to allow air to percolate down through the pile. No extra space was provided between the top layer of boards and the roof of the pile, the latter being separated from the pile only by a layer of 1" x 2" stickers. The roof overhung the pile on all sides and was weighted down with tiles to hold the upper layers of lumber flat. About 1200 pounds of tile was placed on the roof, the equivalent of about 50 pounds per square foot of pile area. In order to protect the pile from the direct sun and to reduce the amount of wind entering the pile, a double layer of cheesecloth was tacked to the sides of the pile.

In order to follow the progress of the drying, six samples were prepared in the conventional manner for kiln samples. Three samples were inserted on each side of the pile, one near the bottom, one near the center, and one near the top. The samples were weighed after the first 10 days of drying, once weekly thereafter for 102 days, and again after a total of 134 days. Figure 8 contains a chart showing the course of drying of these samples, as well as the daily relative humidity and average temperature.

As shown in Figure 8, the average moisture content of the samples after 45 days of air drying was approximately 27 per cent. At this point, the untreated group of boards forming the center third of the pile was removed and placed in a small kiln for kiln drying. Four boards were selected from this group to be cut into samples to guide the kiln schedule. The boards selected were representative of the driest, wettest, and average material. The average moisture content of these four samples was 30.0 per cent, the lowest 17.2 per cent, and the highest 45.8 per cent. This range of values resembles closely that of the six air drying samples, the lowest value of which was 16.3 per cent and the highest 43.5 per cent.

The kiln schedule and drying curves for this group of boards is shown in Figure 9. The temperature changes were based on the moisture content of the wettest sample in an attempt to keep honeycomb at a minimum. This procedure prolonged the drying time considerably, when compared with the drying time obtained in the kiln schedule experiments with the short samples. Particular care was again taken to equalize the moisture content among the samples and to relieve stresses.

After the kiln drying was completed, the material was examined and graded as described previously, and a section was cut from each board. The data obtained in grading and examining the boards are given in Tables 1 and 7; a photograph of the sections is given in Figure 10.

The salt-treated group of boards and the remaining untreated group were air dried for a total of 132 days. At that time, the average moisture content of the six samples was 14.6 per cent, with a range from 10.8 per cent to 17.8 per cent. In unstacking the air seasoning pile, several boards, those suspected of being the slowest drying, were tested with a moisture meter to determine whether or not the maximum moisture content inside these boards was still above the fiber saturation point. The tests indicated that all boards were below the fiber saturation point throughout their thickness. The kiln schedule, consequently, was started at a temperature of 180° F. Four boards were cut into kiln samples and these, with the six air drying samples, were used to follow the progress of kiln drying. The kiln schedule and the drying curves are shown in Figure 11.

As with the first group of boards, the boards were graded and examined, and a section was cut from each board. The data for each group are given in Tables 2, 3, and 7; the sections are shown photographically in Figures 12 and 13.

Two more groups of 6-foot boards were piled to obtain information on the effects of winter air seasoning, one group being piled in October and the other in early January. The boards were piled in essentially the same manner as those piled for summer air drying, but no cloth was tacked to the sides of the pile. These groups were air dried until the following June; they were then dried together in the same kiln. The progress of the air drying is shown in Figure 14, and the kiln schedule is given in Figure 15. The information obtained from the final inspection of these groups is given in Tables 4, 5, and 7; cross sections of the boards are shown in Figures 16 and 17.

After the preliminary runs with 30-inch samples had been completed and further experience had been gained from some of the air-dried groups of boards, one group of 6-foot boards was kiln dried from the green condition. As with the air seasoned material, nominal 1 inch by 2 inch stickers were spaced at 2-foot intervals in the pile, and the pile was weighted with tile at the same loading of 50 pounds per square foot in order to control warping. Five samples were prepared to guide the kiln schedule. The wettest sample controlled the schedule changes, the driest sample the start of the equalization period. Excellent control of kiln conditions was obtained. The schedule and drying curves are shown in Figure 18. As with the other groups of boards, data on grades, cutting units, and shrinkage were obtained at the conclusion of drying and are given in Tables 6 and 7. The cross sections of the boards are shown in the photograph, Figure 19.

## DISCUSSION OF RESULTS

There was a decidedly greater amount of honeycomb in the 30-inch samples after kiln drying from the green condition than in the 6-foot boards seasoned under similar circumstances. This difference may be attributed to (1) better control of initial conditions during drying, and (2) application of the schedule to the slowest drying material.

The kiln charge of 30-inch samples represented a comparatively small volume. In attempting to maintain a high relative humidity at the lower temperatures in this small load, the heat given off by the steam spray was more than sufficient to maintain the desired temperature, because little heat was required for evaporation of water. Consequently, the dry bulb temperature tended to rise above the set point. When the kiln was loaded with boards, however, there was more than enough water being evaporated to absorb the surplus heat from the steam spray, and this difficulty was not present.

High temperature is conducive to the development of honeycomb, if it is applied while the moisture content in any part of the wood is over the fiber saturation point, about 30 per cent moisture content. If the kiln schedule is governed by the wettest material, high temperatures would not be used until practically all parts of all boards had dried below the fiber saturation point, and therefore the danger of developing honeycomb would be lessened. This factor was probably the more important of the two causes for the greater amount of honeycomb in the short samples.

Consideration of these two factors may indicate what may be expected in a kiln of commercial size and may tend to discourage the possibility of kiln drying tanoak green from the saw on a commercial scale. In a commercial kiln, the normal temperature variation and fluctuation is sometimes as great or greater than the differences in temperature used on both the boards and the samples. Modern kilns are designed to give good uniformity of air circulation, so there should be no difficulty in this respect. A commercial load, however, is much wider than the loads used in these experiments and, therefore, because of the temperature drop across the load and consequent lag in drying, the drying time in a commercial kiln may be longer than was required in these experiments. If the charge is dried on the basis of the wettest material, as it should be, it will require 34 days, as shown in Figure 18. It is doubtful that such a long kiln drying time would be commercially practical.

A comparison of the results obtained from kiln drying boards green from the saw with those obtained from air seasoning before kiln drying tends further to discourage the possibility of kiln drying green material. As shown in Tables 1 through 6, the total loss of all cutting areas 36 square inches or more in size was almost 10 per cent of the material kiln dried from the green condition, but only 5 to 6 per cent of the material air dried before kiln drying. An inspection of the tables also shows a greater grade downfall, especially in the upper grades. Further loss of material may be expected because, as shown in Table 6, 18 of the 41 pieces appeared to have shrunk so much in thickness that they could not be dressed to standard thickness without skips. The photographs of the cross sections of the pieces give additional visual evidence of the greater shrinkage in thickness. In confirmation of this result, a statistical analysis of the shrinkage data indicated a significant difference for the material kiln dried from the green condition. The least significant mean (average) difference found in the analysis is given in Table 7.

Whether air seasoning to less than 20 per cent before kiln drying has any particular advantage over air seasoning to 30 per cent is a matter of argument. On the basis of total cutting units, the results were approximately the same, and the statistical analysis of the shrinkage data did not indicate a difference in this respect. In the two groups, there was little difference in downfall in the upper grades. There was, however, a greater downfall in the lower grades of the group air dried to 30 per cent; the photographs of the cross sections of the boards show a possibility of still further loss through failure of an appreciably larger proportion of the boards to dress to standard thickness. In order to obtain further information on the extent of further losses, the available data on thickness for the groups air dried in the summer are plotted in Figure 20. In this figure, the percentage of boards having a given thickness or less are plotted against thickness. On the assumption that a board should have a thickness of 15/16 inches (0.94 inches) in order to dress to 13/16 inches (0.81 inches), Figure 20 shows that 13 per cent of the boards air seasoned to 30 per cent would not dress to standard thickness, in comparison to only 2 per cent of the boards air seasoned to less than 20 per cent. Statistically, no difference has been shown between these two groups. In view, however, of the generally greater shrinkage of the material kiln dried from the green condition and the large number of boards having a high moisture content when the average is 30 per cent, it seems only logical to expect that more boards will shrink excessively in thickness when kiln dried if air dried first to an average of 30 per cent instead of to an average of less than 20 per cent. The results, therefore, are definitely in favor of air seasoning to below 20 per cent before kiln drying.

The salt treated material showed less shrinkage than the untreated and suffered approximately the same loss in total cutting units. Eight out of 41 pieces in the salt treated group, however, were degraded, as compared with only 3 out of 44 pieces in the untreated group, although both groups were dried by the same method at the same time. Practically all of the degrading was caused by surface checking. These checks may have resulted from the moisture picked up by the salt under the higher humidity conditions during the last month of air seasoning. The extra moisture may have swelled the surface layers and induced a compression set which prevented the surface checks from closing up properly on further drying. Regardless of the cause, additional handling cost and the cost of the chemical would appear to nullify any advantages from the salt treatment.

The two groups air dried in the winter months compare fairly well with the other air dried groups. The group whose air drying started in October, however, shows a somewhat greater loss in total cutting units, and the loss occurred in a greater number of boards. What may be of greater importance is that more of the losses occurred in the larger clear areas and caused a rather large loss through degrade. In this respect, the group resembles the salt treated group, and, possibly, the cause for the greater loss in grade is the same, namely, the development of compression set in the surfaces of the dry or partially dry wood. Figure 14 shows that the wood was drying at a fair rate until early December, at which time the drying rate became almost negligible and continued so for the next two months. During the last six to seven months of drying, the surfaces could possibly have developed compression set either from high humidity over long periods, or from actual wetting by rain or snow. Better protection from the elements might have improved the results.

The group whose air drying period started in January shows a lower loss in total cutting units than the other air dried groups, but the number of boards degraded seems to be about the same. The reason for the lower loss in cutting units is not understood.

# CONCLUSIONS AND RECOMMENDATIONS

It is concluded from the results and considerations presented in the preceding discussion that seasoning tanoak by kiln drying green stock is the least promising method of seasoning this species and probably would not be successful in a commercial operation. On the other hand, seasoning by thoroughly air drying until the average moisture content of the wettest boards is below 20 per cent and then kiln drying appears to be the most promising method.

Because of the small scale of the kilns and air seasoning piles used in this study, the drying times are only roughly indicative of those that might have to be used in commercial practice. In air drying, further inconsistencies result from differences in weather and climate, and in the site where the wood is dried. It is concluded, nevertheless, that 1-inch tanoak lumber can be air dried in about four months on a good site, during the more favorable seasons of the year. As much as nine months may be required in the less favorable seasons on the same site. In the damp coastal region, the drying time would probably be longer in any season of the year.

The kiln drying time for 1-inch green stock would be about five weeks, whereas the time for thoroughly air dried stock would be from five to eight days.

Partial air drying before kiln drying gives results that are better than kiln drying green stock but poorer than thorough air drying before kiln drying. An exact comparison presumably would depend on the extent of the partial air drying.

Vertical grain stock is more subject to collapse (or excessive shrinkage in thickness) than flat grain stock, and is slower drying. Flat grain and vertical grain stock should be separated before drying, and both should be thoroughly air dried prior to kiln drying. Figures 21 and 22 are sketches giving some general suggestions for air drying. It is recognized that it may not be possible always thoroughly to air dry the wood prior to kiln drying. The following kiln schedules are suggested for partially air dried and thoroughly air dried stock:

KILN SCHEDULE FOR THOROUGHLY AIR DRIED 1-INCH TANOAK LUMBER

| Approximate duration | Temperature | | Relative humidity | Equilibrium moisture content |
|---|---|---|---|---|
| | Dry bulb | Wet bulb | | |
| | *°F.* | *°F.* | *Per cent* | *Per cent* |
| For first day* | 180 | 168 | 75 | 10.1 |
| For one or two more days | 180 | 162 | 65 | 8.1 |
| Until final moisture content is reached | 180 | 135 | 30 | 3.8 |

* Omit this step in dry summer months.

KILN SCHEDULE FOR PARTLY AIR DRIED 1-INCH TANOAK LUMBER

| Approximate duration | Temperature | | Relative humidity | Equilibrium moisture content |
|---|---|---|---|---|
| | Dry bulb | Wet bulb | | |
| | *°F.* | *°F.* | *Per cent* | *Per cent* |
| For one or two days* | 120 | 110 | 72 | 12.1 |
| For one or two more days | 120 | 103 | 55 | 9.0 |
| Maintain until wettest material has dried to 20 per cent moisture content | 120 | 95 | 40 | 6.6 |
| Maintain to final moisture content | 180 | 135 | 32 | 3.8 |

* Omit this step in dry summer months.

# APPENDIX

## Figures



## Tables

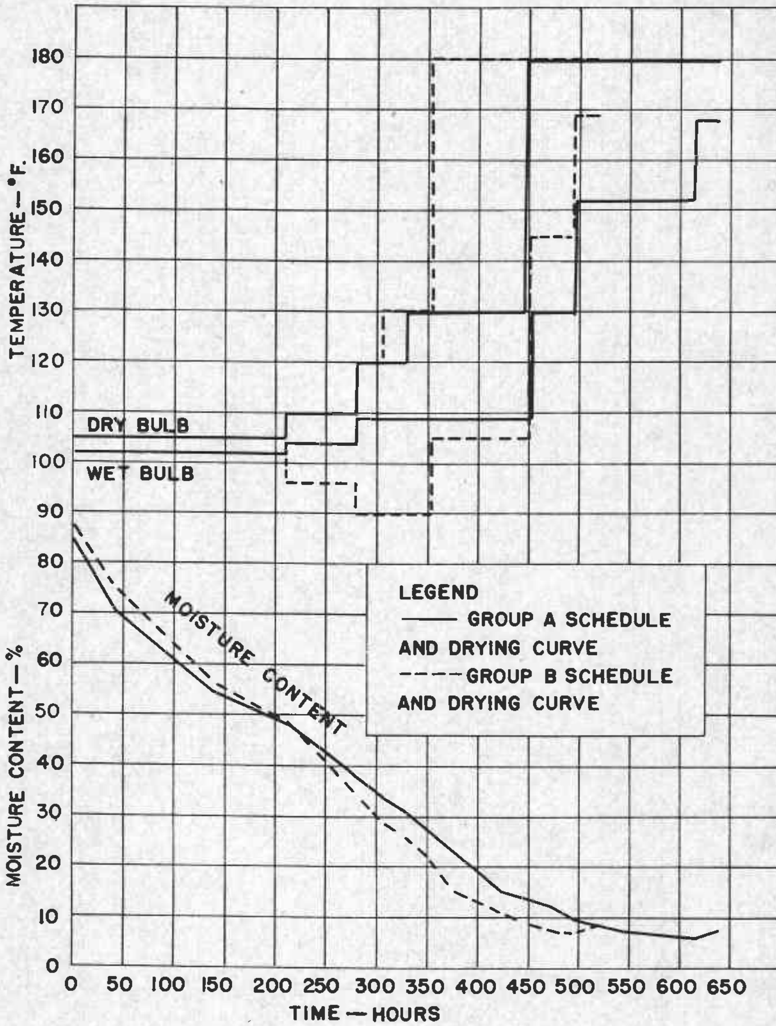



Figure 1. Kiln schedule and drying curve, 30-inch samples.

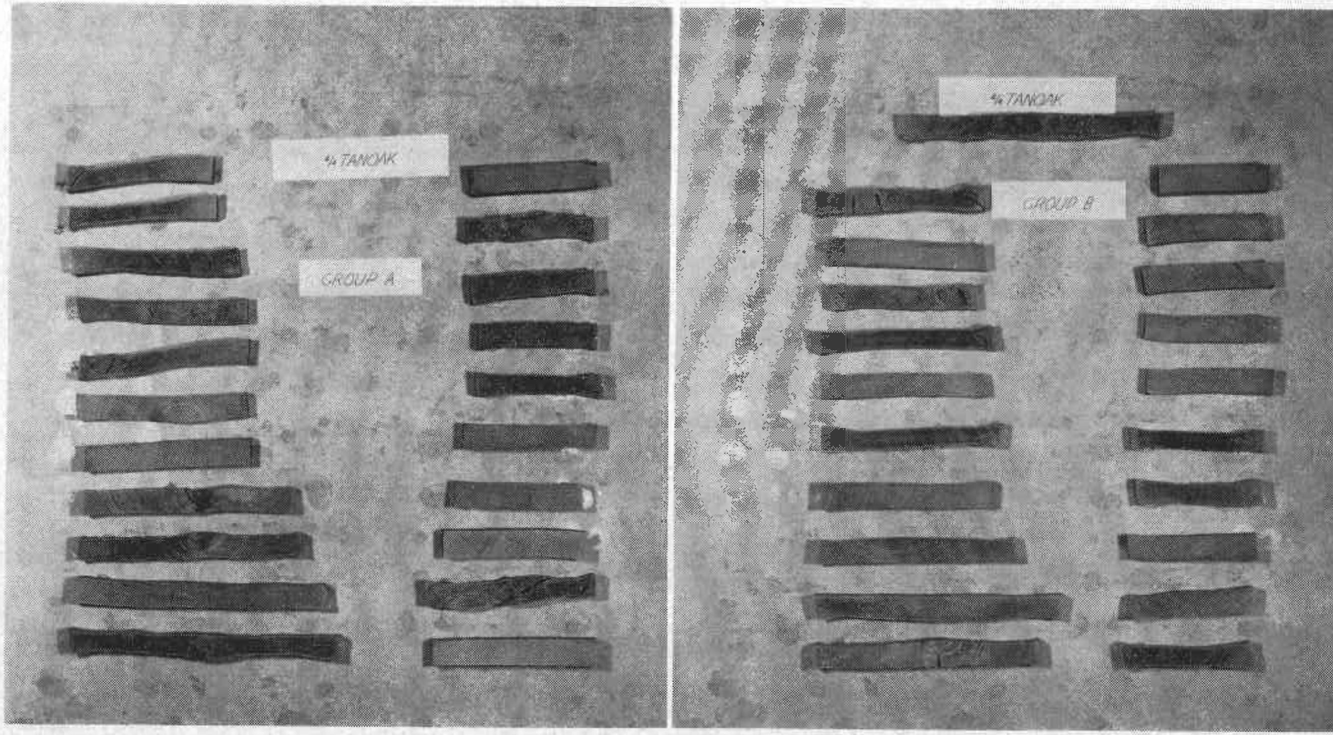



Figure 2.  Cross sections of 30-inch samples dried by different schedules.

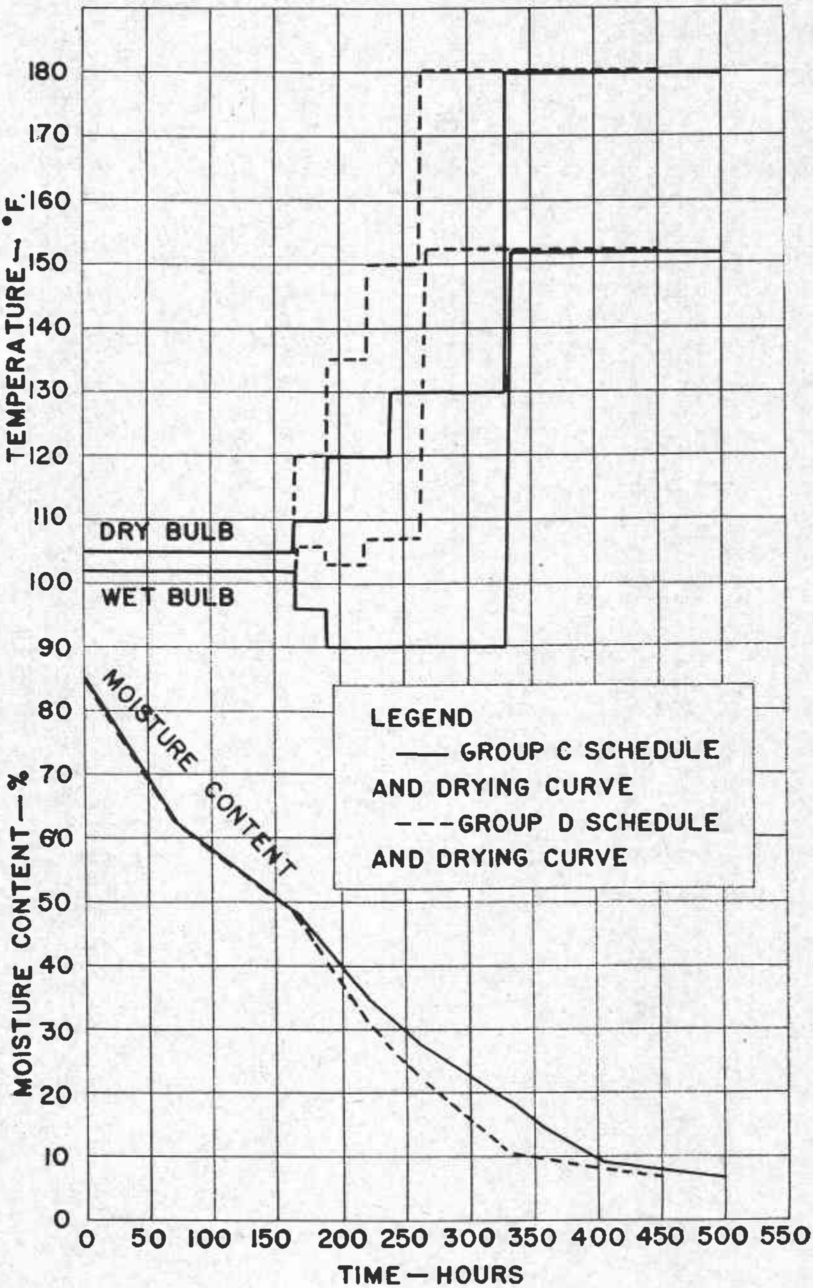



Figure 3. Kiln schedule and drying curve, 30-inch samples.

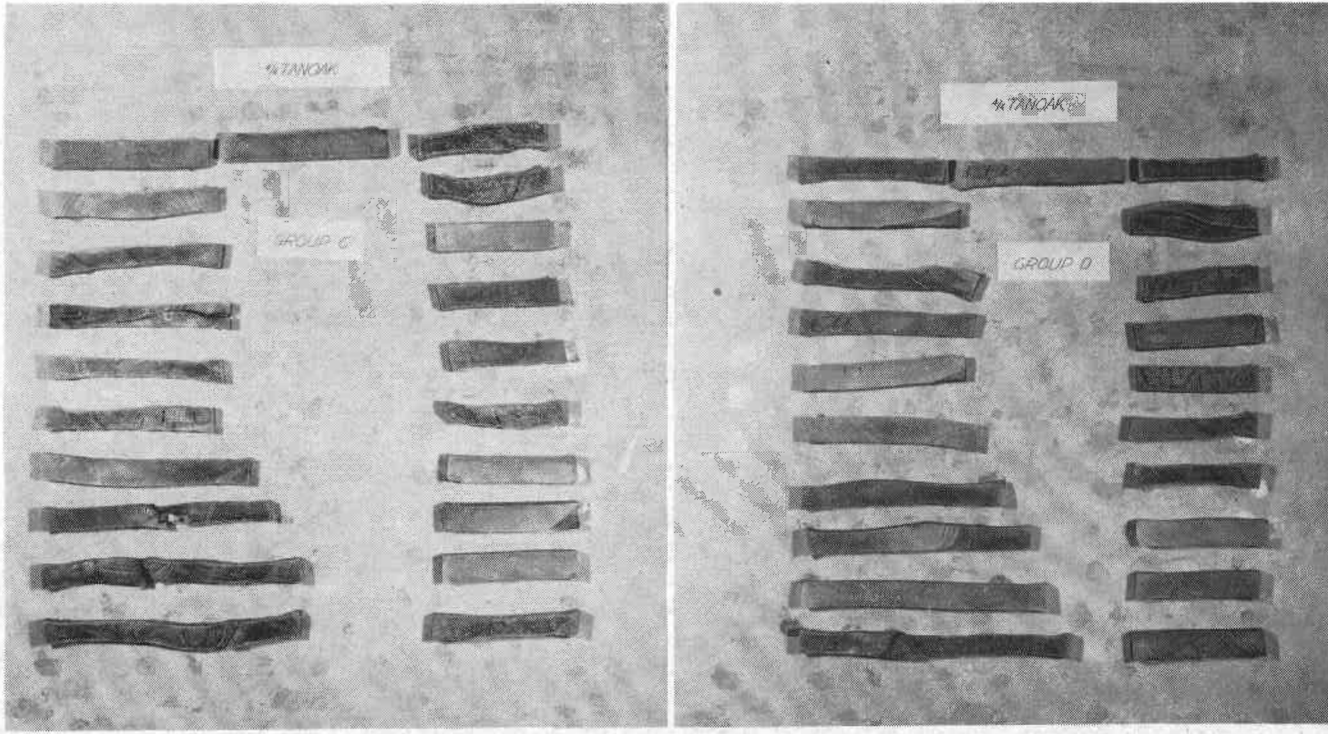



Figure 4. Cross sections of 30-inch samples dried by different schedules.

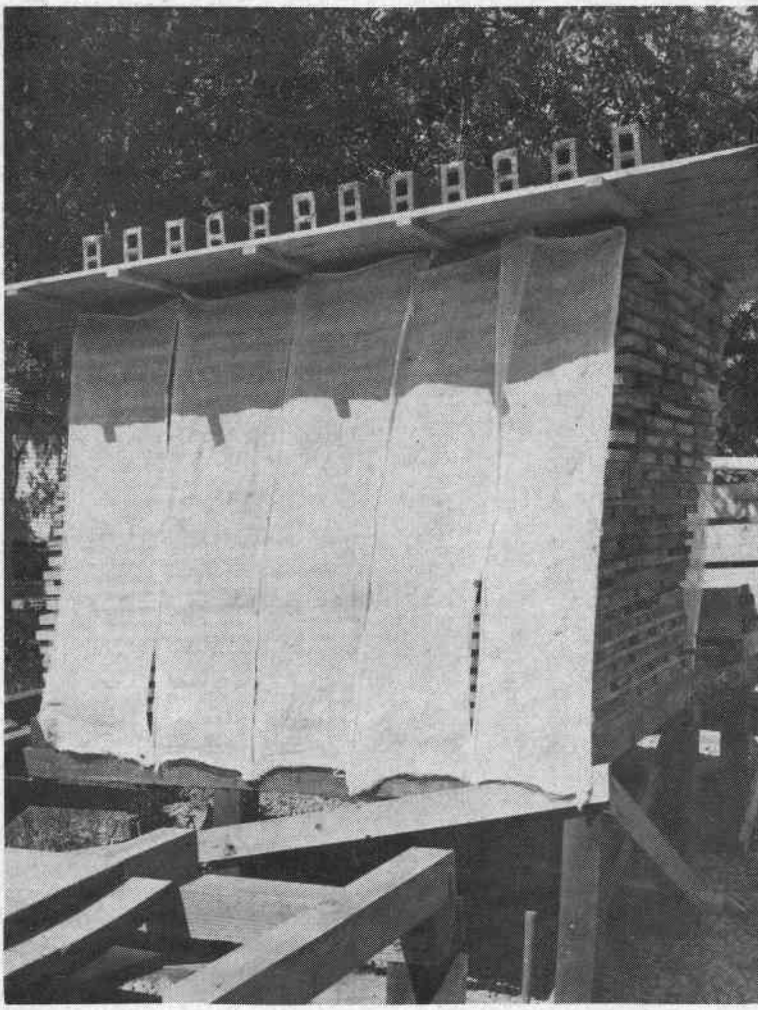


Figure 5. Side view of tanoak air seasoning pile showing cheesecloth tacked in place. Note overhang of roof and weight on top of pile.

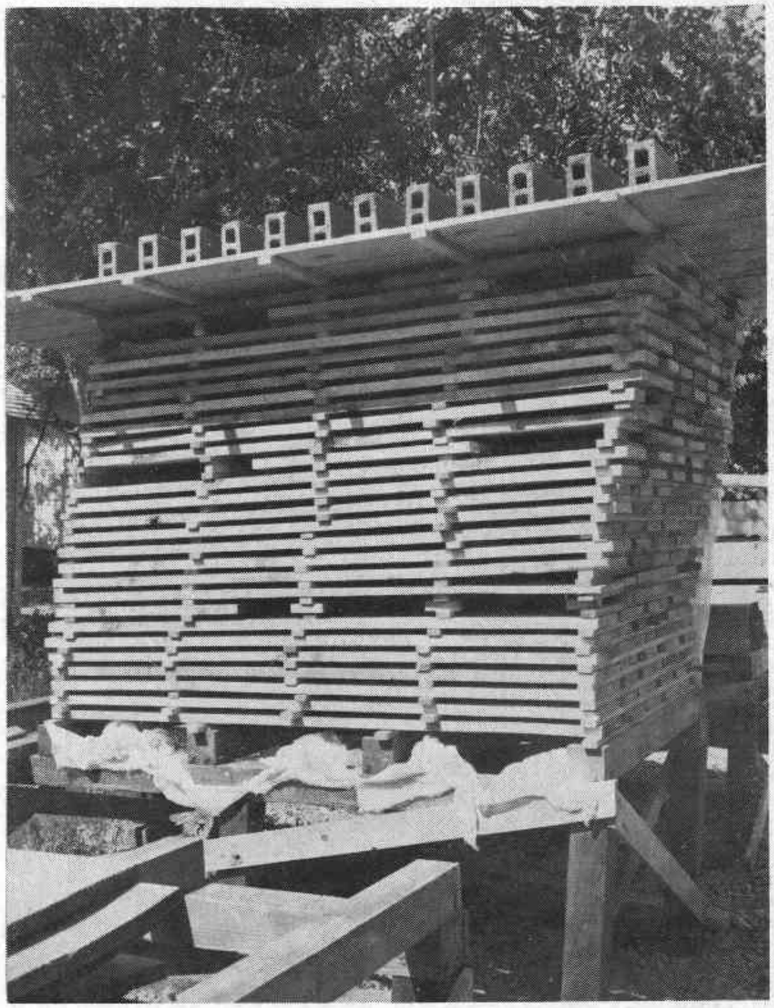


Figure 6. Side view of tanoak air seasoning pile showing sticker spacing and 30-inch drying samples. Sticker alignment could be improved.

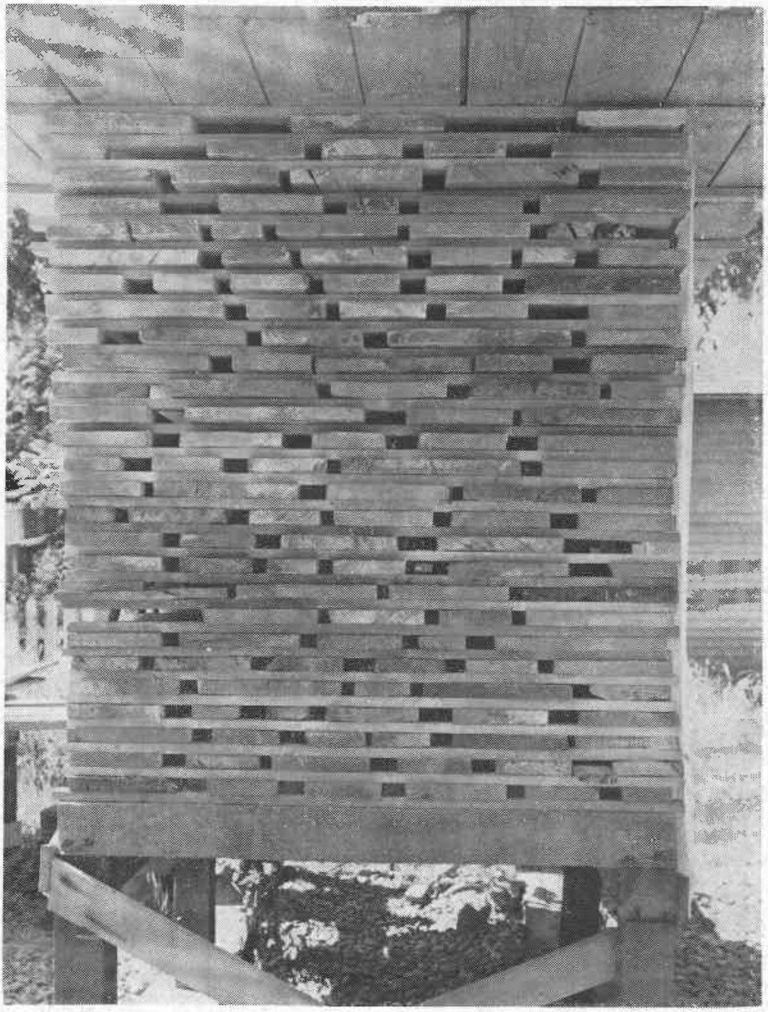
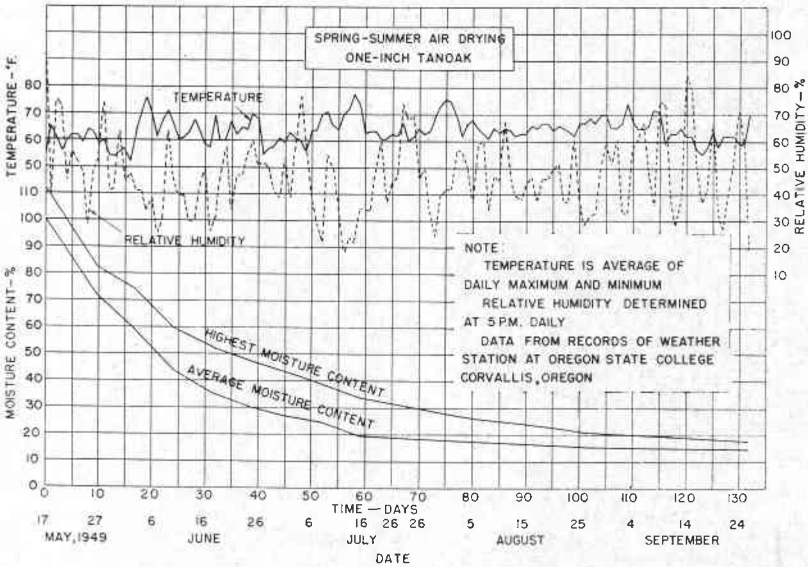


Figure 7. Front view of tanoak air seasoning pile. Note overhang of roof and spacing between boards in pile.



SPRING-SUMMER AIR DRYING
ONE-INCH TANOAK
TEMPERATURE
RELATIVE HUMIDITY
HIGHEST MOISTURE CONTENT
AVERAGE MOISTURE CONTENT
NOTE:
TEMPERATURE IS AVERAGE OF DAILY MAXIMUM AND MINIMUM
RELATIVE HUMIDITY DETERMINED AT 5 P.M. DAILY
DATA FROM RECORDS OF WEATHER STATION AT OREGON STATE COLLEGE CORVALLIS, OREGON
TEMPERATURE - °F.
MOISTURE CONTENT - %
RELATIVE HUMIDITY - %
TIME — DAYS
DATE
MAY, 1949
JUNE
JULY
AUGUST
SEPTEMBER


Figure 8.

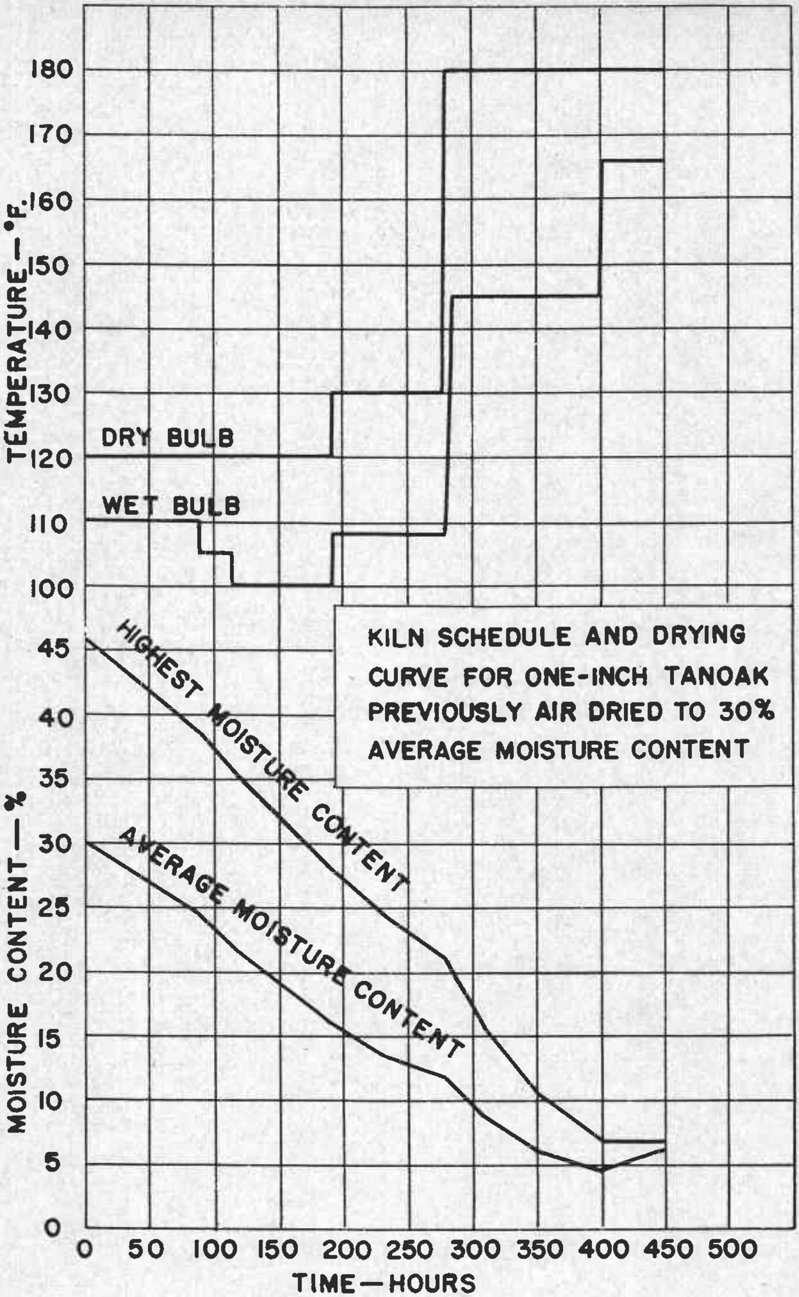

DRY BULB
WET BULB
KILN SCHEDULE AND DRYING CURVE FOR ONE-INCH TANOAK PREVIOUSLY AIR DRIED TO 30% AVERAGE MOISTURE CONTENT
HIGHEST MOISTURE CONTENT
AVERAGE MOISTURE CONTENT
TEMPERATURE — °F.
MOISTURE CONTENT — %
TIME—HOURS
180
170
160
150
140
130
120
110
100
45
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
450
500

Figure 9.

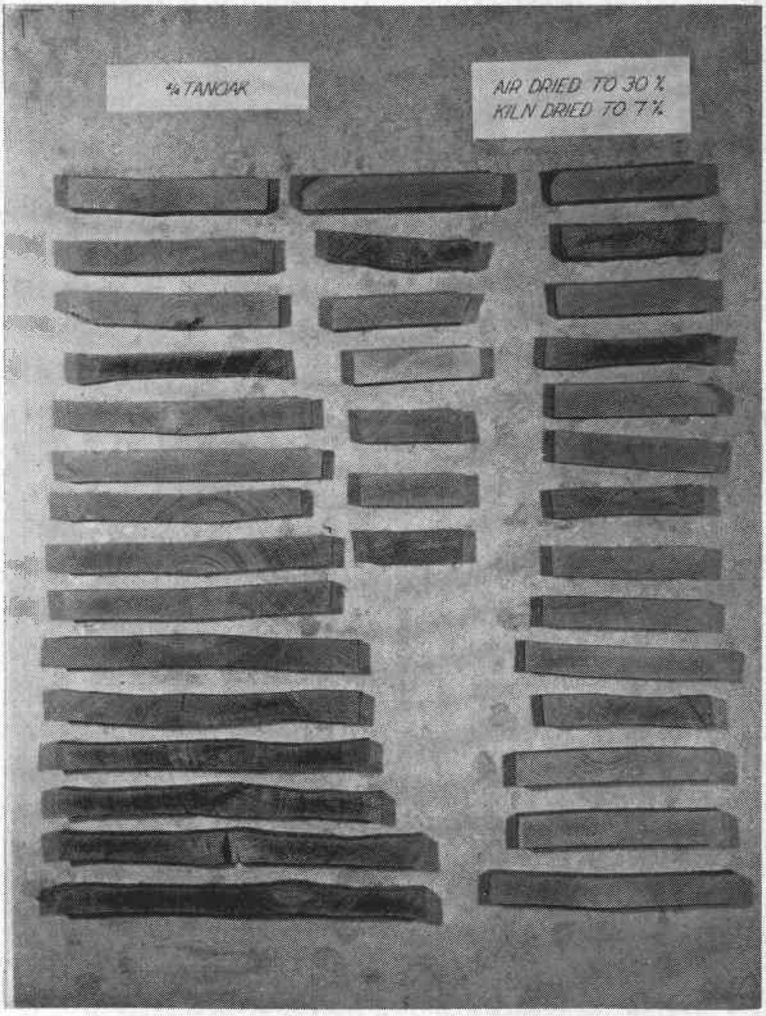



Figure 10. Cross sections of boards air dried to 30 per cent moisture content in summer and kiln dried.

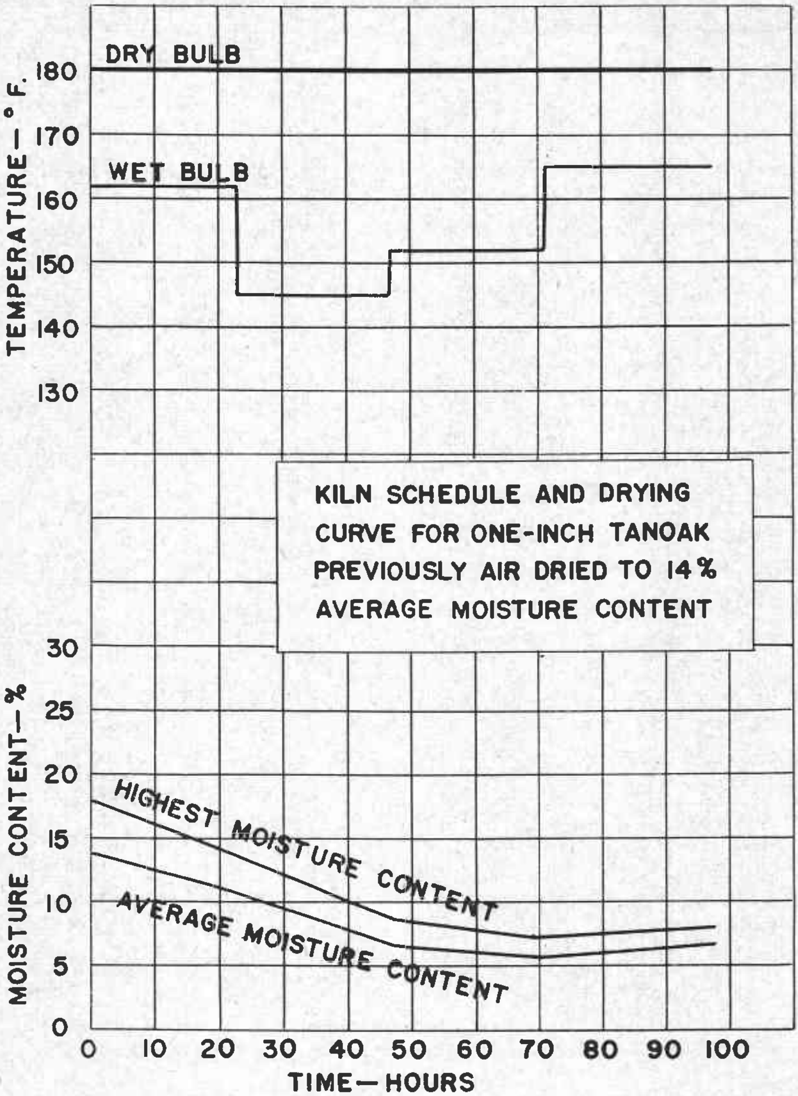

DRY BULB
WET BULB
TEMPERATURE — ° F.
180
170
160
150
140
130
KILN SCHEDULE AND DRYING CURVE FOR ONE-INCH TANOAK PREVIOUSLY AIR DRIED TO 14% AVERAGE MOISTURE CONTENT
MOISTURE CONTENT — %
30
25
20
15
10
5
0
HIGHEST MOISTURE CONTENT
AVERAGE MOISTURE CONTENT
0
10
20
30
40
50
60
70
80
90
100
TIME — HOURS

Figure 11.

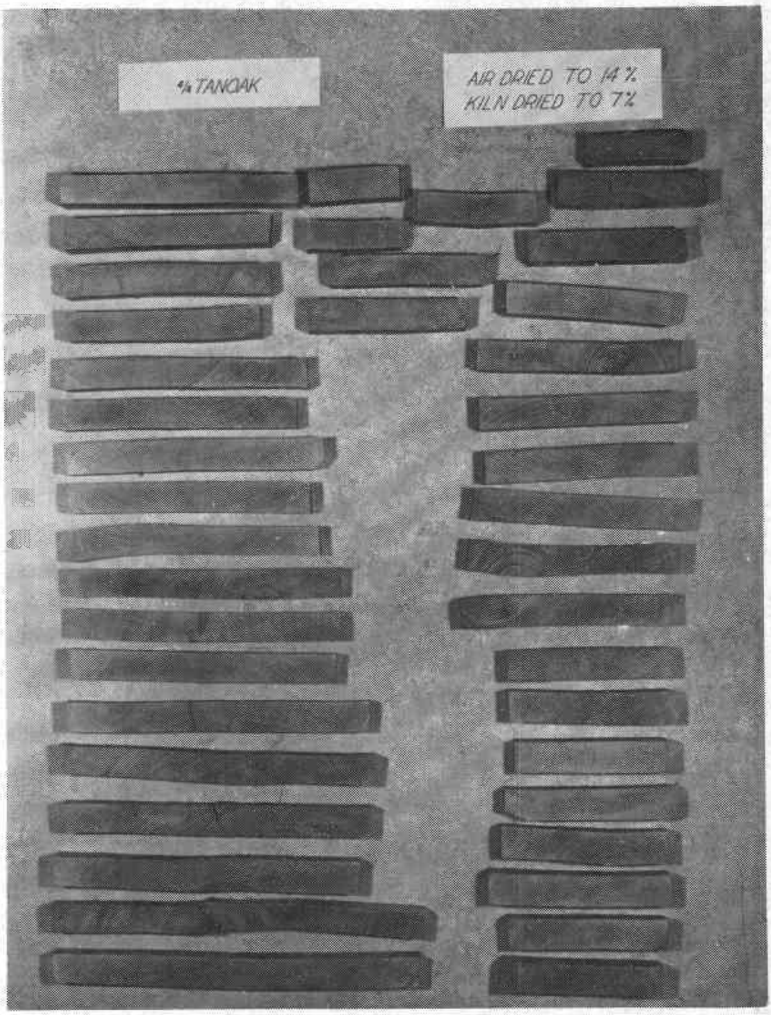



Figure 12. Cross sections of boards air dried to 14 per cent moisture content in summer and kiln dried.

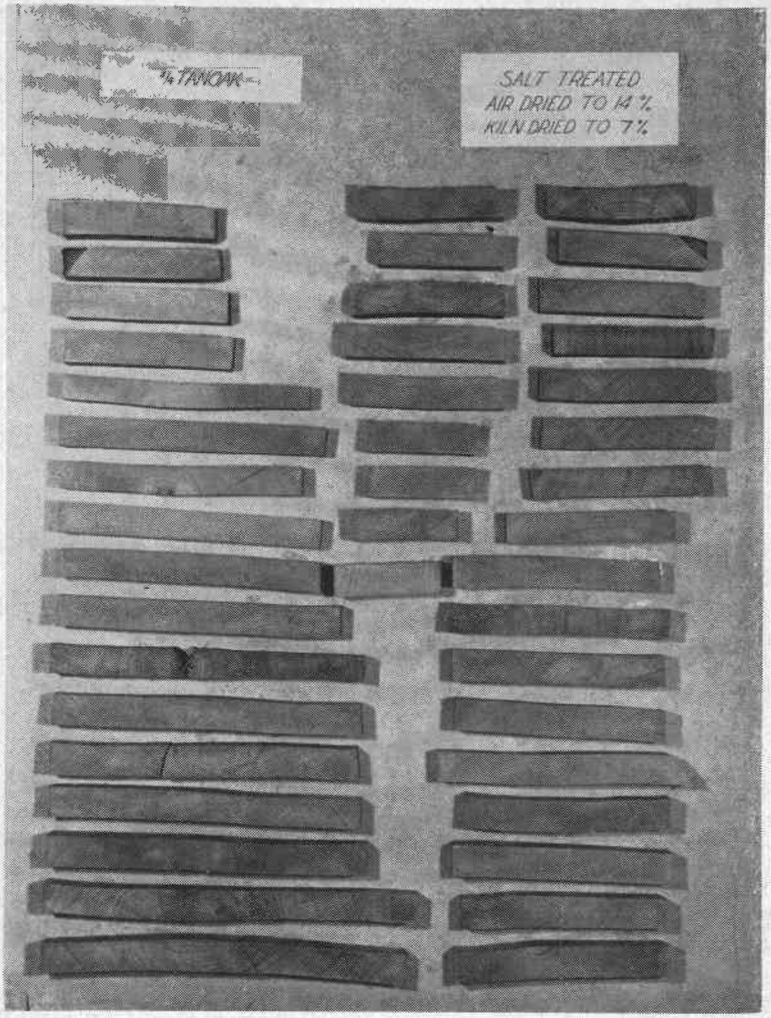



Figure 13. Cross sections of boards salt treated, air dried to 14 per cent and kiln dried.

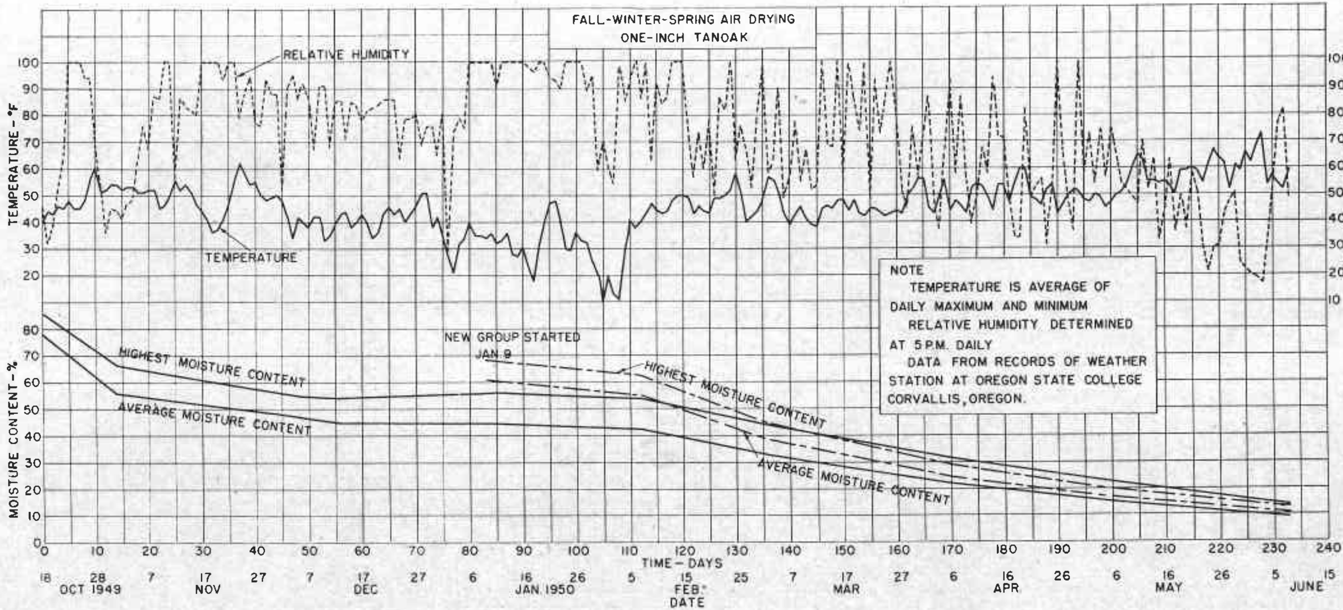

FALL-WINTER-SPRING AIR DRYING
ONE-INCH TANOAK
RELATIVE HUMIDITY
TEMPERATURE
TEMPERATURE - °F
RELATIVE HUMIDITY - %
MOISTURE CONTENT - %
HIGHEST MOISTURE CONTENT
AVERAGE MOISTURE CONTENT
NEW GROUP STARTED
JAN. 9
HIGHEST MOISTURE CONTENT
AVERAGE MOISTURE CONTENT
NOTE
TEMPERATURE IS AVERAGE OF DAILY MAXIMUM AND MINIMUM
RELATIVE HUMIDITY DETERMINED AT 5 P.M. DAILY
DATA FROM RECORDS OF WEATHER STATION AT OREGON STATE COLLEGE CORVALLIS, OREGON.
TIME - DAYS
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
18 OCT 1949
28
7
17 NOV
27
7
17 DEC
27
6
16 JAN. 1950
26
5
15 FEB.
25
7
17 MAR
27
6
16 APR
26
6
16 MAY
26
5
15 JUNE
DATE

Figure 14.

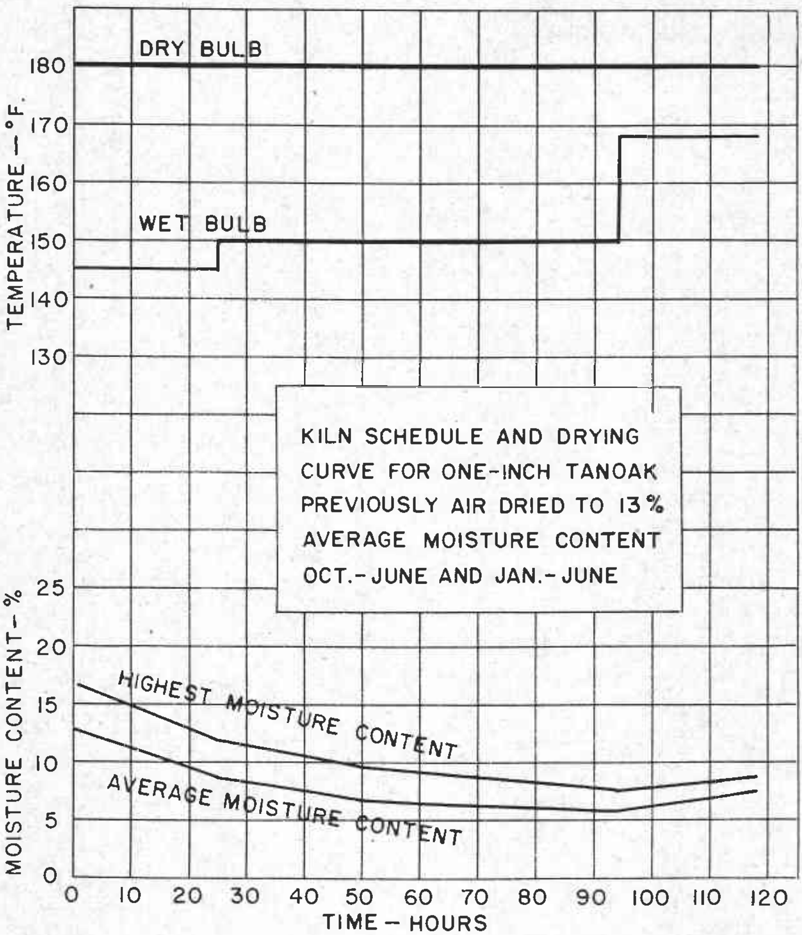

DRY BULB
WET BULB
180
170
160
150
140
130
TEMPERATURE — °F.
KILN SCHEDULE AND DRYING
CURVE FOR ONE-INCH TANOAK
PREVIOUSLY AIR DRIED TO 13%
AVERAGE MOISTURE CONTENT
OCT.-JUNE AND JAN.-JUNE
25
20
15
10
5
0
MOISTURE CONTENT - %
HIGHEST MOISTURE CONTENT
AVERAGE MOISTURE CONTENT
0 10 20 30 40 50 60 70 80 90 100 110 120
TIME — HOURS

Figure 15.

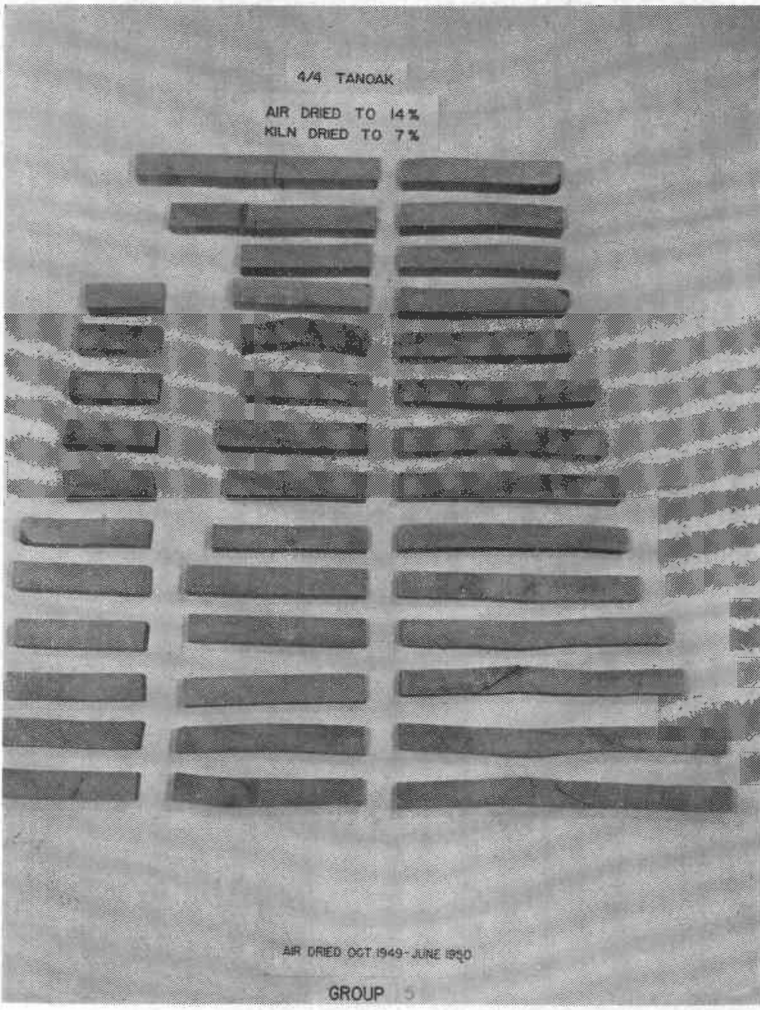



Figure 16. Cross sections of boards air dried October to June and kiln dried.

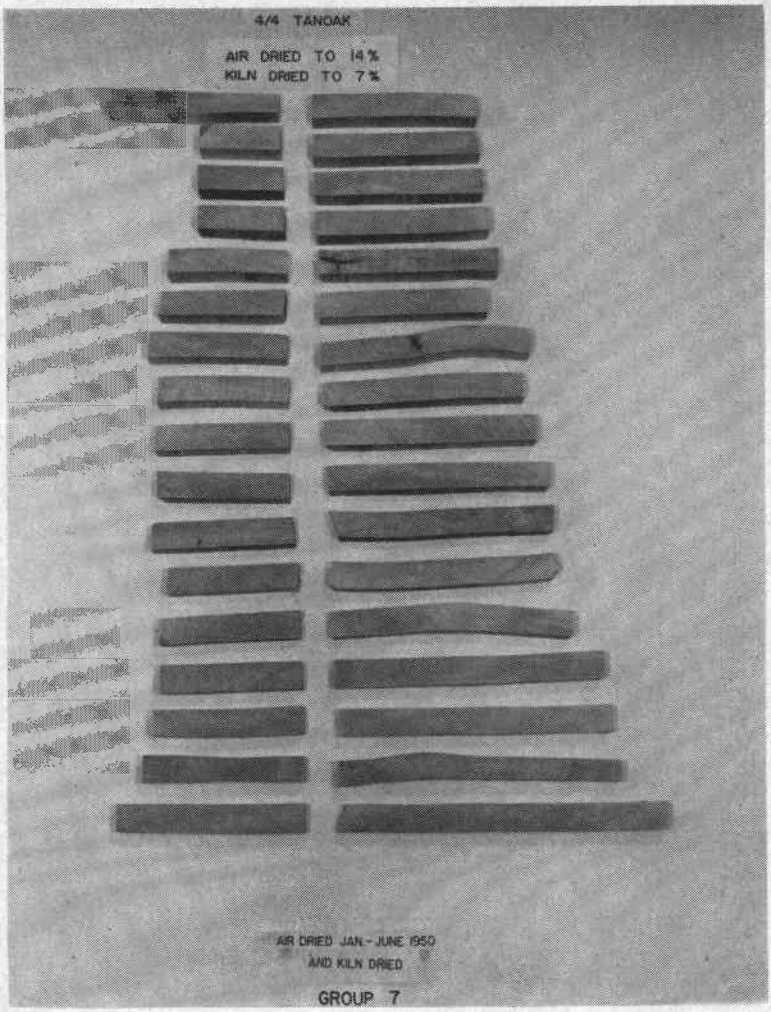
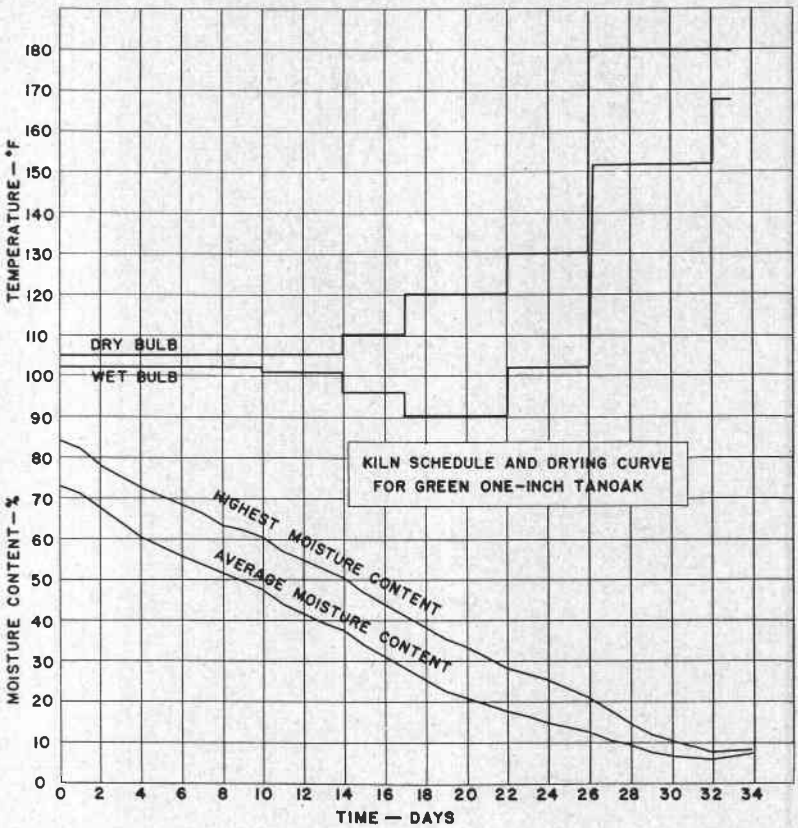



Figure 17. Cross sections of boards air dried January to June and kiln dried.



TEMPERATURE — °F
MOISTURE CONTENT — %
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
DRY BULB
WET BULB
KILN SCHEDULE AND DRYING CURVE
FOR GREEN ONE-INCH TANOAK
HIGHEST MOISTURE CONTENT
AVERAGE MOISTURE CONTENT
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34
TIME — DAYS


Figure 18.

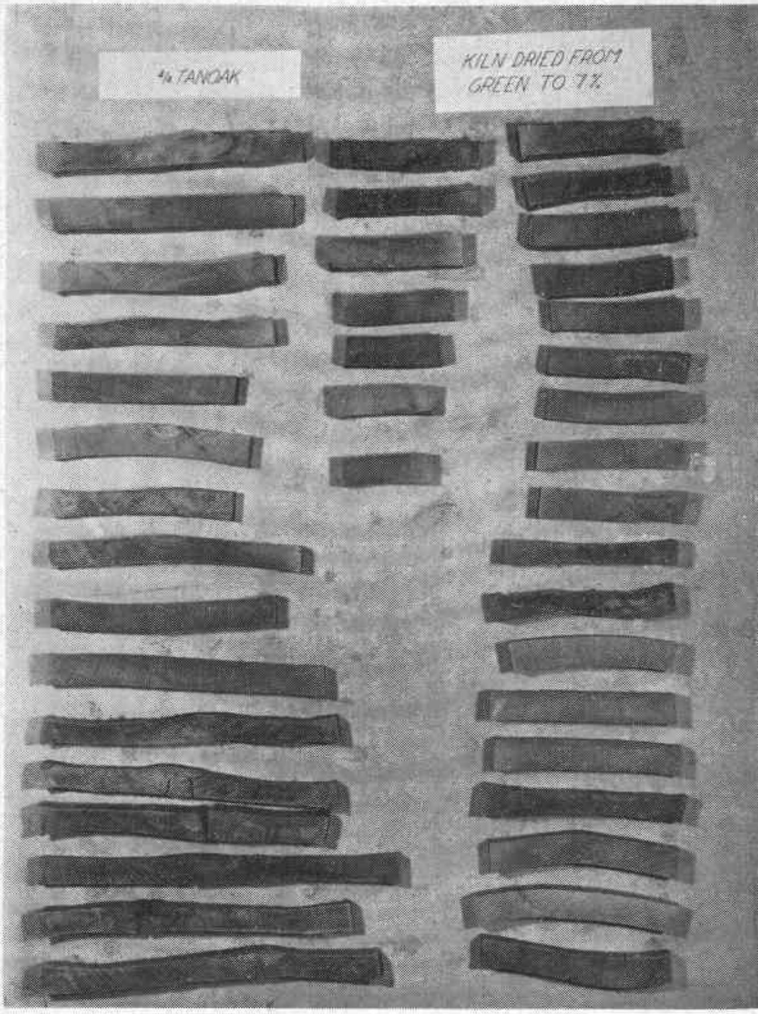



Figure 19. Cross sections of boards kiln dried from green condition.

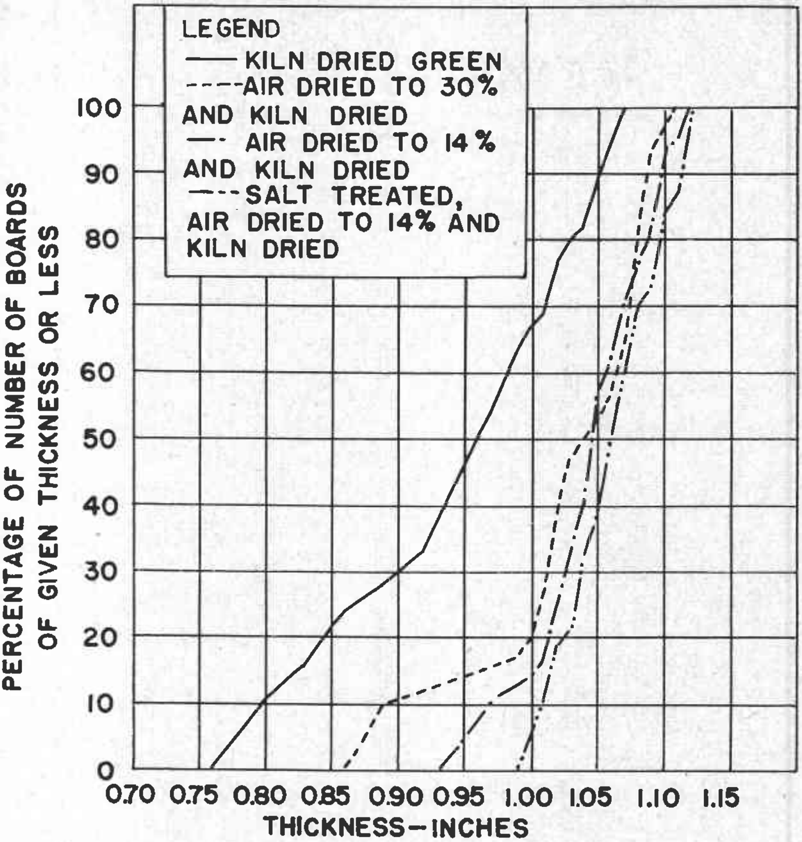



Figure 20. Distribution of dry thicknesses obtained by various seasoning procedures.

SUGGESTED PILING METHOD FOR AIR SEASONING OREGON HARDWOODS

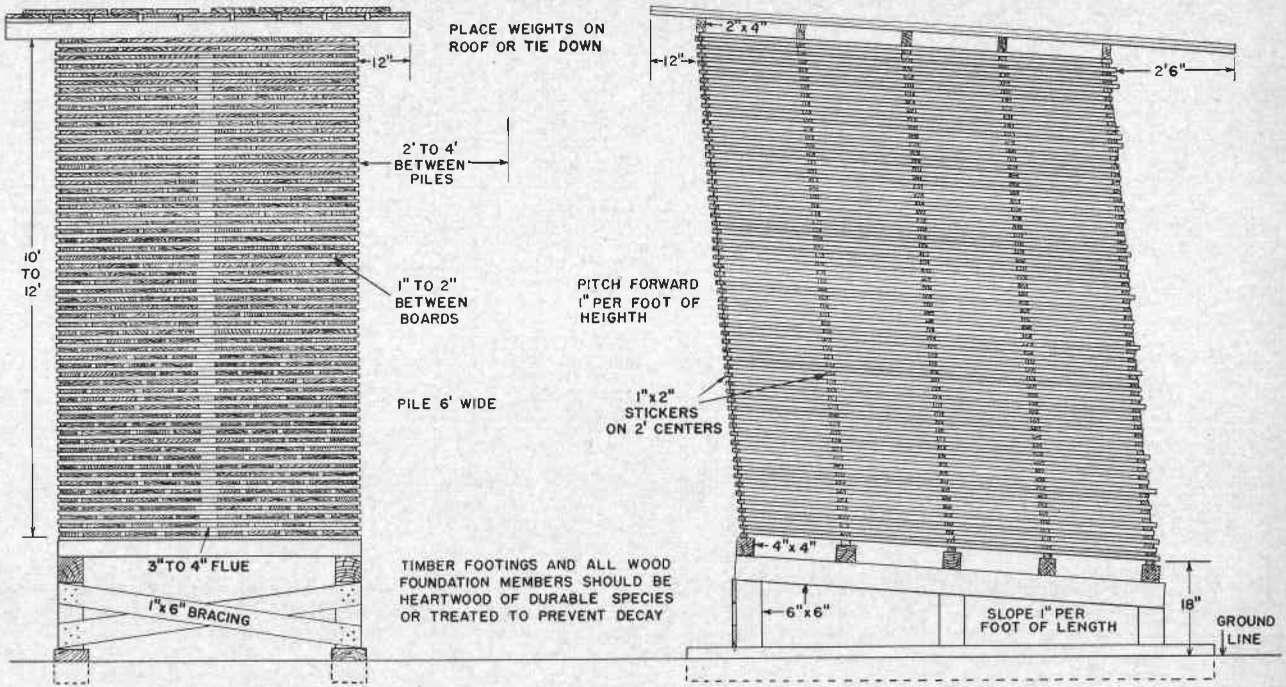



Figure 21.

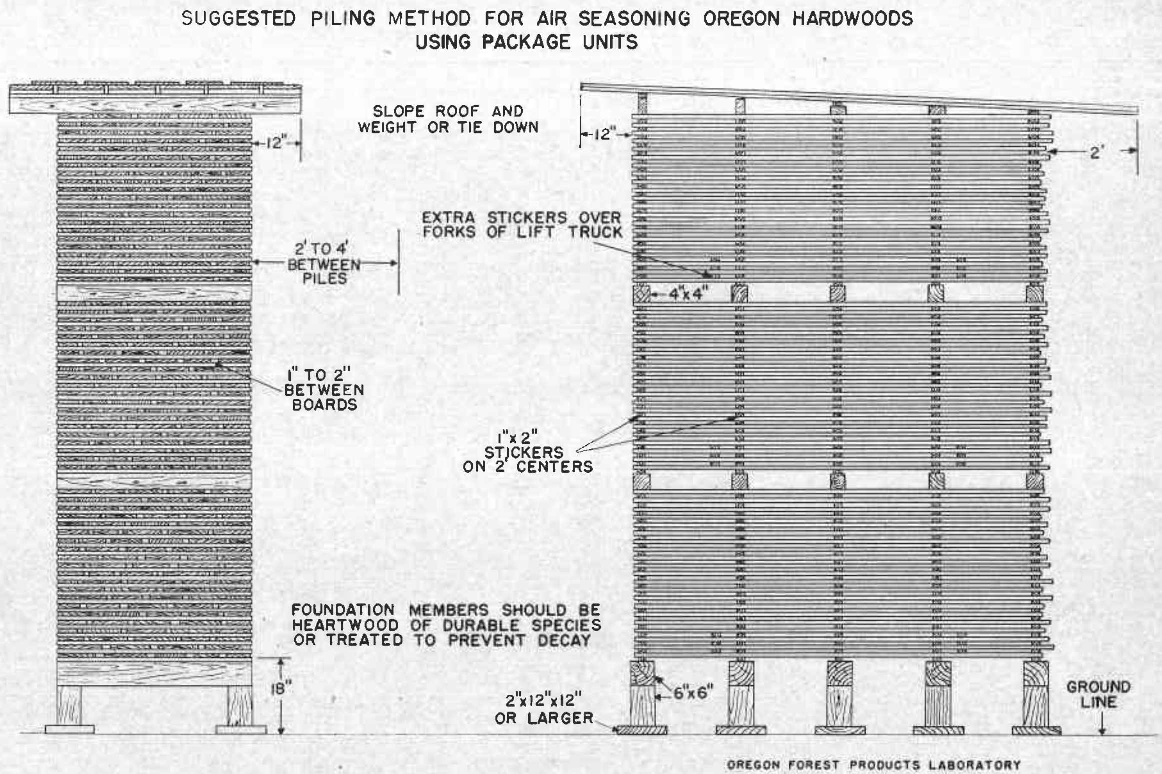

SUGGESTED PILING METHOD FOR AIR SEASONING OREGON HARDWOODS
USING PACKAGE UNITS
SLOPE ROOF AND
WEIGHT OR TIE DOWN
12"
12"
2'
EXTRA STICKERS OVER
FORKS OF LIFT TRUCK
2' TO 4'
BETWEEN
PILES
4"x4"
1" TO 2"
BETWEEN
BOARDS
1"x 2"
STICKERS
ON 2' CENTERS
FOUNDATION MEMBERS SHOULD BE
HEARTWOOD OF DURABLE SPECIES
OR TREATED TO PREVENT DECAY
18"
6"x6"
2"x12"x12"
OR LARGER
GROUND
LINE
OREGON FOREST PRODUCTS LABORATORY

Figure 22.

Table 1. Grades and Cutting Units of Boards Partially Air Dried in Summer and Kiln Dried

| Board number | Dry surface measure | Grade disregarding seasoning defects | Total cutting units[1] disregarding seasoning defects | Actual yield: Grade size cutting units in boards not degraded | Boards degraded by seasoning defects: Revised grade | Boards degraded by seasoning defects: Cutting units in grade-size cuttings | Number of grade-size cuttings | Cutting units in cuttings smaller than grade-size | Number of cuttings smaller than grade-size | Cutting units lost | Reason for drop in grade or loss of cutting units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Sq. ft.* | | | | | | | | | | |
| 19 | 4.5 | First | 55 | 55 | | .... | 1 | 0 | 0 | 0 | |
| 63 | 3.0 | " | 36 | 36 | | .... | 1 | 0 | 0 | 0 | |
| 96 | 3.7 | " | 46 | 46 | | .... | 1 | 0 | 0 | 0 | |
| 179 | 4.5 | " | 53 | 53 | | .... | 1 | 0 | 0 | 0 | |
| 118 | 3.0 | Second | 39 | 36 | | .... | 1 | 3 | 1 | 0 | |
| 168 | 3.5 | " | 45 | 42 | | .... | 1 | 3 | 1 | 0 | |
| 81 | 3.0 | Select | 38 | 38 | | .... | 1 | 0 | 0 | 0 | |
| 141 | 3.8 | " | 41 | 41 | | .... | 1 | 0 | 0 | 0 | |
| 228 | 3.0 | " | 33 | 33 | | .... | 1 | 0 | 0 | 0 | |
| 18 | 3.0 | No. 1 Com. | 28 | 25 | | .... | 1 | 3 | 1 | 0 | |
| 26 | 3.0 | " | 31 | 31 | | .... | 2 | 0 | 0 | 0 | |
| 91 | 4.7 | " | 48 | 44 | | .... | 2 | 4 | 1 | 0 | |
| 231 | 4.5 | " | 51 | 40 | | .... | 2 | 11 | 3 | 0 | |
| 132 | 5.0 | " | 58 | 42 | | .... | 2 | 16 | 2 | 0 | |
| 263 | 1.8 | " | 18 | 18 | | .... | 1 | 0 | 0 | 0 | |
| 244 | 2.5 | " | 27 | .... | No. 3a Com. | 20 | 2 | 0 | 0 | 7 | Checks[2] |
| 207 | 1.8 | No. 2 Com. | 15 | 15 | | .... | 1 | 0 | 0 | 0 | |
| 215 | 2.8 | " | 29 | 22 | | .... | 1 | 3 | 1 | 4 | Checks |
| 237 | 3.5 | " | 35 | 21 | | .... | 1 | 14 | 4 | 0 | |
| 279 | 2.8 | " | 30 | 24 | | .... | 2 | 6 | 1 | 0 | |
| 34 | 5.5 | " | 60 | .... | No. 3a Com. | 24 | 3 | 9 | 2 | 27 | Checks[2] |
| 47 | 5.5 | " | 49 | .... | No. 3a Com. | 29 | 3 | 11 | 2 | 9 | Checks |
| 181 | 5.5 | " | 50 | .... | No. 3b Com. | 27 | 1 | 16 | 4 | 7 | Checks |
| 2 | 5.5 | No. 3a Com. | 39 | 26 | | .... | 3 | 12 | 3 | 1 | Checks[2] |
| 15 | 1.8 | " | 17 | 9 | | .... | 1 | 8 | 2 | 0 | |
| 40 | 3.5 | " | 29 | 23 | | .... | 3 | 6 | 2 | 0 | |
| 60 | 4.5 | " | 38 | 32 | | .... | 3 | 6 | 2 | 0 | |
| 75 | 6.5 | " | 58 | 45 | | .... | 4 | 12 | 4 | 1 | Checks[2] |
| 148 | 4.5 | " | 37 | 20 | | .... | 2 | 17 | 4 | 0 | |
| 204 | 3.7 | " | 32 | 18 | | .... | 1 | 14 | 3 | 0 | |
| 205 | 2.5 | " | 28 | 22 | | .... | 2 | 6 | 1 | 0 | |
| 258 | 2.8 | " | 22 | 18 | | .... | 2 | 4 | 1 | 0 | |
| 281 | 3.5 | " | 31 | 15 | | .... | 2 | 16 | 4 | 0 | |
| 290 | 4.5 | " | 39 | 30 | | .... | 3 | 9 | 3 | 0 | |
| 8 | 6.5 | " | 59 | .... | No. 3b Com. | 23 | 1 | 28 | 6 | 8 | Checks[2] |
| 55 | 2.8 | No. 3b Com. | 16 | 9 | | .... | 3 | 0 | 0 | 7 | Warp[2] |
| 104 | 2.2 | " | 11 | 11 | | .... | 2 | 0 | 0 | 0 | |
| 251 | 3.7 | " | 16 | 13 | | .... | 2 | 3 | 1 | 0 | |
| Total | .... | | 1,387 | 953 | | 123 | .... | 240 | .... | 71[3] | |

[1] "Total cutting units" include those in grade size cuttings plus units in cuttings of 36 square inches or over; based on dry dimensions. A cutting unit is 12 square inches of surface area.
[2] Collapse: may not dress without skips.
[3] 5.1 per cent of total cutting units.

| Board number | Dry surface measure | Grade disregarding seasoning defects | Total cutting units[1] disregarding seasoning defects | Grade size cutting units in boards not degraded | Actual yield: Boards degraded by seasoning defects: Revised grade | Actual yield: Boards degraded by seasoning defects: Cutting units in grade-size cuttings | Actual yield: Number of grade-size cuttings | Actual yield: Cutting units in cuttings smaller than grade-size | Actual yield: Number of cuttings smaller than grade-size | Cutting units lost | Reason for drop in grade or loss of cutting units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Sq. ft.* | | | | | | | | | | |
| 44 | 4.4 | First | 52 | 52 | | .... | 1 | 0 | 0 | 0 | |
| 51 | 4.3 | " | 53 | 50 | | .... | 1 | 0 | 0 | 3 | End checks |
| 67 | 3.8 | " | 42 | 42 | | .... | 1 | 0 | 0 | 0 | |
| 80 | 3.0 | " | 33 | 33 | | .... | 1 | 0 | 0 | 0 | |
| 90 | 4.8 | " | 57 | 52 | | .... | 1 | 5 | 1 | 0 | |
| 95 | 2.8 | " | 33 | 33 | | .... | 1 | 0 | 0 | 0 | |
| 178 | 4.7 | " | 58 | 52 | | .... | 1 | 0 | 0 | 6 | End checks |
| 224 | 3.8 | " | 45 | 45 | | .... | 1 | 0 | 0 | 0 | |
| 10 | 5.1 | Second | 50 | 43 | | .... | 1 | 5 | 1 | 2 | End checks |
| 87 | 3.7 | " | 36 | 36 | | .... | 1 | 0 | 0 | 0 | |
| 121 | 3.8 | " | 44 | 39 | | .... | 1 | 5 | 1 | 0 | |
| 167 | 3.6 | " | 39 | 39 | | .... | 1 | 0 | 0 | 0 | |
| 1 | 5.4 | " | 60 | .... | Select | 57 | 1 | 3 | 1 | 0 | Checks |
| 17 | 3.2 | Select | 39 | 39 | | .... | 1 | 0 | 0 | 0 | |
| 100 | 2.0 | " | 35 | 32 | | .... | 1 | 3 | 1 | 0 | |
| 134 | 4.3 | " | 49 | 49 | | .... | 1 | 0 | 0 | 0 | |
| 138 | 2.8 | " | 31 | 31 | | .... | 1 | 0 | 0 | 0 | |
| 21 | 2.9 | No. 1 Com. | 31 | 24 | | .... | 1 | 7 | 1 | 0 | |
| 32 | 6.5 | " | 73 | 61 | | .... | 3 | 3 | 1 | 9 | Checks |
| 33 | 5.5 | " | 57 | 47 | | .... | 1 | 8 | 2 | 2 | End checks |
| 114 | 3.1 | " | 31 | 27 | | .... | 1 | 4 | 1 | 0 | |
| 137 | 3.0 | " | 31 | 27 | | .... | 1 | 4 | 1 | 0 | |
| 277 | 2.9 | " | 29 | 26 | | .... | 2 | 3 | 1 | 0 | |
| 154 | 5.6 | " | 62 | .... | No. 2 Com. | 33 | 2 | 16 | 4 | 13 | Checks |
| 11 | 1.7 | " | 17 | .... | No. 3a Com. | 9 | 1 | 3 | 1 | 5 | Checks |
| 177 | 1.9 | No. 2 Com. | 20 | 13 | | .... | 1 | 7 | 1 | 0 | |
| 7 | 6.9 | " | 47 | 44 | | .... | 3 | 3 | 1 | 0 | |
| 46 | 5.6 | " | 59 | 34 | | .... | 3 | 6 | 1 | 19 | Checks |
| 62 | 3.0 | " | 33 | 24 | | .... | 2 | 7 | 2 | 2 | End checks |
| 214 | 2.9 | " | 27 | 18 | | .... | 1 | 9 | 2 | 0 | |
| 225 | 4.8 | " | 44 | 29 | | .... | 2 | 12 | 2 | 3 | End split |
| 234 | 2.6 | " | 25 | 25 | | .... | 2 | 0 | 0 | 0 | |
| 37 | 3.5 | No. 3a Com. | 26 | 18 | | .... | 3 | 8 | 2 | 0 | |
| 54 | 2.8 | " | 18 | 11 | | .... | 1 | 7 | 1 | 0 | |
| 202 | 3.9 | " | 36 | 18 | | .... | 1 | 14 | 4 | 4 | Checks |
| 203 | 2.9 | " | 30 | 14 | | .... | 1 | 16 | 3 | 0 | |
| 257 | 2.9 | " | 22 | 11 | | .... | 1 | 11 | 2 | 0 | |
| 268 | 4.8 | " | 48 | 19 | | .... | 1 | 26 | 6 | 3 | End split |
| 287 | 4.4 | " | 41 | 22 | | .... | 2 | 19 | 2 | 0 | |
| 139 | 3.5 | No. 3b Com. | 35 | 16 | | .... | 2 | 19 | 4 | 0 | |
| 158 | 2.8 | " | 27 | 11 | | .... | 2 | 3 | 1 | 13 | Warp, checks |
| 250 | 3.7 | " | 25 | 15 | | .... | 2 | 10 | 3 | 0 | |
| 259 | 1.7 | " | 17 | 17 | | .... | 1 | 0 | 0 | 0 | |
| 280 | 3.7 | " | 35 | 18 | | .... | 1 | 11 | 3 | 6 | Checks |
| Total | .... | | 1,702 | 1,256 | | 99 | .... | 257 | .... | 90[2] | |

[1] "Total cutting units" includes those in grade size cuttings plus units in cuttings of 36 square inches or over: based on dry dimensions. A cutting unit is 12 square inches of surface area.

[2] 5.3 per cent of total cutting units.

Table 3. GRADES AND CUTTING UNITS OF BOARDS SALT TREATED, AIR DRIED THOROUGHLY IN SUMMER, AND KILN DRIED

| Board number | Dry surface measure | Grade disregarding seasoning defects | Total cutting units[1] disregarding seasoning defects | Actual yield: Grade size cutting units in boards not degraded | Actual yield: Boards degraded by seasoning defects: Revised grade | Actual yield: Boards degraded by seasoning defects: Cutting units in grade-size cuttings | Actual yield: Number of grade-size cuttings | Actual yield: Cutting units in cuttings smaller than grade-size | Actual yield: Number of cuttings smaller than grade-size | Cutting units lost | Reason for drop in grade or loss of cutting units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Sq. ft.* | | | | | | | | | | |
| 69 | 3.2 | First | 38 | 38 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 70 | 5.6 | " | 67 | 67 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 102 | 4.7 | " | 57 | 57 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 130 | 3.1 | " | 38 | 38 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 170 | 3.9 | " | 43 | 43 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 235 | 5.2 | " | 62 | 62 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 282 | 3.8 | " | 44 | .... | Second | 38 | 1 | 4 | 1 | 2 | Checks |
| 28 | 4.8 | " | 57 | .... | No. 1 Com. | 42 | 2 | 5 | 1 | 10 | End split |
| 20 | 3.3 | Second | 39 | 33 | ........ | .... | 1 | 6 | 1 | 0 | ........ |
| 103 | 3.8 | " | 41 | 37 | ........ | .... | 1 | 4 | 1 | 0 | ........ |
| 107 | 2.0 | Select | 24 | 24 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 169 | 3.0 | " | 36 | 36 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 220 | 1.9 | " | 23 | 23 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 226 | 2.8 | " | 33 | 33 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 236 | 4.7 | " | 57 | .... | No. 1 Com. | 42 | 2 | 3 | 1 | 12 | End split and check |
| 64 | 3.0 | No. 1 Com. | 36 | 26 | ........ | .... | 1 | 10 | 2 | 0 | ........ |
| 98 | 3.0 | " | 35 | 27 | ........ | .... | 1 | 8 | 1 | 0 | ........ |
| 129 | 5.6 | " | 65 | 54 | ........ | .... | 2 | 11 | 2 | 0 | ........ |
| 140 | 3.0 | " | 32 | 27 | ........ | .... | 1 | 5 | 1 | 0 | ........ |
| 182 | 4.7 | " | 50 | 42 | ........ | .... | 1 | 8 | 1 | 0 | ........ |
| 191 | 1.9 | " | 21 | 17 | ........ | .... | 1 | 4 | 1 | 0 | ........ |
| 3 | 5.6 | " | 50 | .... | No. 2 Com. | 38 | 3 | 10 | 2 | 2 | Checks |
| 186 | 5.5 | " | 58 | .... | No. 2 Com. | 34 | 2 | 16 | 2 | 8 | Checks |
| 9 | 6.5 | No. 2 Com. | 60 | 39 | ........ | .... | 3 | 7 | 2 | 14 | Checks |
| 16 | 1.9 | " | 23 | 14 | ........ | .... | 1 | 7 | 2 | 2 | End check |
| 27 | 2.9 | " | 24 | 24 | ........ | .... | 2 | 0 | 0 | 0 | ........ |
| 146 | 4.0 | " | 38 | 30 | ........ | .... | 1 | 8 | 1 | 0 | ........ |
| 149 | 4.4 | " | 40 | 31 | ........ | .... | 2 | 6 | 1 | 3 | End check |
| 239 | 3.8 | " | 39 | 29 | ........ | .... | 2 | 10 | 3 | 0 | ........ |
| 246 | 2.8 | " | 24 | 24 | ........ | .... | 2 | 0 | 0 | 0 | ........ |
| 265 | 2.7 | " | 18 | 18 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 266 | 2.0 | " | 18 | 15 | ........ | .... | 1 | 3 | 1 | 0 | ........ |
| 35 | 5.6 | " | 49 | .... | No. 3a Com. | 26 | 2 | 7 | 1 | 16 | Checks |
| 76 | 6.5 | " | 64 | .... | No. 3a Com. | 30 | 2 | 19 | 4 | 15 | Checks |
| 84 | 2.7 | " | 26 | .... | No. 3a Com. | 12 | 1 | 11 | 2 | 3 | Extension of shake |
| 65 | 4.4 | No. 3a Com. | 40 | 22 | ........ | .... | 2 | 18 | 3 | 0 | ........ |
| 206 | 2.9 | " | 26 | 17 | ........ | .... | 2 | 9 | 2 | 0 | ........ |
| 217 | 3.8 | " | 29 | 19 | ........ | .... | 2 | 7 | 2 | 3 | Checks |
| 255 | 3.7 | " | 29 | 20 | ........ | .... | 2 | 9 | 1 | 0 | ........ |
| 283 | 2.8 | " | 27 | 12 | ........ | .... | 1 | 15 | 3 | 0 | ........ |
| 45 | 3.9 | No. 3b Com. | 39 | 14 | ........ | .... | 1 | 24 | 4 | 1 | End check |
| Total | .... | ........ | 1,619 | 1,012 | ........ | 262 | .... | 254 | .... | 91[2] | ........ |

[1] "Total cutting units" includes those in grade size cuttings plus units in cuttings of 36 square inches or over; based on dry dimensions. A cutting unit is 12 square inches of surface area.

[2] 5.6 per cent of total cutting units.

Table 4.—Grades and Cutting Units of Boards Air Dried from October to June and Kiln Dried

| Board number | Dry surface measure | Grade disregarding seasoning defects | Total cutting units[1] disregarding seasoning defects | Actual yield: Grade size cutting units in boards not degraded | Actual yield: Boards degraded by seasoning defects: Revised grade | Actual yield: Boards degraded by seasoning defects: Cutting units in grade-size cuttings | Actual yield: Number of grade-size cuttings | Actual yield: Cutting units in cuttings smaller than grade-size | Actual yield: Number of cuttings smaller than grade-size | Cutting units lost | Reason for drop in grade or loss of cutting units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Sq. ft.* | | | | | | | | | | |
| 31 | 5.8 | First | 55 | .... | No. 1 Com. | 52 | 2 | 0 | 0 | 3 | Warp (cup) |
| 53 | 3.2 | " | 39 | 39 | | .... | 1 | 0 | 0 | 0 | |
| 155 | 3.0 | " | 33 | .... | Second | 31 | 1 | 0 | 0 | 2 | End check |
| 160 | 3.7 | " | 44 | 44 | | .... | 1 | 0 | 0 | 0 | |
| 243 | 3.8 | " | 46 | .... | No. 2 Com. | 31 | 2 | 0 | 0 | 15 | Checks |
| 73 | 2.7 | Second | 31 | 27 | | .... | 1 | 4 | 1 | 0 | |
| 190 | 3.7 | " | 39 | 39 | | .... | 1 | 0 | 0 | 0 | |
| 273 | 1.7 | " | 18 | 18 | | .... | 1 | 0 | 0 | 0 | |
| 285 | 5.5 | " | 63 | .... | No. 2 Com. | 38 | 2 | 13 | 2 | 12 | Checks |
| 41 | 2.6 | Select | 25 | 25 | | .... | 1 | 0 | 0 | 0 | |
| 108 | 3.7 | " | 45 | 45 | | .... | 1 | 0 | 0 | 0 | |
| 187 | 2.5 | " | 30 | 30 | | .... | 1 | 0 | 0 | 0 | |
| 4 | 5.5 | No. 1 Com. | 58 | 56 | | .... | 4 | 0 | 0 | 2 | Split |
| 83 | 3.7 | " | 46 | 33 | | .... | 1 | 13 | 2 | 0 | |
| 101 | 2.7 | " | 31 | .... | No. 3a Com. | 14 | 1 | 11 | 2 | 6 | Checks |
| 112 | 5.6 | " | 62 | .... | No. 2 Com. | 39 | 2 | 14 | 3 | 9 | Checks and warp |
| 194 | 1.7 | " | 20 | 20 | | .... | 2 | 0 | 0 | 0 | |
| 209 | 2.9 | " | 29 | .... | No. 2 Com. | 26 | 2 | 0 | 0 | 3 | Checks |
| 229 | 2.6 | " | 23 | 20 | | .... | 1 | 3 | 1 | 0 | |
| 241 | 1.7 | " | 21 | 21 | | .... | 1 | 0 | 0 | 0 | |
| 253 | 2.7 | " | 29 | .... | No. 2 Com. | 18 | 1 | 7 | 2 | 4 | Checks |
| 288 | 3.6 | " | 38 | 33 | | .... | 2 | 5 | 1 | 0 | |
| 289 | 2.7 | " | 25 | 25 | | .... | 2 | 0 | 0 | 0 | |
| 56 | 3.7 | No. 2 Com. | 33 | 24 | | .... | 1 | 9 | 3 | 0 | |
| 116 | 4.2 | " | 44 | 38 | | .... | 3 | 6 | 1 | 0 | |
| 131 | 3.6 | " | 35 | 28 | | .... | 2 | 7 | 2 | 0 | |
| 143 | 5.5 | " | 49 | 30 | | .... | 3 | 6 | 1 | 13 | Checks |
| 162 | 1.9 | " | 21 | 13 | | .... | 1 | 8 | 2 | 0 | |
| 171 | 4.4 | " | 40 | .... | No. 3a Com. | 31 | 3 | 9 | 2 | 0 | |
| 199 | 4.7 | " | 39 | 27 | | .... | 1 | 7 | 2 | 5 | Warp |
| 219 | 3.5 | " | 34 | 21 | | .... | 2 | 13 | 3 | 0 | |
| 260 | 4.7 | " | 47 | 28 | | .... | 2 | 12 | 3 | 7 | End checks |
| 272 | 3.1 | " | 29 | 21 | | .... | 1 | 8 | 2 | 0 | |
| 13 | 6.7 | No. 3a Com. | 38 | 35 | | .... | 3 | 3 | 1 | 0 | |
| 38 | 5.8 | " | 30 | 23 | | .... | 3 | 4 | 1 | 3 | Warp |
| 147 | 3.0 | " | 27 | 12 | | .... | 1 | 11 | 3 | 4 | Checks |
| 151 | 4.9 | " | 38 | 31 | | .... | 3 | 7 | 1 | 0 | |
| 183 | 6.5 | " | 47 | 31 | | .... | 2 | 16 | 5 | 0 | |
| 213 | 1.8 | " | 8 | .... | No. 3b Com. | 7 | 1 | 0 | 0 | 1 | Checks |
| 269 | 3.7 | " | 30 | 20 | | .... | 2 | 3 | 1 | 7 | Checks |
| 68 | 2.7 | No. 3b Com. | 16 | 12 | | .... | 3 | 4 | 1 | 0 | |
| Total | .... | | 1,455 | 869 | | 287 | .... | 203 | .... | 96[2] | |

[1] "Total cutting units" includes those in grade-size cuttings plus units in cuttings of 36 square inches or over: based on dry dimensions. A cutting unit is 12 square inches of surface area.

[2] 6.6 per cent of total cutting units.

Table 5. Grades and Cutting Units of Boards Air Dried from January to June and Kiln Dried

| Board number | Dry surface measure | Grade disregarding seasoning defects | Total cutting units[1] disregarding seasoning defects | Actual yield: Grade size cutting units in boards not degraded | Actual yield: Boards degraded by seasoning defects: Revised grade | Actual yield: Boards degraded by seasoning defects: Cutting units in grade-size cuttings | Actual yield: Number of grade-size cuttings | Actual yield: Cutting units in cuttings smaller than grade-size | Actual yield: Number of cuttings smaller than grade-size | Cutting units lost | Reason for drop in grade or loss of cutting units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Sq. ft.* | | | | | | | | | | |
| 86 | 3.6 | First | 43 | .... | Select | 43 | 1 | 0 | 0 | 0 | Checks on one face |
| 106 | 2.9 | " | 36 | 36 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 157 | 2.8 | " | 33 | 33 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 165 | 3.8 | " | 42 | 42 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 216 | 4.6 | " | 54 | .... | Second | 54 | 2 | 0 | 0 | 0 | Short straight split |
| 222 | 3.1 | " | 35 | 35 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 25 | 5.5 | Second | 59 | .... | No. 1 Com. | 50 | 2 | 8 | 2 | 1 | Checks |
| 128 | 2.9 | " | 33 | 30 | .... | .... | 1 | 3 | 1 | 0 | .... |
| 49 | 2.6 | Select | 31 | 31 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 74 | 2.8 | " | 34 | 34 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 196 | 2.6 | " | 32 | 32 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 212 | 2.7 | " | 33 | 33 | .... | .... | 1 | 0 | 0 | 0 | .... |
| 233 | 2.8 | " | 33 | .... | No. 1 Com. | 32 | 2 | 0 | 0 | 1 | Warp |
| 43 | 5.4 | No. 1 Com. | 58 | .... | No. 3a Com. | 23 | 2 | 13 | 3 | 22 | Checks |
| 59 | 3.6 | " | 41 | 34 | .... | .... | 2 | 7 | 1 | 0 | .... |
| 61 | 3.2 | " | 30 | 30 | .... | .... | 2 | 0 | 0 | 0 | .... |
| 126 | 4.2 | " | 45 | 38 | .... | .... | 1 | 7 | 2 | 0 | .... |
| 150 | 5.6 | " | 63 | .... | No. 2 Com. | 37 | 2 | 12 | 2 | 14 | Warp and checks |
| 174 | 4.6 | " | 44 | 44 | .... | .... | 2 | 0 | 0 | 0 | .... |
| 198 | 1.8 | " | 18 | 18 | .... | .... | 2 | 0 | 0 | 0 | .... |
| 256 | 2.9 | " | 28 | 24 | .... | .... | 2 | 4 | 1 | 0 | .... |
| 276 | 2.8 | " | 27 | 27 | .... | .... | 2 | 0 | 0 | 0 | .... |
| 24 | 6.6 | No. 2 Com. | 67 | 45 | .... | .... | 2 | 20 | 5 | 2 | Checks |
| 136 | 3.7 | " | 35 | 30 | .... | .... | 2 | 5 | 1 | 0 | .... |
| 200 | 3.7 | " | 38 | 30 | .... | .... | 2 | 8 | 2 | 0 | .... |
| 238 | 4.5 | " | 34 | 27 | .... | .... | 2 | 7 | 1 | 0 | .... |
| 248 | 1.8 | " | 16 | 11 | .... | .... | 1 | 5 | 1 | 0 | .... |
| 249 | 3.6 | " | 38 | 24 | .... | .... | 2 | 14 | 3 | 0 | .... |
| 50 | 4.4 | No. 3a Com. | 29 | 20 | .... | .... | 2 | 8 | 2 | 1 | Warp |
| 119 | 3.8 | " | 21 | 18 | .... | .... | 2 | 3 | 1 | 0 | .... |
| 176 | 1.9 | " | 19 | 9 | .... | .... | 1 | 10 | 2 | 0 | .... |
| 262 | 4.9 | " | 39 | 29 | .... | .... | 3 | 10 | 2 | 0 | .... |
| 275 | 3.7 | " | 26 | 22 | .... | .... | 3 | 4 | 1 | 0 | .... |
| 120 | 5.6 | No. 3b Com. | 30 | 30 | .... | .... | 4 | 0 | 0 | 0 | .... |
| Total | .... | .... | 1,244 | 816 | .... | 239 | .... | 148 | .... | 41[2] | .... |

[1] "Total cutting units" includes those in grade-size cuttings plus units in cuttings of 36 square inches or over; based on dry dimensions. A cutting unit is 12 square inches of surface area.

[2] 3.3 per cent of total cutting units.

| Board number | Dry surface measure | Grade disregarding seasoning defects | Total cutting units[1] disregarding seasoning defects | Actual yield: Grade size cutting units in boards not degraded | Actual yield: Boards degraded by seasoning defects: Revised grade | Actual yield: Boards degraded by seasoning defects: Cutting units in grade-size cuttings | Number of grade-size cuttings | Cutting units in cuttings smaller than grade-size | Number of cuttings smaller than grade-size | Cutting units lost | Reason for drop in grade or loss of cutting units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Sq. ft.* | | | | | | | | | | |
| 218 | 3.3 | First | 36 | 36 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 82 | 3.2 | " | 39 | .... | Select | 39 | 1 | 0 | 0 | 0 | Checks |
| 240 | 3.3 | " | 41 | .... | No. 1 Com. | 30 | 1 | 11 | 1 | 0 | Warp[2] (cup) |
| 105 | 3.2 | " | 39 | .... | No. 2 Com. | 23 | 1 | 7 | 2 | 9 | Checks[2] |
| 159 | 3.6 | " | 44 | .... | No. 2 Com. | 26 | 2 | 10 | 3 | 8 | Checks[2] |
| 66 | 2.5 | Second | 28 | 28 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 144 | 2.7 | Select | 32 | 32 | ........ | .... | 1 | 0 | 0 | 0 | ........[2] |
| 153 | 2.6 | " | 31 | 31 | ........ | .... | 1 | 0 | 0 | 0 | ........[2] |
| 227 | 2.5 | " | 27 | 27 | ........ | .... | 1 | 0 | 0 | 0 | ........[2] |
| 252 | 2.6 | " | 32 | .... | No. 1 Com. | 32 | 2 | 0 | 0 | 0 | Warp[2] |
| 99 | 2.5 | " | 30 | .... | No. 2 Com. | 15 | 1 | 9 | 2 | 6 | Checks |
| 22 | 3.0 | No. 1 Com. | 33 | 33 | ........ | .... | 2 | 0 | 0 | 0 | ........ |
| 72 | 3.1 | " | 35 | 30 | ........ | .... | 2 | 5 | 1 | 0 | ........[2] |
| 115 | 4.0 | " | 47 | 37 | ........ | .... | 1 | 10 | 1 | 0 | ........ |
| 193 | 4.1 | " | 45 | 40 | ........ | .... | 2 | 3 | 1 | 2 | Checks |
| 223 | 4.9 | " | 44 | 33 | ........ | .... | 2 | 11 | 2 | 0 | ........ |
| 232 | 1.5 | " | 18 | 18 | ........ | .... | 1 | 0 | 0 | 0 | ........ |
| 127 | 3.6 | " | 34 | .... | No. 3a Com. | 16 | 2 | 11 | 2 | 7 | Warp,[2] checks |
| 208 | 2.6 | " | 25 | .... | No. 3a Com. | 13 | 1 | 12 | 3 | 0 | Warp |
| 23 | 1.7 | No. 2 Com. | 18 | 14 | ........ | .... | 1 | 4 | 1 | 0 | ........ |
| 29 | 4.4 | " | 37 | 32 | ........ | .... | 1 | 3 | 1 | 2 | Checks |
| 30 | 2.8 | " | 22 | 22 | ........ | .... | 2 | 0 | 0 | 0 | ........ |
| 109 | 2.0 | " | 19 | 15 | ........ | .... | 1 | 4 | 1 | 0 | ........ |
| 142 | 4.6 | " | 44 | 37 | ........ | .... | 2 | 7 | 2 | 0 | ........ |
| 166 | 3.9 | " | 34 | 30 | ........ | .... | 2 | 4 | 1 | 0 | ........[2] |
| 172 | 2.5 | " | 22 | 22 | ........ | .... | 2 | 0 | 0 | 0 | ........ |
| 245 | 4.5 | " | 38 | 27 | ........ | .... | 2 | 4 | 1 | 7 | Checks[2] |
| 271 | 2.5 | " | 24 | 24 | ........ | .... | 2 | 0 | 0 | 0 | ........ |
| 284 | 2.3 | " | 21 | 18 | ........ | .... | 2 | 0 | 0 | 3 | Checks[2] |
| 12 | 6.5 | " | 61 | .... | No. 3a Com. | 27 | 2 | 26 | 4 | 8 | Checks[2] |
| 36 | 5.4 | " | 50 | .... | No. 3a Com. | 23 | 2 | 15 | 3 | 12 | Checks[2] |
| 133 | 5.4 | " | 50 | .... | No. 3a Com. | 30 | 2 | 6 | 1 | 14 | Warp,[2] checks |
| 189 | 3.3 | " | 33 | .... | No. 3a Com. | 15 | 1 | 16 | 4 | 2 | Warp,[2] end split |
| 180 | 6.1 | " | 58 | .... | No. 3b Com. | 22 | 2 | 21 | 3 | 15 | Checks[2] |
| 94 | 5.2 | No. 3a Com. | 48 | 26 | ........ | .... | 3 | 11 | 3 | 11 | Warp,[2] checks |
| 192 | 1.6 | " | 18 | 8 | ........ | .... | 1 | 10 | 2 | 0 | ........ |
| 264 | 3.4 | " | 31 | 20 | ........ | .... | 2 | 11 | 3 | 0 | ........[2] |
| 5 | 5.6 | " | 45 | .... | No. 3b Com. | 25 | 2 | 15 | 3 | 5 | Checks |
| 52 | 3.4 | " | 29 | .... | No. 3b Com. | 10 | 2 | 12 | 2 | 7 | Warp, checks |
| 286 | 3.5 | No. 3b Com. | 28 | 13 | ........ | .... | 2 | 15 | 4 | 0 | ........ |
| 88 | 2.8 | " | 24 | .... | Cull | 0 | 0 | 6 | 1 | 18 | Check, warp |
| Total | .... | ........ | 1,414 | 653 | ........ | 346 | .... | 279 | .... | 136[3] | ........ |

[1] "Total cutting units" includes those in grade size cuttings plus units in cuttings of 36 square inches or over: based on dry dimensions. A cutting unit is 12 square inches of surface area.
[2] Collapse: may not dress without skips.
[3] 9.6 per cent of total cutting units.

Table 7. SHRINKAGE, GREEN TO FINAL MOISTURE CONTENT, OF BOARDS DRIED BY VARIOUS PROCEDURES

| Seasoning procedure | Average shrinkage[1] in width | Average shrinkage[1] in thickness | Average final moisture content |
|---|---|---|---|
| | *Per cent* | *Per cent* | *Per cent* |
| Kiln dried from green condition | 14.3 | 15.5 | 7.4 |
| Air dried to 30 per cent in summer and kiln dried | 8.4 | 8.4 | 7.0 |
| Air dried to 14 per cent in summer and kiln dried | 7.6 | 6.7 | 6.4 |
| Salt treated, air dried and kiln dried | 5.9 | 5.8 | 7.1 |
| Air dried October-June and kiln dried | 8.3 | 5.8 | 7.6 |
| Air dried January-June and kiln dried | 7.3 | 5.8 | 7.3 |
| Least significant mean difference | 1.3 | 2.7 | .... |

[1]Based on green dimensions.

KEEP
OREGON
GREEN