

TESTS FOR KILN-DRIED AIRCRAFT LUMBER

November 1941



THIS REPORT IS ONE OF A SERIES ISSUED
TO AID THE NATION'S DEFENSE EFFORT

No. 1368

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CORVALLIS, OREGON

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Tests During Drying

In order to be sure that the material in the kiln is drying uniformly and without developing defects, the following tests should be made during the drying process:

- (1) Samples should be inserted in the pile so that they will be subjected to the same drying as the portion of the pile where inserted. They should be easily removable for periodic weighing.
- (2) Not less than three samples should be used for each 10,000 board feet or less of material in the pile. Each sample should be about 2 feet long and cut at least 2 feet from the end of the board. The samples should represent the wettest, thickest, and slowest drying material in the load.
- (3) To determine the original moisture content, crosscut the board or other stock at least 2 feet from one end, to avoid the effect of end drying, and then again about 1 inch from the first cut, thus gaining a section as wide and as thick as the original stock and 1 inch long, measured with the grain. Remove all loose splinters from the section and weigh it immediately on a sensitive scale. Record the weight, which is called "original weight". Place the section in a drying oven kept at a temperature of about 212° F., leaving it there until it no longer loses weight, usually from 12 to 24 hours, although sometimes longer. Leaving a section in the oven for more than the required time may cause an appreciable error in the result. Remove the section from the oven and again weigh it; the scale reading will be the "oven-dry" weight of the wood -- the weight of the actual wood substance. The difference between the original weight and the oven-dry weight is the weight of the water originally in the section. Samples should be weighed immediately after cutting the moisture section and before placing in the kiln.
- (4) Before placing the samples in the pile, the ends of the samples should be given a thorough coating of approved material, such as filled hardened gloss oil, or 213° coal-tar pitch, to retard end drying.
- (5) Samples should be so located in the pile as to measure average, fastest, and slowest drying conditions, except they should not be in the top or bottom layers. The wettest, thickest, and slowest drying sample should be placed close to the recording hygrometer bulbs, and the drying conditions should be controlled by the moisture content of that sample.
- (6) The samples should be weighed daily when the time of drying is 10 days or less, and at least every 2 days when the time of drying is more than 10 days. The samples should be weighed on a scale which can be read to an accuracy of at least 0.1 of 1 percent.

¹This mimeograph is one of a series of reports issued by the Forest Products Laboratory to aid the Nation's defense effort.

(7) The moisture content of each sample should be calculated from its dry weight and current weight and no stock should be subjected to more severe drying conditions than those given in the specifications.

(8) The following example illustrates the method of determining the moisture content of a 2-foot sample:

Original weight, 7.35 pounds.

Original moisture percent (average of the two 1-inch sections)
= 47 percent.

Calculated dry weight of sample is $\frac{7.35}{100 + 47} \times 100 = 5.00$ pounds.

Current weight 6.23 pounds.

Moisture of sample $6.23 - 5.00 = 1.23$ pounds.

Current moisture expressed in percent is $\frac{100 \times 1.23}{5.00} =$
24.6 percent.

Tests After Drying

Adequate tests should be made after drying to insure that the stock is at the proper moisture content and free of casehardening stresses. If there is any doubt that the condition of the load is represented by the samples, other pieces should be designated for moisture and casehardening tests. Sections for these additional tests may be cut from any part along the length of a board or plank provided that they are cut not nearer than 2 feet from the ends of the pieces.

The tests should be made as follows:

(1) Three adjacent sections, 1 inch in length in the direction of the grain, should be cut from each piece of test stock.

(2) The first section should be dried whole and the average moisture content determined in the manner described in item 3, page 1 of this mimeograph. (See Forest Products Laboratory Mimeograph 1367, "Kiln Drying Essentials for Aircraft Stock," for method of determining acceptable range in average moisture content.)

(3) From the second section (moisture distribution section) cut a shell of a thickness equal to one-fourth of the thickness of the piece, having a core equal to one-half of the thickness of the piece. Discard the shell, and determine the moisture content of the core as described above. (See Forest Products Laboratory Mimeograph No. 1367, "Kiln Drying Essentials for Aircraft Stock," for acceptable range in moisture content of the core.)

(4) Saw the third section parallel to the wide faces of the original board into tongues or prongs, leaving about one-half inch of solid wood at one end of the section. For material less than 2 inches thick two saw cuts are made, and for material more than 2 inches thick five saw cuts should be made. In sections having six prongs, the second prong from each side should be broken out, leaving two outer and two central prongs. Remove the center prong from sections having only three prongs.

(5) Allow the third section to come to a uniform moisture condition which meets the requirements specified in Forest Products Laboratory Mimeograph No. 1367, "Kiln Drying Essentials for Aircraft Stock."

(6) If the prongs remain straight, or nearly so, the stock will be in a satisfactory condition at the moisture content it will have in use.

(7) If the outer prongs bend in, conditions of casehardening are indicated.

(8) Only very slight casehardening will be permissible.

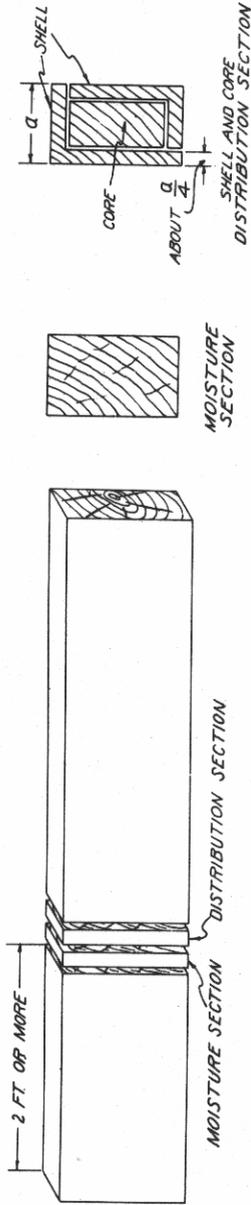
Another acceptable casehardening test may be made in the following manner when the purpose to which the stock will be put is known.

Cut the test section on a band saw to simulate the finished cross-section or profile the piece would have after manufacture. Place the section in the factory workrooms for 24 hours, or until the moisture content is uniform. Any distortion is evidence of casehardening or lack of uniformity of moisture distribution and indicative of the change in shape which would have occurred had the stock been worked up while in the condition represented by the section. If the distortion exceeds that allowed for the member or part, the stock should be steamed to relieve the stresses, or rejected.

Example.--Stock intended for propeller use is too thick, and after jointing one face the excess will be dressed off the other. As the depth of the cut on opposite faces would not be equal, the casehardening stresses would become unbalanced; and if the stresses were of sufficient intensity, the piece would cup toward the face having the deeper cut. This condition may be simulated in a casehardening test by cutting the section with a shallow cut on one side, equal to the jointing operation, and a deeper cut on the opposite face. The amount of distortion which would follow after room drying would determine whether the stock would be acceptable for the purpose.

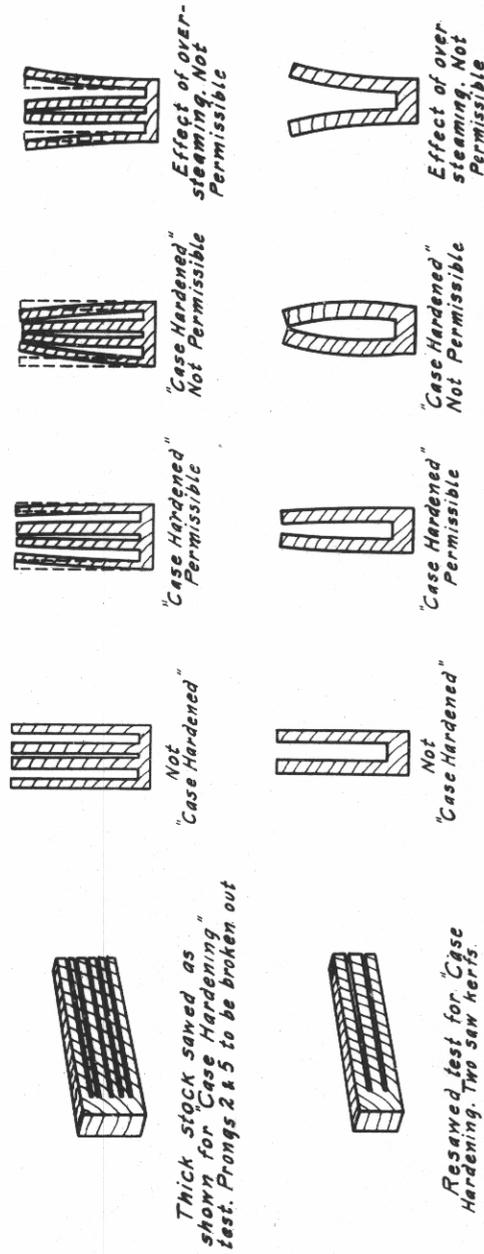
All casehardening test sections should be numbered corresponding to the number of the kiln run with an indelible pencil.

MOISTURE CONTENT SECTIONS



CASE HARDENING SECTIONS

SECTIONS TO BE ROOM DRIED BEFORE CONCLUSION AS TO CASE HARDENING IS MADE



TEST SECTIONS FOR MOISTURE CONTENT & CASE HARDENING

Fig. 1. Casehardening tests.