RELATIVE HUMIDITY AND EQUILIBRIUM MOISTURE CONTENT GRAPHS AND TABLES FOR USE IN KILN DRYING LUMBER

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RELATIVE HUMIDITY AND EQUILIBRIUM MOISTURE CONTENT GRAPHS AND TABLES FOR USE IN KILN DRYING LUMBER[1]

Forest Products Laboratory,[2] Forest Service
U. S. Department of Agriculture

Introduction

Much of the operating data that are of use in the operation of dry kilns can be best expressed in either graphs or tables. Each method has advantages under certain conditions.

Graphs reveal maximum and minimum points, rates of change, and periodic changes that are frequently difficult to determine in large tables. Graphs mark the interrelation of two or more variables in a compact form and often record on one page the information that might require many pages in a table. The accuracy with which a graph may be read, however, varies with the scales, the frequency of the grid lines, and the accuracy of the original plotting, as well as with the personal ability of the user. Well-prepared graphs are valuable to a kiln operator and provide an excellent means of recording data.

Specific values are shown in the tabular method of presenting information, and it therefore has the advantages of accuracy and ease of reading. When such accuracy is essential and space is not a factor, data are usually recorded in tabular form.

The advantages of each form of presentation can be realized only if they are properly used. The purpose of this report, therefore, is to explain the correct procedure for the use of graphs and tables typical of those in current use in kiln drying.

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[1] By Harvey H. Smith, Technologist at the Forest Products Laboratory.

[2] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

Graphs

Graphs may show a qualitative picture of a process or a condition. They tell the whole story at a glance.

Graphs may also show the relationship between two or more variables. The simplest of this type is one in which there are only two variables, such as a graph showing the drying of lumber during the course of air seasoning (fig. 1).

A graph showing the relationship between three variables is more complicated. Instead of a single curve, there is a family of related curves, each properly labeled. Figure 2 shows the relationship between dry-bulb temperature, wet-bulb temperature, and equilibrium moisture content of wood. In using this graph, a given dry-bulb temperature is located on the horizontal x-axis, and a given wet-bulb temperature is located on the vertical y-axis. At the intersection of imaginary lines extending up from the x-axis and across from the y-axis, the corresponding value of equilibrium moisture content (EMC) will be found.

An example of the use of this graph is as follows:

For temperatures of 160° F. dry bulb and 140° F. wet bulb, what is the EMC? The intersection of a vertical line from 160° F. on the x-axis intersects a horizontal line from 140° F. on the y-axis at a point slightly below the 8 percent EMC line. The EMC is therefore estimated to be 7.9 percent.

Figure 3 is a graph showing the relationship between dry-bulb temperature, wet-bulb depression, and equilibrium moisture content. A second family of curves showing relative humidity is also included, but the interval is large, and the graph is best suited for determining values of EMC when dry-bulb and wet-bulb temperatures are known.

The use of this graph is similar to that of figure 2. For example:

For temperatures of 160° F. dry bulb and 140° F. wet bulb, what is the EMC? The wet-bulb depression is 160° - 140°, or 20° F. The vertical line from 160° F. on the x-axis intersects the curve labeled 20° wet-bulb depression at a point very slightly below the horizontal 8 percent EMC line extending from the vertical y-axis. The EMC is therefore estimated to be 7.9 percent.

The "humidity diagram" in figure 4 is a composite graph showing the relationship of several values, including:

1. Temperature, in °F.
2. Wet-bulb depression, in °F.
3. Relative humidity, in percent.
4. Absolute humidity, in grains per cubic foot.

The use of the humidity diagram can best be understood by simple examples that will show the various applications of this graph, as follows:

1. To find the relative humidity, when the dry-bulb and wet-bulb temperatures are given.

Find the dry-bulb temperatures along the x-axis. Follow up the vertical line from this point until it intersects the wet-bulb depression curve. The horizontal line passing through this intersection will give the corresponding relative-humidity value. This value is read from the relative-humidity scale, the y-axis at either side of the graph.

Assumed conditions	(Dry-bulb temperatures	160° F.
	(Wet-bulb temperatures	141° F.
	(Wet-bulb depression	19° F.
Answer	Relative humidity	60 percent

2. To find the absolute humidity, or the weight of water in grains per cubic foot of dry air, when the dry-bulb and wet-bulb temperatures are given.

Find the relative humidity as in example No. 1. The concave curves will indicate the weight of water in grains per cubic foot when the air is cooled to the dew point (100 percent relative humidity). Using the same quantities as in example No. 1, this will be approximately 57 grains.

3. To find the amount (in grains per cubic foot at dew point) of water required to saturate air at a given temperature.

Find on the top line (100 percent relative humidity) the given temperature. The concave curves intersecting the 100 percent relative humidity line indicate the number of grains per cubic foot. Estimating, or interpolating, may be necessary for greater accuracy.

Again using the temperature given in example No. 1 (160° F.), this will be approximately 91 grains.

4. To find the dew point, or temperature at 100 percent relative humidity.

Find the relative humidity as in example No. 1. Follow up from this point parallel to the nearest concave absolute-humidity lines to the top horizontal line (100 percent relative humidity). The temperature on the horizontal line at this intersection will be the dew point temperature.

Continuing example No. 1, the dew point will be approximately 139.5° F.

5. To find the change in the relative humidity produced by a change of temperature, with no change of absolute humidity.

Continuing example No. 1, what will the relative humidity be if the temperature is reduced 10° F.? Follow up parallel to the nearest concave absolute humidity lines to the intersection of the 150° F. temperature line. The intersection is on the 77 percent relative-humidity line, which is the desired value.

6. To find the amount of condensation produced by lowering the temperature.

Continuing example No. 1, how much water would be condensed if the temperature were lowered to 130° F.? The dew point, as determined in example No. 4 is 139.5° F. The air contains 57.0 grains per cubic foot of air (example No. 2). By reducing the temperature to 130° F. the moisture carrying capacity of the air is reduced and the weight of water per cubic foot of air at saturation is only 44.5 grains (the absolute moisture content of air at 100 percent relative humidity and 130° F.). The amount of condensation is 57.0 less 44.5 or 12.5 grains per cubic foot.

7. To find the amount of water required to produce saturation.

Use again the figures in example No. 1. Air at 160° F. and relative humidity of 60 percent contains 57 grains of water per cubic foot (example No. 2). Air at 160° F. and saturation contains 91 grains of moisture (example No. 3); therefore, the amount of water required to produce saturation will be 91 less 57, or 34 grains per cubic foot.

Tables

Tables may be grouped in three general classes: qualitative, statistical, and functional. Tables of the functional class are the most important.

In general, the procedures used in the preparation of graphs are applicable to the preparation of tables. A working knowledge of tables is of value in the operation of lumber dry kilns.

Table 1 shows the dry-bulb temperature values in the two outside vertical columns and the wet-bulb depression values in the column headings. Values of relative humidity and equilibrium moisture content for each condition of dry-bulb temperature and wet-bulb depression can be located in the column headed by the given wet-bulb depression in the square opposite the given horizontal dry-bulb temperature. Use of this table is so relatively easy that every kiln operator can learn its use with very little practice. For example:

At a dry-bulb temperature of 160° F. and wet-bulb temperature of 145° F., what are the relative humidity and the equilibrium moisture content? The wet-bulb depression is 15° F. (160° - 145° = 15° F. wet-bulb depression). In the vertical column for 15° F. wet-bulb depression opposite the dry-bulb temperature of 160° F. are given two values: the first, above the diagonal line, is 67, which, according to the footnote, is relative humidity in percent; and the second, below the diagonal line, is 9.4, which is the equilibrium moisture content value in percent.

Table 1. --Relative humidity[1] and equilibrium moisture content[2] table for use with dry-bulb temperatures and wet-bulb depressions

Temperature dry bulb (° F.)	Wet bulb—depression (° F.)																																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	32	34	36	38	40	45	50
30	89	78	67	57	46	36	27	17	6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*15.9*	*12.9*	*10.8*	*9.0*	*7.4*	*5.7*	*3.9*	*1.6*	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
35	90	81	72	63	54	45	37	28	19	11	3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*16.8*	*13.9*	*11.9*	*10.3*	*8.8*	*7.4*	*6.0*	*4.5*	*2.9*	*0.8*	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
40	92	83	75	68	60	52	45	37	29	22	15	8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*17.6*	*14.8*	*12.9*	*11.2*	*9.9*	*8.6*	*7.4*	*6.2*	*5.0*	*3.5*	*1.9*	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
45	93	85	78	72	64	58	51	44	37	31	25	19	12	6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*18.3*	*15.6*	*13.7*	*12.0*	*10.7*	*9.5*	*8.5*	*7.5*	*6.5*	*5.3*	*4.2*	*2.9*	*1.5*	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
50	93	86	80	74	68	62	56	50	44	38	32	27	21	16	10	5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*19.0*	*16.3*	*14.4*	*12.7*	*11.5*	*10.3*	*9.4*	*8.5*	*7.6*	*6.7*	*5.7*	*4.8*	*3.9*	*2.8*	*1.5*	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
55	94	88	82	76	70	65	60	54	49	44	39	34	28	24	19	14	9	5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*19.5*	*16.9*	*15.1*	*13.4*	*12.2*	*11.0*	*10.1*	*9.3*	*8.4*	*7.6*	*6.8*	*6.0*	*5.3*	*4.5*	*3.6*	*2.5*	*1.3*	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
60	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	9	5	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*19.9*	*17.4*	*15.6*	*13.9*	*12.7*	*11.6*	*10.7*	*9.9*	*9.1*	*8.3*	*7.6*	*6.9*	*6.3*	*5.6*	*4.9*	*4.1*	*3.2*	*2.3*	*1.3*	*0.2*	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
65	95	90	84	80	75	70	66	61	56	52	48	44	39	36	32	27	24	20	16	13	8	6	2	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	----	*20.3*	*17.8*	*16.1*	*14.4*	*13.3*	*12.1*	*11.2*	*10.4*	*9.7*	*8.9*	*8.3*	*7.7*	*7.1*	*6.5*	*5.8*	*5.2*	*4.5*	*3.8*	*3.0*	*2.3*	*1.4*	*0.4*	----	----	----	----	----	----	----	----	----	----	----	----	----	----
70	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	15	12	9	6	3	----	----	----	----	----	----	----	----	----	----	----	----
	----	*20.6*	*18.2*	*16.5*	*14.9*	*13.7*	*12.5*	*11.6*	*10.9*	*10.1*	*9.4*	*8.8*	*8.3*	*7.7*	*7.2*	*6.6*	*6.0*	*5.5*	*4.9*	*4.3*	*3.7*	*2.9*	*2.3*	*1.5*	*0.7*	----	----	----	----	----	----	----	----	----	----	----	----
75	95	91	86	82	78	74	70	66	62	58	54	51	47	44	41	37	34	31	28	24	21	18	15	12	10	7	4	1	----	----	----	----	----	----	----	----	----
	----	*20.9*	*18.5*	*16.8*	*15.2*	*14.0*	*12.9*	*12.0*	*11.2*	*10.5*	*9.8*	*9.3*	*8.7*	*8.2*	*7.7*	*7.2*	*6.7*	*6.2*	*5.6*	*5.1*	*4.7*	*4.1*	*3.5*	*2.9*	*2.3*	*1.7*	*0.9*	*0.2*	----	----	----	----	----	----	----	----	----
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	20	18	15	12	10	7	5	3	----	----	----	----	----	----	----
	----	*21.0*	*18.7*	*17.0*	*15.5*	*14.3*	*13.2*	*12.3*	*11.5*	*10.9*	*10.1*	*9.7*	*9.1*	*8.6*	*8.1*	*7.7*	*7.2*	*6.8*	*6.3*	*5.8*	*5.4*	*5.0*	*4.5*	*4.0*	*3.5*	*3.0*	*2.4*	*1.8*	*1.1*	*0.3*	----	----	----	----	----	----	----
85	96	92	88	84	80	76	73	70	66	63	59	56	53	50	47	44	41	38	36	33	30	28	25	23	20	18	15	13	11	9	4	----	----	----	----	----	----
	----	*21.2*	*18.8*	*17.2*	*15.7*	*14.5*	*13.5*	*12.5*	*11.8*	*11.2*	*10.5*	*10.0*	*9.5*	*9.0*	*8.5*	*8.1*	*7.6*	*7.2*	*6.7*	*6.3*	*6.0*	*5.6*	*5.2*	*4.8*	*4.3*	*3.9*	*3.4*	*3.0*	*2.4*	*1.7*	*0.9*	----	----	----	----	----	----
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	29	26	24	22	19	17	15	13	9	5	1	----	----	----	----
	----	*21.3*	*18.9*	*17.3*	*15.9*	*14.7*	*13.7*	*12.8*	*12.0*	*11.4*	*10.7*	*10.2*	*9.7*	*9.3*	*8.8*	*8.4*	*8.0*	*7.6*	*7.2*	*6.8*	*6.5*	*6.1*	*5.7*	*5.3*	*4.9*	*4.6*	*4.2*	*3.8*	*3.5*	*2.8*	*2.1*	*1.5*	*0.4*	----	----	----	----
95	96	92	89	85	82	79	75	72	69	66	63	60	57	55	52	49	46	44	42	39	37	34	32	30	28	26	23	22	20	17	14	10	6	2	----	----	----
	----	*21.3*	*19.0*	*17.4*	*16.1*	*14.9*	*13.9*	*12.9*	*12.2*	*11.6*	*11.0*	*10.5*	*10.0*	*9.5*	*9.1*	*8.7*	*8.2*	*7.9*	*7.5*	*7.1*	*6.8*	*6.4*	*6.1*	*5.7*	*5.3*	*5.1*	*4.8*	*4.4*	*4.0*	*3.6*	*3.0*	*2.3*	*1.5*	*0.6*	----	----	----
100	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	39	37	35	33	30	28	26	24	22	21	17	13	10	7	4	----	----
	----	*21.3*	*19.0*	*17.5*	*16.1*	*15.0*	*13.9*	*13.1*	*12.4*	*11.8*	*11.2*	*10.6*	*10.1*	*9.6*	*9.2*	*8.9*	*8.5*	*8.1*	*7.8*	*7.4*	*7.0*	*6.7*	*6.4*	*6.1*	*5.7*	*5.4*	*5.2*	*4.9*	*4.6*	*4.2*	*3.6*	*3.1*	*2.4*	*1.6*	*0.7*	----	----
105	96	93	90	87	83	80	77	74	71	69	66	63	60	58	55	53	50	48	46	44	42	40	37	35	34	31	29	28	26	24	20	17	14	11	8	----	----
	----	*21.4*	*19.0*	*17.5*	*16.2*	*15.1*	*14.0*	*13.2*	*12.6*	*11.9*	*11.3*	*10.8*	*10.3*	*9.8*	*9.4*	*9.0*	*8.7*	*8.3*	*7.9*	*7.6*	*7.3*	*6.9*	*6.7*	*6.4*	*6.1*	*5.7*	*5.4*	*5.2*	*4.8*	*4.6*	*4.2*	*3.6*	*3.1*	*2.4*	*1.8*	----	----
110	97	93	90	87	84	81	78	75	73	70	67	65	62	60	57	55	52	50	48	46	44	42	40	38	36	34	32	30	28	26	23	20	17	14	11	4	----
	----	*21.4*	*19.0*	*17.5*	*16.2*	*15.1*	*14.1*	*13.3*	*12.6*	*12.0*	*11.4*	*10.8*	*10.4*	*9.9*	*9.5*	*9.2*	*8.8*	*8.4*	*8.1*	*7.7*	*7.5*	*7.2*	*6.8*	*6.6*	*6.3*	*6.0*	*5.7*	*5.4*	*5.2*	*4.8*	*4.5*	*4.0*	*3.5*	*3.0*	*2.5*	*1.1*	----
115	97	93	90	88	85	82	79	76	74	71	68	66	63	61	58	56	54	52	50	48	45	43	41	40	38	36	34	32	31	29	26	23	20	17	14	8	2
	----	*21.4*	*19.0*	*17.5*	*16.2*	*15.1*	*14.1*	*13.4*	*12.7*	*12.1*	*11.5*	*10.9*	*10.4*	*10.0*	*9.6*	*9.3*	*8.9*	*8.6*	*8.2*	*7.8*	*7.6*	*7.3*	*7.0*	*6.7*	*6.5*	*6.2*	*5.9*	*5.6*	*5.4*	*5.2*	*4.7*	*4.3*	*3.9*	*3.4*	*2.9*	*1.7*	*0.4*
120	97	94	91	88	85	82	80	77	74	72	69	67	65	62	60	58	55	53	51	49	47	45	43	41	40	38	36	34	33	31	28	25	22	19	17	10	5
	----	*21.3*	*19.0*	*17.4*	*16.2*	*15.1*	*14.1*	*13.4*	*12.7*	*12.1*	*11.5*	*11.0*	*10.5*	*10.0*	*9.7*	*9.4*	*9.0*	*8.7*	*8.3*	*7.9*	*7.7*	*7.4*	*7.2*	*6.8*	*6.6*	*6.3*	*6.1*	*5.8*	*5.6*	*5.4*	*5.0*	*4.6*	*4.2*	*3.7*	*3.3*	*2.3*	*1.1*
125	97	94	91	88	86	83	80	77	75	73	70	68	65	63	61	59	57	55	53	51	48	47	45	43	41	39	38	36	35	33	30	27	24	22	19	13	8
	----	*21.2*	*18.9*	*17.3*	*16.1*	*15.0*	*14.0*	*13.4*	*12.7*	*12.1*	*11.5*	*11.0*	*10.5*	*10.0*	*9.7*	*9.4*	*9.0*	*8.7*	*8.3*	*8.0*	*7.7*	*7.5*	*7.2*	*7.0*	*6.7*	*6.5*	*6.2*	*6.0*	*5.8*	*5.5*	*5.2*	*4.8*	*4.4*	*4.0*	*3.6*	*2.7*	*1.6*
130	97	94	91	89	86	83	81	78	76	73	71	69	67	64	62	60	58	56	54	52	50	48	47	45	43	41	40	38	37	35	32	29	26	24	21	15	10
	----	*21.0*	*18.8*	*17.2*	*16.0*	*14.9*	*14.0*	*13.4*	*12.7*	*12.1*	*11.5*	*11.0*	*10.5*	*10.0*	*9.7*	*9.4*	*9.0*	*8.7*	*8.3*	*8.0*	*7.8*	*7.6*	*7.3*	*7.0*	*6.8*	*6.6*	*6.4*	*6.1*	*5.9*	*5.6*	*5.3*	*4.9*	*4.6*	*4.2*	*3.8*	*3.0*	*2.0*
140	97	95	92	89	87	84	82	79	77	75	73	70	68	66	64	62	60	58	56	54	53	51	49	47	46	44	43	41	40	38	35	32	30	27	25	19	14
	----	*20.7*	*18.6*	*16.9*	*15.8*	*14.8*	*13.8*	*13.2*	*12.5*	*11.9*	*11.4*	*10.9*	*10.4*	*10.0*	*9.6*	*9.4*	*9.0*	*8.7*	*8.4*	*8.0*	*7.8*	*7.6*	*7.3*	*7.1*	*6.9*	*6.6*	*6.4*	*6.2*	*6.0*	*5.8*	*5.4*	*5.1*	*4.8*	*4.4*	*4.1*	*3.4*	*2.6*
150	98	95	92	90	87	85	82	80	78	76	74	72	70	68	66	64	62	60	58	57	55	53	51	49	48	46	45	43	42	41	38	36	33	30	28	23	18
	----	*20.2*	*18.4*	*16.6*	*15.4*	*14.5*	*13.7*	*13.0*	*12.4*	*11.8*	*11.2*	*10.8*	*10.3*	*9.9*	*9.5*	*9.2*	*8.9*	*8.6*	*8.3*	*8.0*	*7.8*	*7.5*	*7.3*	*7.1*	*6.9*	*6.7*	*6.4*	*6.2*	*6.0*	*5.8*	*5.4*	*5.2*	*4.9*	*4.5*	*4.2*	*3.6*	*2.5*
160	98	95	93	90	88	86	83	81	79	77	75	73	71	69	67	65	64	62	60	58	57	55	53	52	50	49	47	46	44	43	41	38	35	33	31	25	21
	----	*19.8*	*18.1*	*16.2*	*15.2*	*14.2*	*13.4*	*12.7*	*12.1*	*11.5*	*11.0*	*10.6*	*10.1*	*9.7*	*9.4*	*9.1*	*8.8*	*8.5*	*8.2*	*7.9*	*7.7*	*7.4*	*7.2*	*7.0*	*6.8*	*6.7*	*6.4*	*6.2*	*6.0*	*5.8*	*5.5*	*5.2*	*4.9*	*4.6*	*4.3*	*3.7*	*3.2*
170	98	95	93	91	89	86	84	82	80	78	76	74	72	70	69	67	65	63	62	60	59	57	55	53	52	51	49	48	47	45	43	40	38	35	33	28	24
	----	*19.4*	*17.7*	*15.8*	*14.8*	*13.9*	*13.2*	*12.4*	*11.8*	*11.3*	*10.8*	*10.4*	*9.9*	*9.6*	*9.2*	*9.0*	*8.6*	*8.4*	*8.0*	*7.8*	*7.6*	*7.3*	*7.2*	*6.9*	*6.7*	*6.6*	*6.4*	*6.2*	*6.0*	*5.7*	*5.5*	*5.2*	*4.9*	*4.6*	*4.4*	*3.7*	*3.2*
180	98	96	94	91	89	87	85	83	81	79	77	75	73	72	70	68	67	65	63	62	60	58	57	55	54	52	51	50	48	47	45	42	40	38	35	30	26
	----	*18.9*	*17.3*	*15.5*	*14.5*	*13.7*	*12.9*	*12.2*	*11.6*	*11.1*	*10.6*	*10.1*	*9.7*	*9.4*	*9.0*	*8.8*	*8.4*	*8.1*	*7.8*	*7.6*	*7.4*	*7.2*	*7.0*	*6.8*	*6.5*	*6.4*	*6.2*	*6.0*	*5.8*	*5.7*	*5.4*	*5.2*	*4.8*	*4.6*	*4.4*	*3.8*	*3.3*
190	98	96	94	92	90	88	85	84	82	80	78	76	75	73	71	69	68	66	65	63	62	60	58	57	56	54	53	51	50	49	46	44	42	39	37	32	28
	----	*18.5*	*16.9*	*15.2*	*14.2*	*13.4*	*12.7*	*12.0*	*11.4*	*10.9*	*10.5*	*10.0*	*9.6*	*9.2*	*8.9*	*8.6*	*8.2*	*7.9*	*7.7*	*7.4*	*7.2*	*7.0*	*6.8*	*6.6*	*6.4*	*6.2*	*6.0*	*5.9*	*5.7*	*5.5*	*5.3*	*5.0*	*4.8*	*4.5*	*4.4*	*3.8*	*3.5*
200	98	96	94	92	90	88	86	84	82	80	79	77	75	74	72	70	69	67	66	64	63	61	60	58	57	55	54	53	52	51	48	46	43	41	39	34	30
	----	*18.1*	*16.4*	*14.9*	*14.0*	*13.2*	*12.4*	*11.8*	*11.2*	*10.8*	*10.3*	*9.8*	*9.4*	*9.1*	*8.8*	*8.4*	*8.1*	*7.7*	*7.5*	*7.2*	*7.0*	*6.9*	*6.6*	*6.4*	*6.2*	*6.0*	*5.9*	*5.7*	*5.6*	*5.4*	*5.2*	*4.9*	*4.7*	*4.5*	*4.3*	*3.8*	*3.3*
210	98	96	94	92	90	88	86	85	83	81	79	78	76	75	73	71	70	68	67	65	64	63	61	60	59	57	56	54	53	52	50	47	45	43	41	36	32
	----	*17.7*	*16.0*	*14.6*	*13.8*	*13.0*	*12.2*	*11.7*	*11.1*	*10.6*	*10.0*	*9.7*	*9.2*	*9.0*	*8.7*	*8.3*	*8.0*	*7.6*	*7.4*	*7.1*	*6.9*	*6.8*	*6.5*	*6.3*	*6.1*	*5.9*	*5.8*	*5.5*	*5.4*	*5.3*	*5.1*	*4.8*	*4.6*	*4.4*	*4.2*	*3.7*	*3.2*

[1] Relative hu midity values in roman type.
[2] Equilibrium moisture content values in italic type.

Z M 90607 F

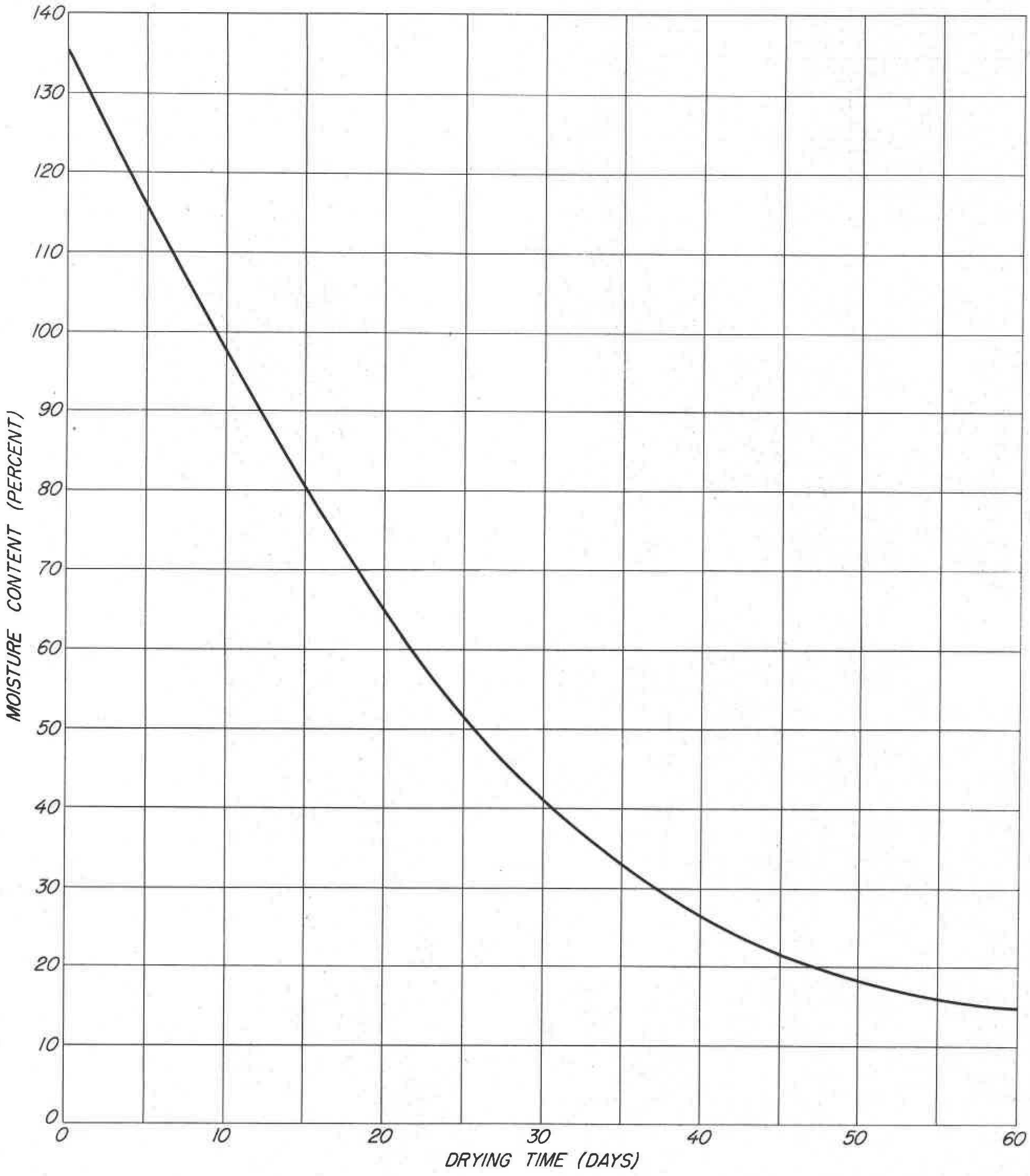

Figure 1.--Air seasoning of 6/4 aspen lumber during favorable drying conditions in northern Minnesota.

Z M 74580 F

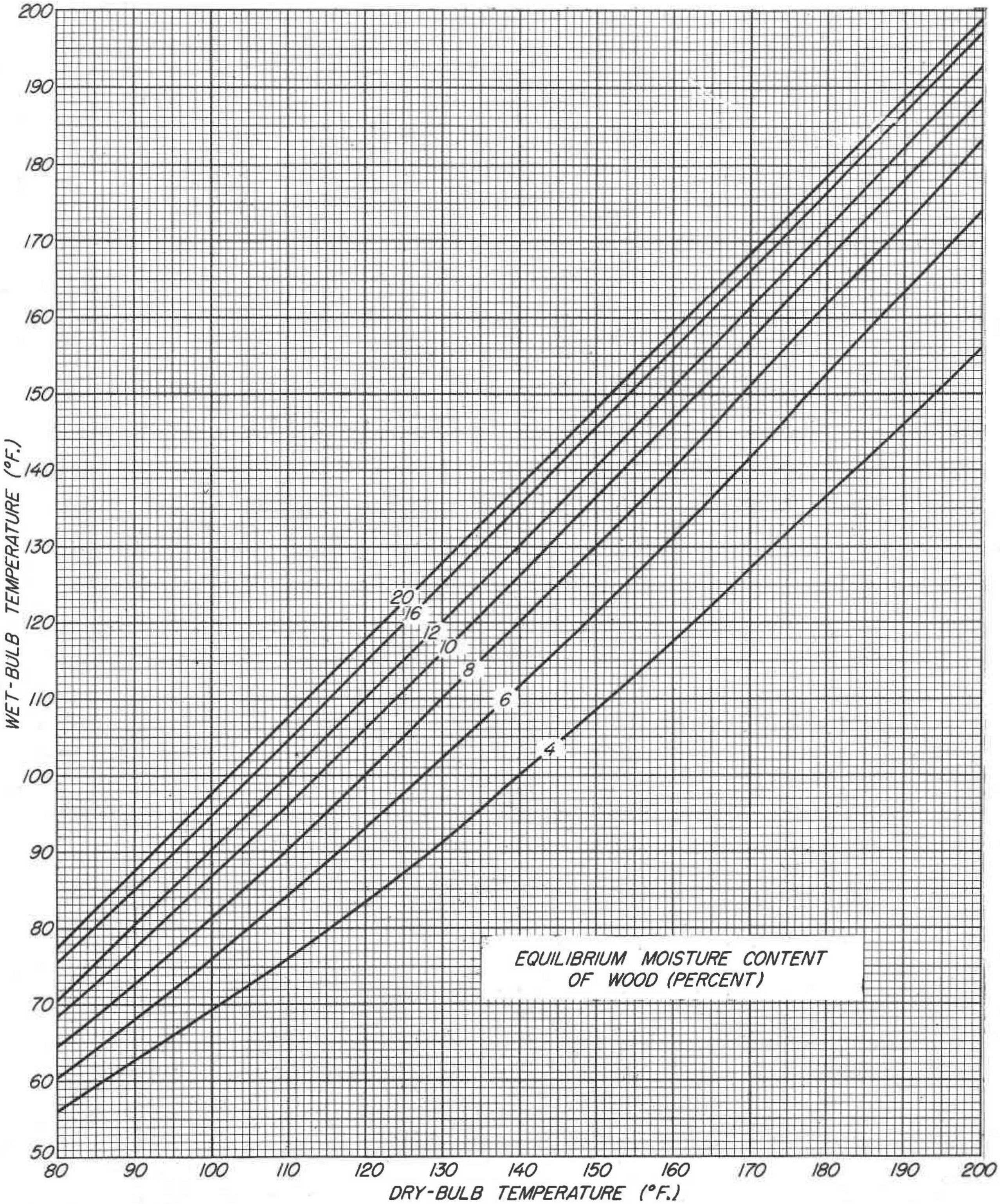

Figure 2.--Lines of constant equilibrium moisture content.

Z M 74581 F

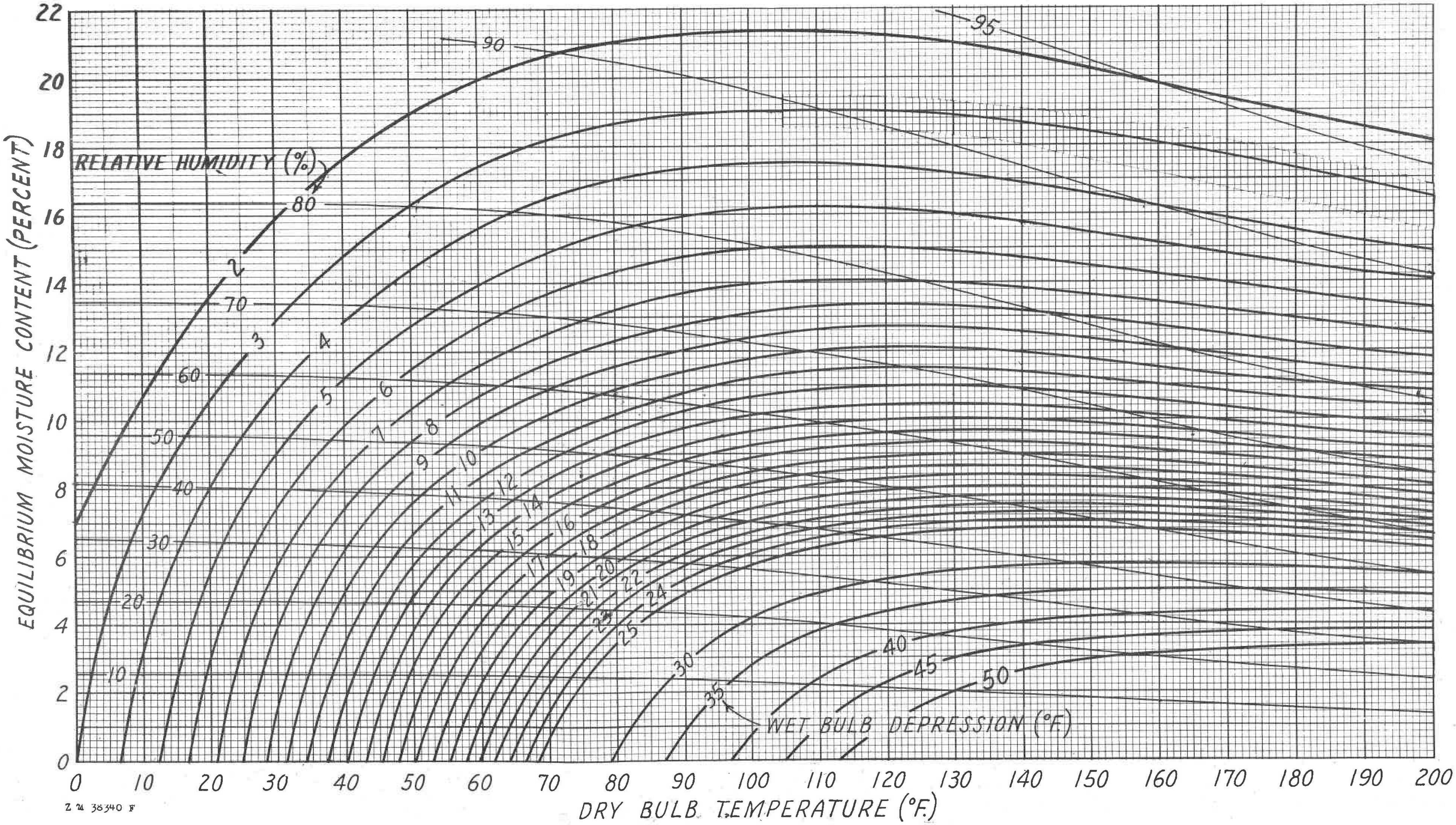

Figure 3.--Equilibrium moisture content of wood as a function of dry-bulb temperature, wet-bulb depression, and relative humidity.

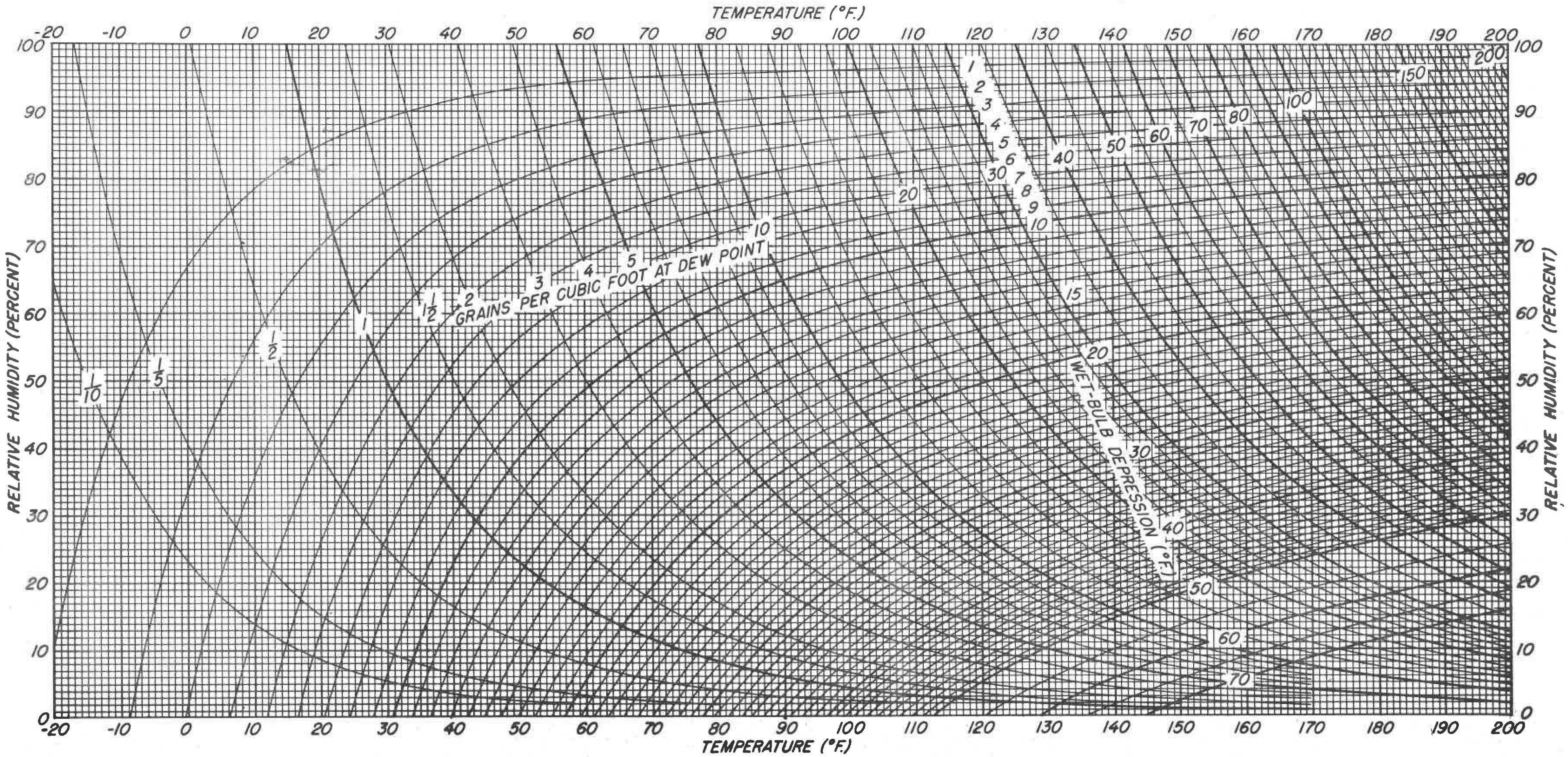

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Figure 4.--Humidity diagram, consisting of two distinct sets of curves: one showing values of wet-bulb depression, the other showing values of absolute humidity.