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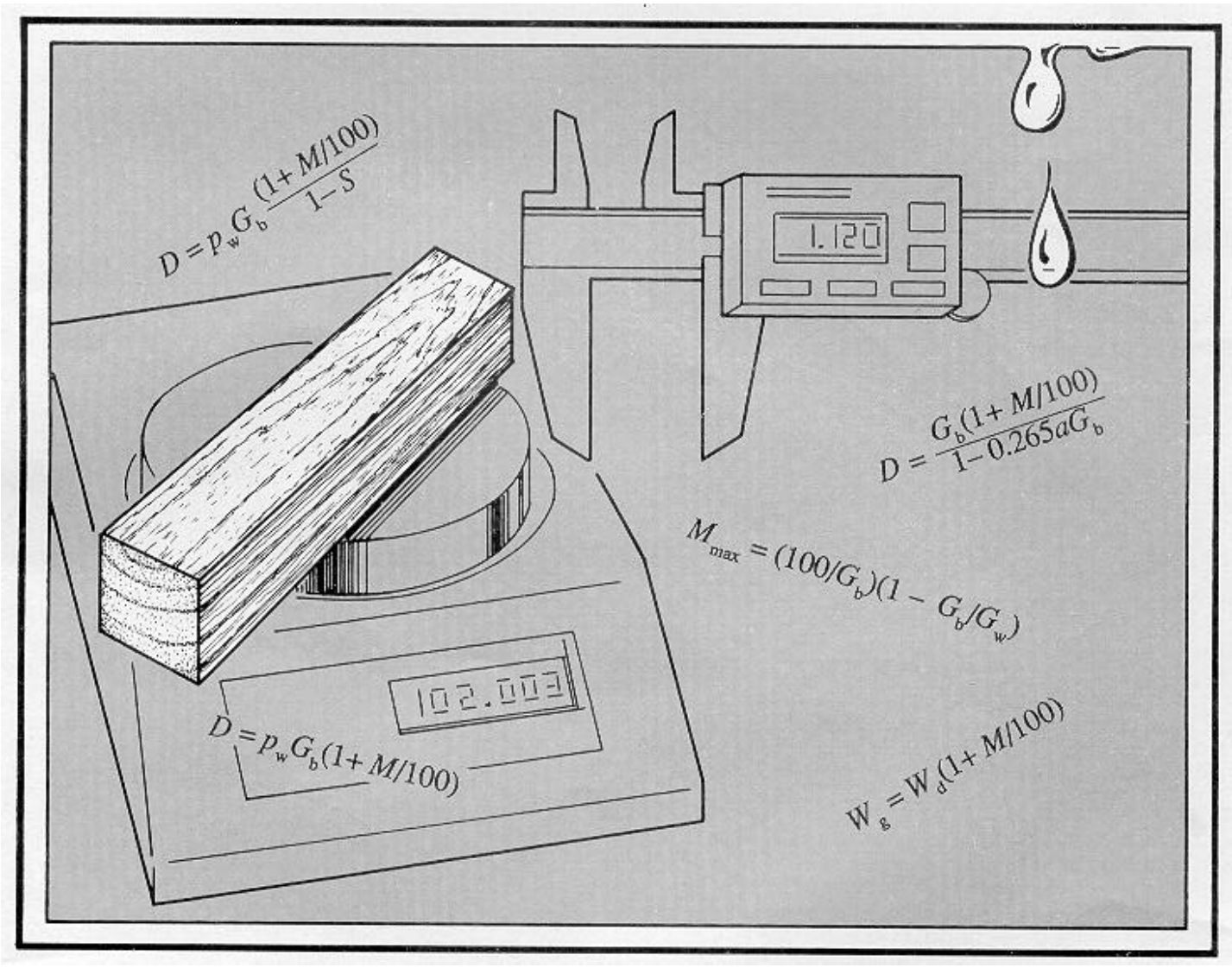
FPL-GTR-76

# Specific Gravity, Moisture Content, and Density Relationship for Wood

William T. Simpson



## Abstract

This report reviews the basis for determining values for the density of wood as it depends on moisture content and specific gravity. The data are presented in several ways to meet the needs of a variety of users.



Keywords: Specific gravity, density, wood weight

**July 1993**

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## Errata

**Page 1, column 2, Equation (2)**

$$D = (W_d/V_g)\,(1 + M/100) \qquad (2)$$

The term $W_d/V_g$ is related to basic specific gravity $G_b$ by

**Pages 9-12, Tables 5-8. Note on tables should read**

Exceeds maximum possible moisture content

**Page 13, Appendix, Equation (la)**

$$G_b = (W_d/V_g)p_w \qquad (1a)$$

where $W_d$ is oven-dry weight of wood, $V_{gg}$ is volume of green wood, and $p_w$ is density of water.

**Page 13, Appendix, Equation (4*a*)**

$$S = (V_g - V_M)/V_g$$

or

$$V_M = V_g\,(1 - S) \qquad (4a)$$

# Specific Gravity, Moisture Content, and Density Relationship for Wood

**William T. Simpson, Research Forest Products Technologist**
**Forest Products Laboratory, Madison, Wisconsin**

## Introduction

Knowledge about the density of wood is useful for estimating shipping weights. The density of wood depends on specific gravity and moisture content. A common way to present density data is in tabular and graphical form, where density in pounds per cubic foot or kilograms per cubic meter is shown for a series of specific gravity and moisture content values. This kind of system is shown in the *Wood Handbook* (FPL 1987). However, the system has several shortcomings.

One shortcoming is that density values in the *Wood Handbook* are shown for moisture contents above the maximum possible for those specific gravity values (Tables 1 and 2). Another shortcoming is that this system requires two steps: first, a graphical conversion of specific gravity from one volume base to another, and then a reading from a table. Furthermore, no equations are offered for direct calculation of density as a function of moisture content and specific gravity, which precludes easy use of the system in computer programs or spreadsheet calculations. Finally, the system is subject to misinterpretation and thus can yield erroneous density values if the user is not aware of the various definitions of specific gravity as it applies to wood.

This report discusses these shortcomings and develops equations, graphs, and tables for determining density as a function of moisture content and several common definitions of specific gravity.

## System for Determining Wood Density

The common definition of wood moisture content on a dry basis can be written as

$$W_g = W_d(1 + M/100) \quad (1)$$

where $W_g$ is the green weight of wood (pounds or kilograms) at moisture content $M$ (percent), and $W_d$ is the oven-dry weight of wood.

Dividing both sides of Equation (1) by the volume of wood at moisture content $M(V_g)$, the density $D$ is

$$D = (W_d/a_g)(1 + M/100) \quad (2)$$

The term $W_d V_g$ is related to basic specific gravity $G_b$ by

$$W_d/V_g = p_w G_b \quad (3)$$

where $p_w$ is the density of water (62.4 lb/ft$^3$ or 1,000 kg/m$^3$) based on volume when above 30 percent moisture content. Substituting Equation (3) into Equation (2) results in the following equation for calculating density:

$$D = p_w G_b(1 + M/100) \quad (4)$$

A possible misapplication of Equation (4) is to use it at <30 percent moisture content with no correction in specific gravity for volumetric shrinkage. It is also possible to overlook or misunderstand the definition of specific gravity in the ***Wood Handbook,*** which could cause a user to read incorrect density values from the tables. Specific gravity is defined on the basis of volume at the tabulated moisture content- not on the more common basis of green volume, as is used to define basic specific gravity. Misunderstandings can cause errors 115 percent, as will be illustrated in another section of this report.

The ***Wood Handbook*** describes a graphical way to convert basic specific gravity to specific gravity based

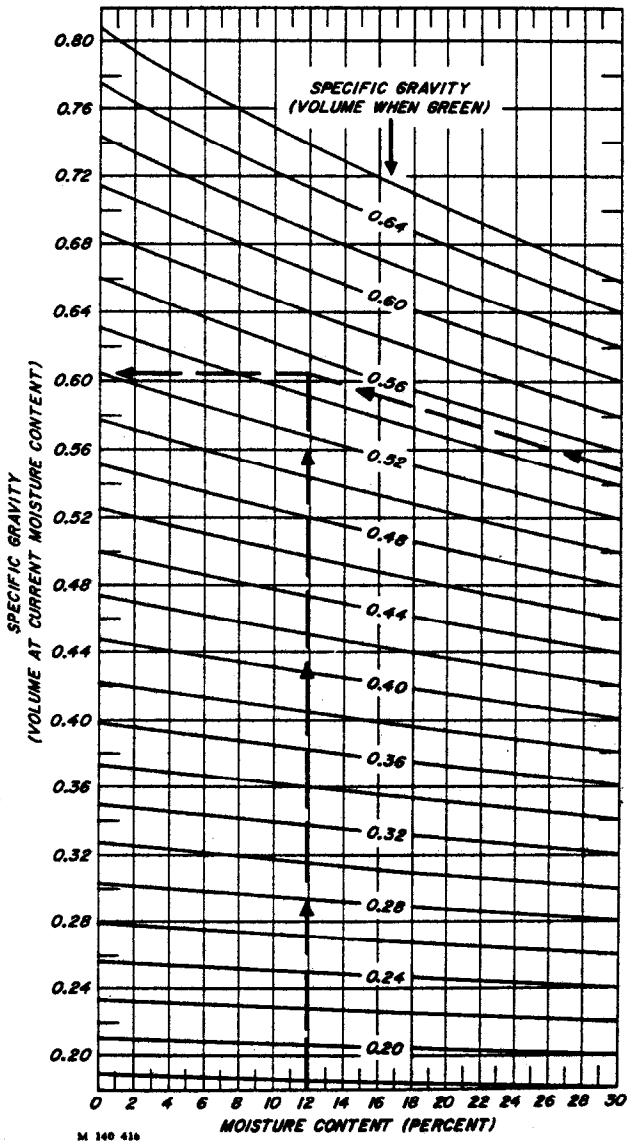


***Figure 1—Relation of specific gravity to moisture content. Follow line for specific gravity (volume when green) to desired moisture content, then read specific gravity (volume at current moisture content) from vertical axis. Source: Wood Handbook, Figures 3 and 4 (FPL 1987).***

on volume at any of the tabulated moisture contents (Fig. 1). Density values can then be read from the tables after the conversion. Although this system of determining density values is valid, it requires two steps and the use of both a graph and a table. The same density information can be presented in one table or one graph.

The maximum moisture content of wood is reached when the cell walls and cell lumens are completely filled with water. When specific gravity is high, lumen volume is low and maximum moisture content is

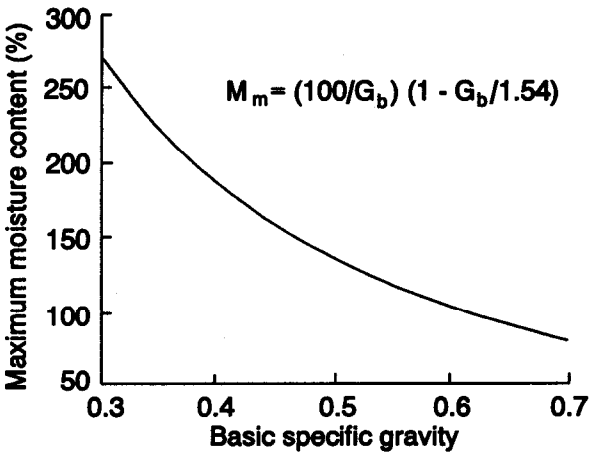


***Figure 2—Theoretical maximum possible moisture content of wood ($M_{max}$) as a function of basic specific gravity ($G_b$).***

therefore restricted. This relationship can be estimated by

$$M_{max} = (100/G_b)(1 - G_b/G_w) \quad (5)$$

where $M_{max}$ is maximum moisture content and $G_w$ is the specific gravity of wood substance, equal to approximately 1.54 (Skaar 1988). Equation (5) is shown in Figure 2.

Therefore, some density values at high specific gravity and moisture content values in Table 1 are not possible because the tabulated moisture content exceeds the maximum possible moisture content. These conditions will be discussed later in this report.

# Density Tables

## Basic Specific Gravity

Equation (4) can be used to change the basis of tabulated density values below 30 percent moisture content from specific gravity baaed on volume at tabulated moisture content to basic specific gravity if volume is corrected for shrinkage. Assuming a linear relationship between shrinkage and moisture content from 30 to 0 percent (Stamm 1964), the volumetric shrinkage $S$ at any moisture content is

$$S = aS_t \quad (6)$$

where $a$ is (30 - M)/30 and $S_t$ is total volumetric shrinkage from 30 to 0 percent moisture content.

Introducing Equation (6) into Equation (4) to account for shrinkage

$$D = p_w G_b \frac{(1 + M/100)}{1 - S} \quad (7)$$

Volumetric shrinkage data are necessary for using Equation (7). Each species has its own $S_t$ value, and ideally there would be a density table for each species. However, this would be somewhat cumbersome and may not be necessary, given the inherent variability of wood and the known relationship between volumetric shrinkage and basic specific gravity. Stamm (1964) summarized the background on this relationship. The result is that volumetric shrinkage of both hardwoods and softwoods can be reasonably approximated by

$$S_t = 0.265 G_b \quad (8)$$

Therefore, even if a density table is not constructed for each species, Equation (8) accounts for the major source of variation in shrinkage between species.

Combining Equations (6) to (8) results in

$$D = \frac{G_b(1 + M/100)}{1 - 0.265 a G_b} \quad (9)$$

The results of Equation (9) are listed in Table 3 and shown in Figure 3. Table 3 also shows maximum moisture content and density values. (The data in Table 3 are expressed in SI units in Table 4.)

The following example illustrates how using the incorrect specific gravity results in an incorrect density value. Suppose the user wants to know the density of wood when specific gravity is 0.56 and moisture content is 8 percent. If the volume basis for this given specific gravity is not clear, or if the user is not aware of the importance of the volume basis, the user might go directly to the tabular data (Table 1) and read a density of 37.7 lb/ft$^3$ (605 kg/m$^3$). If the given specific gravity of 0.56 is the basic specific gravity, the correct density is 42.3 lb/ft$^3$ (679 kg/m$^3$) (Table 3) and the incorrect value is in error by 11 percent. Although this may seem an unlikely error for specialists in wood technology, it does not seem unlikely for someone who does not realize the necessity of knowing the exact definition of specific gravity for specific tables or handbooks. These definitions, if present, are often cited in footnotes that can be overlooked or ignored.

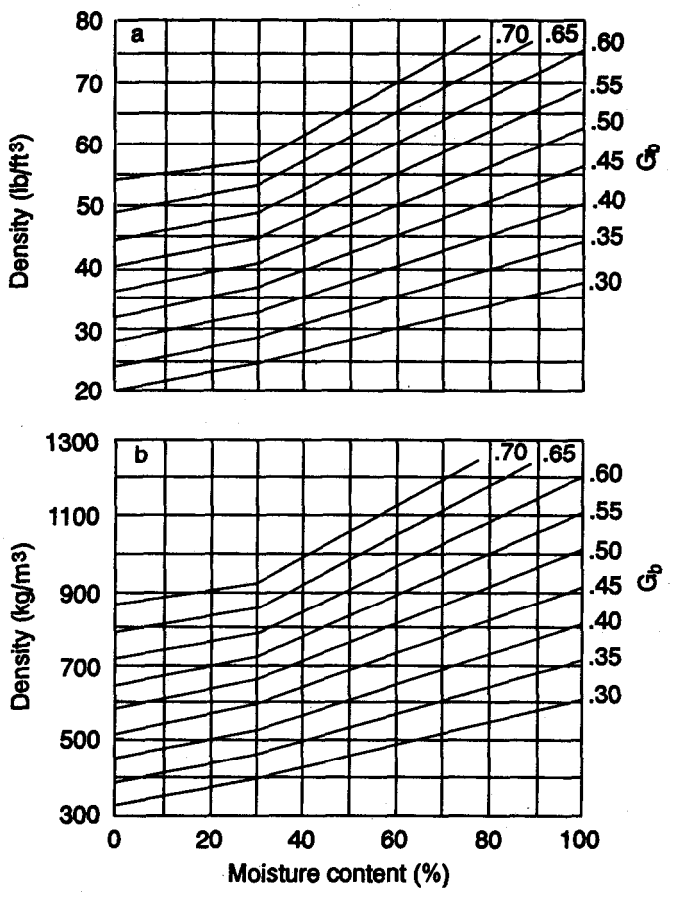


***Figure 3—Density of wood as a function of moisture content and basic specific gravity ($G_b$); (a) English units, (b) SI units.***

## Other Specific Gravity Values

Some references list specific gravity values on a basis other than green volume; in those cases, Table 3 is of no use in determining density values. Oven-dry volume (Hildebrand 1970) and volume at 12 percent moisture content (Chichignoud and others 1990) are common alternative bases. Equation (9) can be generalized for specific gravity baaed on volume at any moisture content if we develop the relationship between basic specific gravity and specific gravity based on the other volumes (Appendix). The result of this relationship is

$$G_b = \frac{G_M}{1 + 0.265 a G_M} \quad (10)$$

where $G_M$ is specific gravity based on volume at moisture content $M$. Equation (10) is substituted into Equation (9) for moisture contents <30 percent and into Equations (3) and (4) for moisture contents ≥30 percent.

Table 5 is a density table for specific gravity based on volume at 12 percent moisture content ($G_M = G_{12}$)

(see Table 6 for SI units). Table 7 shows specific gravity values based on oven-dry volume ($G_M = G_O$) (see Table 8 for SI values).

## Concluding Remarks

The validity and efficiency of a method for determining the density of wood at various combinations of specific gravity and moisture content depend on an understanding of the definition of specific gravity. Because specific gravity depends on wood volume, shrinkage must be accounted for when determining specific gravity below the fiber saturation point. The equations and tables described in this report can be used to determine density at any moisture content and specific gravity.

## References

**Chichiguoud, M.; Deon, G.; Detienne, P.; Parant, B.; and Vantomme, P.** 1990. Tropical timber atlas of Latin America. Yokohama, Japan: International Tropical Timber Organization, and Nogent-Sur-Marne Cedex, France: Centre Technique Forestier Tropical.

**Forest Products Laboratory.** 1987. Wood handbook: Wood as an engineering material. Agric. Handb. 72. (Rev.) Washington, DC: U.S. Department of Agriculture. 466 p.

**Hildebrand, R.** 1970. Kiln drying of sawn timber. Germany: Maschinenbau GmbH. 198 p.

**Skaar, C.** 1988. Wood-water relations. New York: Springer-Verlag. 283 p.

**Stamm, A.J.** 1964. Wood and cellulose science. New York: The Ronald Press. 549 p.

**Table 1—*Wood Handbook* data for determining wood density[a]**

| $M$[b] | Density (lb/ft$^3$) at various levels of specific gravity[c] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 18.7 | 20.0 | 21.2 | 22.5 | 23.7 | 25.0 | 26.2 | 27.5 | 28.7 | 30.0 | 31.2 | 32.4 | 33.7 | 34.9 | 36.2 | 37.4 | 38.7 | 39.9 | 41.2 | 42.4 | 43.7 |
| 4 | 19.5 | 20.8 | 22.1 | 23.4 | 24.7 | 26.0 | 27.3 | 28.6 | 29.9 | 31.2 | 32.4 | 33.7 | 35.0 | 36.3 | 37.6 | 38.9 | 40.2 | 41.5 | 42.8 | 44.1 | 45.4 |
| 8 | 20.2 | 21.6 | 22.9 | 24.3 | 25.6 | 27.0 | 28.3 | 29.7 | 31.0 | 32.3 | 33.7 | 35.0 | 36.4 | 37.7 | 39.1 | 40.4 | 41.8 | 43.1 | 44.5 | 45.8 | 47.2 |
| 12 | 21.0 | 22.4 | 23.8 | 25.2 | 26.6 | 28.0 | 29.4 | 30.8 | 32.1 | 33.5 | 34.9 | 36.3 | 37.7 | 39.1 | 40.5 | 41.9 | 43.3 | 44.7 | 46.1 | 47.5 | 48.9 |
| 16 | 21.7 | 23.2 | 24.6 | 26.1 | 27.5 | 29.0 | 30.4 | 31.8 | 33.3 | 34.7 | 36.2 | 37.6 | 39.1 | 40.5 | 42.0 | 43.4 | 44.9 | 46.3 | 47.8 | 49.2 | 50.7 |
| 20 | 22.5 | 24.0 | 25.5 | 27.0 | 28.5 | 30.0 | 31.4 | 32.9 | 34.4 | 35.9 | 37.4 | 38.9 | 40.4 | 41.9 | 43.4 | 44.9 | 46.4 | 47.9 | 49.4 | 50.9 | 52.4 |
| 24 | 23.2 | 24.8 | 26.3 | 27.9 | 29.4 | 31.0 | 32.5 | 34.0 | 35.6 | 37.1 | 38.7 | 40.2 | 41.8 | 43.3 | 44.9 | 46.4 | 48.0 | 49.5 | 51.1 | 52.6 | 54.2 |
| 28 | 24.0 | 25.6 | 27.2 | 28.8 | 30.4 | 31.9 | 33.5 | 35.1 | 36.7 | 38.3 | 39.9 | 41.5 | 43.1 | 44.7 | 46.3 | 47.9 | 49.5 | 51.1 | 52.7 | 54.3 | 55.9 |
| 32 | 24.7 | 26.4 | 28.0 | 29.7 | 31.3 | 32.9 | 34.6 | 36.2 | 37.9 | 39.5 | 41.2 | 42.8 | 44.5 | 46.1 | 47.8 | 49.4 | 51.1 | 52.7 | 54.4 | 56.0 | 57.7 |
| 36 | 25.5 | 27.2 | 28.9 | 30.6 | 32.2 | 33.9 | 35.6 | 37.3 | 39.0 | 40.7 | 42.4 | 44.1 | 45.8 | 47.5 | 49.2 | 50.9 | 52.6 | 54.3 | 56.0 | 57.7 | 59.4 |
| 40 | 26.2 | 28.0 | 29.7 | 31.4 | 33.2 | 34.9 | 36.7 | 38.4 | 40.2 | 41.9 | 43.7 | 45.4 | 47.2 | 48.9 | 50.7 | 52.4 | 54.2 | 55.9 | 57.7 | 59.4 | 61.2 |
| 44 | 27.0 | 28.8 | 30.6 | 32.3 | 34.1 | 35.9 | 37.7 | 39.5 | 41.3 | 43.1 | 44.9 | 46.7 | 48.5 | 50.3 | 52.1 | 53.9 | 55.7 | 57.5 | 59.3 | 61.1 | 62.9 |
| 48 | 27.7 | 29.6 | 31.4 | 33.2 | 35.1 | 36.9 | 38.8 | 40.6 | 42.5 | 44.3 | 46.2 | 48.0 | 49.9 | 51.7 | 53.6 | 55.4 | 57.3 | 59.1 | 61.0 | 62.8 | 64.6 |
| 52 | 28.5 | 30.4 | 32.2 | 34.1 | 36.0 | 37.9 | 39.8 | 41.7 | 43.6 | 45.5 | 47.4 | 49.3 | 51.2 | 53.1 | 55.0 | 56.9 | 58.8 | 60.7 | 62.6 | 64.5 | 66.4 |
| 56 | 29.2 | 31.2 | 33.1 | 35.0 | 37.0 | 38.9 | 40.9 | 42.8 | 44.8 | 46.7 | 48.7 | 50.6 | 52.6 | 54.5 | 56.5 | 58.4 | 60.4 | 62.3 | 64.2 | 66.2 | 68.1 |
| 60 | 30.0 | 31.9 | 33.9 | 35.9 | 37.9 | 39.9 | 41.9 | 43.9 | 45.9 | 47.9 | 49.9 | 51.9 | 53.9 | 55.9 | 57.9 | 59.9 | 61.9 | 63.9 | 65.9 | 67.9 | 69.9 |
| 64 | 30.7 | 32.7 | 34.8 | 36.8 | 38.9 | 40.9 | 43.0 | 45.0 | 47.1 | 49.1 | 51.2 | 53.2 | 55.3 | 57.3 | 59.4 | 61.4 | 63.4 | 65.5 | 67.5 | 69.6 | 71.6 |
| 68 | 31.4 | 33.5 | 35.6 | 37.7 | 39.8 | 41.9 | 44.0 | 46.1 | 48.2 | 50.3 | 52.4 | 54.5 | 56.6 | 58.7 | 60.8 | 62.9 | 65.0 | 67.1 | 69.2 | 71.3 | 73.4 |
| 72 | 32.2 | 34.3 | 36.5 | 38.6 | 40.8 | 42.9 | 45.1 | 47.2 | 49.4 | 51.5 | 53.7 | 55.8 | 58.0 | 60.1 | 62.3 | 64.4 | 66.5 | 68.7 | 70.8 | 73.0 | 75.1 |
| 76 | 32.9 | 35.1 | 37.3 | 39.5 | 41.7 | 43.9 | 46.1 | 48.3 | 50.5 | 52.7 | 54.9 | 57.1 | 59.3 | 61.5 | 63.7 | 65.9 | 68.1 | 70.3 | 72.5 | 74.7 | 76.9 |
| 80 | 33.7 | 35.9 | 38.2 | 40.4 | 42.7 | 44.9 | 47.2 | 49.4 | 51.7 | 53.9 | 56.2 | 58.4 | 60.7 | 62.9 | 65.1 | 67.4 | 69.6 | 71.9 | 74.1 | 76.4 | 78.6 |
| 84 | 34.4 | 36.7 | 39.0 | 41.3 | 43.6 | 45.9 | 48.2 | 50.5 | 52.8 | 55.1 | 57.4 | 59.7 | 62.0 | 64.3 | 66.6 | 68.9 | 71.2 | 73.5 | 75.8 | 78.1 | 80.4 |
| 88 | 35.2 | 37.5 | 39.9 | 42.2 | 44.6 | 46.9 | 49.3 | 51.6 | 54.0 | 56.3 | 58.7 | 61.0 | 63.3 | 65.7 | 68.0 | 70.4 | 72.7 | 75.1 | 77.4 | 79.8 | 82.1 |
| 92 | 35.9 | 38.3 | 40.7 | 43.1 | 45.5 | 47.9 | 50.3 | 52.7 | 55.1 | 57.5 | 59.9 | 62.3 | 64.7 | 67.1 | 69.5 | 71.9 | 74.3 | 76.7 | 79.1 | 81.5 | 83.9 |
| 96 | 36.7 | 39.1 | 41.6 | 44.0 | 46.5 | 48.9 | 51.4 | 53.8 | 56.3 | 58.7 | 61.2 | 63.6 | 66.0 | 68.5 | 70.9 | 73.4 | 75.8 | 78.3 | 80.7 | 83.2 | 85.6 |
| 100 | 37.4 | 39.9 | 42.4 | 44.9 | 47.4 | 49.9 | 52.4 | 54.9 | 57.4 | 59.9 | 62.4 | 64.9 | 67.4 | 69.9 | 72.4 | 74.9 | 77.4 | 79.9 | 82.4 | 84.9 | 87.4 |
| 110 | 39.3 | 41.9 | 44.6 | 47.2 | 49.8 | 52.4 | 55.0 | 57.7 | 60.3 | 62.9 | 65.5 | 68.1 | 70.8 | 73.4 | 76.0 | 78.6 | 81.2 | 83.9 | 86.5 | 89.1 | 91.7 |
| 120 | 41.2 | 43.9 | 46.7 | 49.4 | 52.2 | 54.9 | 57.7 | 60.4 | 63.1 | 65.9 | 68.6 | 71.4 | 74.1 | 76.9 | 79.6 | 82.4 | 85.1 | 87.9 | 90.6 | 93.4 | 96.1 |
| 130 | 43.1 | 45.9 | 48.8 | 51.7 | 54.5 | 57.4 | 60.3 | 63.1 | 66.0 | 68.9 | 71.8 | 74.6 | 77.5 | 80.4 | 83.2 | 86.1 | 89.0 | 91.9 | 94.7 | 97.6 | 100.5 |
| 140 | 44.9 | 47.9 | 50.9 | 53.9 | 56.9 | 59.9 | 62.9 | 65.9 | 68.9 | 71.9 | 74.9 | 77.9 | 80.9 | 83.9 | 86.9 | 89.9 | 92.9 | 95.8 | 98.8 | 101.8 | 104.8 |
| 150 | 46.8 | 49.9 | 53.0 | 56.2 | 59.3 | 62.4 | 65.5 | 68.6 | 71.8 | 74.9 | 78.0 | 81.1 | 84.2 | 87.4 | 90.5 | 93.6 | 96.7 | 99.8 | 103.0 | 106.1 | 109.2 |

[a]Values based on mass when ovendry and volume at tabulated moisture content. From the *Wood Handbook* (FPL 1987); Tables 3 to 7.

[b]$M$ is moisture content.

[c]$D = 62.4G_b(1 + M/100)$ for all levels of moisture content.

**Table 2—*Wood Handbook* data in SI units of measurement**

| *M* | Density (kg/m$^3$) at various levels of specific gravity[a] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 300 | 320 | 340 | 360 | 380 | 400 | 420 | 440 | 460 | 480 | 500 | 520 | 540 | 560 | 580 | 600 | 620 | 640 | 660 | 680 | 700 |
| 4 | 312 | 333 | 354 | 374 | 395 | 416 | 437 | 458 | 478 | 499 | 520 | 541 | 562 | 582 | 603 | 624 | 645 | 666 | 686 | 707 | 728 |
| 8 | 324 | 346 | 367 | 389 | 410 | 432 | 454 | 475 | 497 | 518 | 540 | 562 | 583 | 605 | 626 | 648 | 670 | 691 | 713 | 734 | 756 |
| 12 | 336 | 358 | 381 | 403 | 426 | 448 | 470 | 493 | 515 | 538 | 560 | 582 | 605 | 627 | 650 | 672 | 694 | 717 | 739 | 762 | 784 |
| 16 | 348 | 371 | 394 | 418 | 441 | 464 | 487 | 510 | 534 | 557 | 580 | 603 | 626 | 650 | 673 | 696 | 719 | 742 | 766 | 789 | 812 |
| 20 | 360 | 384 | 408 | 432 | 456 | 480 | 504 | 528 | 552 | 576 | 600 | 624 | 648 | 672 | 696 | 720 | 744 | 768 | 792 | 816 | 840 |
| 24 | 372 | 397 | 422 | 446 | 471 | 496 | 521 | 546 | 570 | 595 | 620 | 645 | 670 | 694 | 719 | 744 | 769 | 794 | 818 | 843 | 868 |
| 28 | 384 | 410 | 435 | 461 | 486 | 512 | 538 | 563 | 589 | 614 | 640 | 666 | 691 | 717 | 742 | 768 | 794 | 819 | 845 | 870 | 896 |
| 32 | 396 | 422 | 449 | 475 | 502 | 528 | 554 | 581 | 607 | 634 | 660 | 686 | 713 | 739 | 766 | 792 | 818 | 845 | 871 | 898 | 924 |
| 36 | 408 | 435 | 462 | 490 | 517 | 544 | 571 | 598 | 626 | 653 | 680 | 707 | 734 | 762 | 789 | 816 | 843 | 870 | 898 | 925 | 952 |
| 40 | 420 | 448 | 476 | 504 | 532 | 560 | 588 | 616 | 644 | 672 | 700 | 728 | 756 | 784 | 812 | 840 | 868 | 896 | 924 | 952 | 980 |
| 44 | 432 | 461 | 490 | 518 | 547 | 576 | 605 | 634 | 662 | 691 | 720 | 749 | 778 | 806 | 835 | 864 | 893 | 922 | 950 | 979 | 1008 |
| 48 | 444 | 474 | 503 | 533 | 562 | 592 | 622 | 651 | 681 | 710 | 740 | 770 | 799 | 829 | 858 | 888 | 918 | 947 | 977 | 1006 | 1036 |
| 52 | 456 | 486 | 517 | 547 | 578 | 608 | 638 | 669 | 699 | 730 | 760 | 790 | 821 | 851 | 882 | 912 | 942 | 973 | 1003 | 1034 | 1064 |
| 56 | 468 | 499 | 530 | 562 | 593 | 624 | 655 | 686 | 718 | 749 | 780 | 811 | 842 | 874 | 905 | 936 | 967 | 998 | 1030 | 1061 | 1092 |
| 60 | 480 | 512 | 544 | 576 | 608 | 640 | 672 | 704 | 736 | 768 | 800 | 832 | 864 | 896 | 928 | 960 | 992 | 1024 | 1056 | 1088 | 1120 |
| 64 | 492 | 525 | 558 | 590 | 623 | 656 | 689 | 722 | 754 | 787 | 820 | 853 | 886 | 918 | 951 | 984 | 1017 | 1050 | 1082 | 1115 | 1148 |
| 68 | 504 | 538 | 571 | 605 | 638 | 672 | 706 | 739 | 773 | 806 | 840 | 874 | 907 | 941 | 974 | 1008 | 1042 | 1075 | 1109 | 1142 | 1176 |
| 72 | 516 | 550 | 585 | 619 | 854 | 688 | 722 | 757 | 791 | 826 | 860 | 894 | 929 | 963 | 998 | 1032 | 1066 | 1101 | 1135 | 1170 | 1204 |
| 76 | 528 | 563 | 598 | 634 | 669 | 704 | 739 | 774 | 810 | 845 | 8B0 | 915 | 950 | 986 | 1021 | 1056 | 1091 | 1126 | 1162 | 1197 | 1232 |
| 80 | 540 | 576 | 612 | 648 | 684 | 720 | 756 | 792 | 828 | 864 | 900 | 936 | 972 | 1008 | 1044 | 1080 | 1116 | 1152 | 1188 | 1224 | 1260 |
| 84 | 552 | 589 | 626 | 662 | 699 | 736 | 773 | 810 | 846 | 883 | 920 | 957 | 994 | 1030 | 1067 | 1104 | 1141 | 1178 | 1214 | 1251 | 1288 |
| 88 | 564 | 602 | 639 | 677 | 714 | 752 | 790 | 827 | 865 | 902 | 940 | 978 | 1015 | 1053 | 1090 | 1128 | 1166 | 1203 | 1241 | 1278 | 1316 |
| 92 | 576 | 614 | 653 | 691 | 730 | 768 | 806 | 845 | 883 | 922 | 960 | 998 | 1037 | 1075 | 1114 | 1152 | 1190 | 1229 | 1267 | 1306 | 1344 |
| 96 | 588 | 627 | 666 | 706 | 745 | 784 | 823 | 862 | 902 | 941 | 980 | 1019 | 1058 | 1098 | 1137 | 1176 | 1215 | 1254 | 1294 | 1333 | 1372 |
| 100 | 600 | 640 | 680 | 720 | 760 | 800 | 840 | 880 | 920 | 960 | l000 | 1040 | 1080 | 1120 | 1160 | 1200 | 1240 | 1280 | 1320 | 1360 | 1400 |
| 110 | 630 | 672 | 714 | 756 | 798 | 840 | 832 | 924 | 966 | 1008 | 1050 | 1092 | 1134 | 1176 | 1218 | 1260 | 1302 | 1344 | 1386 | 1428 | 1470 |
| 120 | 660 | 704 | 748 | 792 | 836 | 880 | 924 | 968 | 1012 | 1056 | 1100 | 1144 | 1188 | 1232 | 1276 | 1320 | 1364 | 1408 | 1452 | 1496 | 1540 |
| 130 | 690 | 736 | 782 | 828 | 874 | 920 | 966 | 1012 | 1058 | 1104 | 1150 | 1196 | 1242 | 1288 | 1334 | 1380 | 1426 | 1472 | 1518 | 1564 | 1610 |
| 140 | 720 | 768 | 816 | 864 | 912 | 960 | 1008 | 1056 | 1104 | 1152 | 1200 | 1248 | 1296 | 1344 | 1392 | 1440 | 1488 | 1536 | 1584 | 1632 | 1680 |
| 150 | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | 1200 | 1250 | 1300 | 1350 | 1400 | 1450 | 1500 | 1550 | 1600 | 1650 | 1700 | 1750 |

[a] $D = 1000G_b(1 + M/100)$ for all levels of moisture content.

**Table 3—Results of Equation (9) for determining wood density**

| *M* | Density (lb/ft$^3$) at various levels of specific gravity (ovendry weight/green volume)[a] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 20.3 | 21.8 | 23 3 | 24.8 | 26.4 | 27.9 | 29.5 | 31.1 | 32.7 | 34.3 | 36.0 | 37.6 | 39.3 | 41.0 | 42.8 | 44.5 | 46.3 | 48.1 | 49.9 | 51.8 | 53.6 |
| 4 | 20.9 | 22.4 | 23.9 | 25.5 | 27.0 | 28.6 | 30.2 | 31.8 | 33.4 | 35.0 | 36.7 | 38.3 | 40.0 | 41.7 | 43.4 | 45.2 | 46.9 | 48.7 | 50.5 | 52.3 | 54.1 |
| 8 | 21.5 | 23.0 | 24.5 | 26.1 | 27.7 | 29.2 | 30.8 | 32.4 | 34.0 | 35.7 | 37.3 | 39.0 | 40.7 | 42.3 | 44.1 | 45.8 | 47.5 | 49.3 | 51.0 | 52.8 | 54.6 |
| 12 | 22.0 | 23.6 | 25.1 | 26.7 | 28.3 | 29.9 | 31.5 | 33.1 | 34.7 | 36.3 | 38.0 | 39.6 | 41.3 | 43.0 | 44.7 | 46.4 | 48.1 | 49.8 | 51.5 | 53.3 | 55.0 |
| 16 | 22.6 | 24.1 | 25.7 | 27.3 | 28.9 | 30.5 | 32.1 | 33.7 | 35.3 | 36.9 | 38.6 | 40.2 | 41.9 | 43.6 | 45.2 | 46.9 | 48.6 | 50.3 | 52.0 | 53.7 | 55.5 |
| 20 | 23.1 | 24.7 | 26.2 | 27.8 | 29.4 | 31.0 | 32.7 | 34.3 | 35.9 | 37.5 | 39.2 | 40.8 | 42.5 | 44.1 | 45.8 | 47.4 | 49.1 | 50.8 | 52.5 | 54.2 | 55.9 |
| 24 | 23.6 | 25.2 | 26.8 | 28.4 | 30.0 | 31.6 | 33.2 | 34.9 | 36.5 | 38.1 | 39.7 | 41.4 | 43.0 | 44.7 | 46.3 | 48.0 | 49.6 | 51.3 | 52.9 | 54.6 | 56.3 |
| 28 | 24.1 | 25.7 | 27.3 | 28.9 | 30.6 | 32.2 | 33.8 | 35.4 | 37.0 | 38.7 | 40.3 | 41.9 | 43.5 | 45.2 | 46.8 | 48.4 | 50.1 | 51.7 | 53.3 | 55.0 | 56.6 |
| 32 | 24.7 | 26.4 | 28.0 | 29.7 | 31.3 | 32.9 | 34.6 | 36.2 | 37.9 | 39.5 | 41.2 | 42.8 | 44.5 | 46.1 | 47.8 | 49.4 | 51.1 | 52.7 | 54.4 | 56.0 | 57.7 |
| 36 | 25.5 | 27.2 | 28.9 | 30.6 | 32.2 | 33.9 | 35.6 | 37.3 | 39.0 | 40.7 | 42.4 | 44.1 | 45.8 | 47.5 | 49.2 | 50.9 | 52.6 | 54.3 | 56.0 | 57.7 | 59.4 |
| 40 | 26.2 | 28.0 | 29.7 | 31.4 | 33.2 | 34.9 | 36.7 | 38.4 | 40.2 | 41.9 | 43.7 | 45.4 | 47.2 | 48.9 | 50.7 | 52.4 | 54.2 | 55.9 | 57.7 | 59.4 | 61.2 |
| 44 | 27.0 | 28.8 | 30.6 | 32.3 | 34.1 | 35.9 | 37.7 | 39.5 | 41.3 | 43.1 | 44.9 | 46.7 | 48.5 | 50.3 | 52.1 | 53.9 | 55.7 | 57.5 | 59.3 | 61.1 | 62.9 |
| 48 | 27.7 | 29.6 | 31.4 | 33.2 | 35.1 | 36.9 | 38.8 | 40.6 | 42.5 | 44.3 | 46.2 | 48.0 | 49.9 | 51.7 | 53.6 | 55.4 | 57.3 | 59.1 | 61.0 | 62.8 | 64.6 |
| 52 | 28.5 | 30.4 | 32.2 | 34.1 | 36.0 | 37.9 | 39.8 | 41.7 | 43.6 | 45.5 | 47.4 | 49.3 | 51.2 | 53.1 | 55.0 | 56.9 | 58.8 | 60.7 | 62.6 | 64.5 | 66.4 |
| 56 | 29.2 | 31.2 | 33.1 | 35.0 | 37.0 | 38.9 | 40.9 | 42.8 | 44.8 | 46.7 | 48.7 | 50.6 | 52.6 | 54.5 | 56.5 | 58.4 | 60.4 | 62.3 | 64.2 | 66.2 | 68.1 |
| 60 | 30.0 | 31.9 | 33.9 | 35.9 | 37.9 | 39.9 | 41.9 | 43.9 | 45.9 | 47.9 | 49.9 | 51.9 | 53.9 | 55.9 | 57.9 | 59.9 | 61.9 | 63.9 | 65.9 | 67.9 | 69.9 |
| 64 | 30.7 | 32.7 | 34.8 | 36.8 | 38.9 | 40.9 | 43.0 | 45.0 | 47.1 | 49.1 | 51.2 | 53.2 | 55.3 | 57.3 | 59.4 | 61.4 | 63.4 | 65.5 | 67.5 | 69.6 | 71.6 |
| 68 | 31.4 | 33.5 | 35.6 | 37.7 | 39.8 | 41.9 | 44.0 | 46.1 | 48.2 | 50.3 | 52.4 | 54.5 | 56.6 | 58.7 | 60.8 | 62.9 | 65.0 | 67.1 | 69.2 | 71.3 | 73.4 |
| 72 | 32.2 | 34.3 | 36.5 | 38.6 | 40.8 | 42.9 | 45.1 | 47.2 | 49.4 | 51.5 | 53.7 | 55.8 | 58.0 | 60.1 | 62.3 | 64.4 | 66.5 | 68.7 | 70.8 | 73.0 | 75.1 |
| 76 | 32.9 | 35.1 | 37.3 | 39.5 | 41.7 | 43.9 | 46.1 | 48.3 | 50.5 | 52.7 | 54.9 | 57.1 | 59.3 | 61.5 | 63.7 | 65.9 | 68.1 | 70.3 | 72.5 | 74.7 | 76.9 |
| 80 | 33.7 | 35.9 | 38.2 | 40.4 | 42.7 | 44.9 | 47.2 | 49.4 | 51.7 | 53.9 | 56.2 | 58.4 | 60.7 | 62.9 | 65.1 | 67.4 | 69.6 | 71.9 | 74.1 | 76.4 | |
| 84 | 34.4 | 36.7 | 39.0 | 41.3 | 43.6 | 45.9 | 48.2 | 50.5 | 52.8 | 55.1 | 57.4 | 59.7 | 62.0 | 64.3 | 66.6 | 68.9 | 71.2 | 73.5 | 75.8 | | |
| 88 | 35.2 | 37.5 | 39.9 | 42.2 | 44.6 | 46.9 | 49.3 | 51.6 | 54.0 | 56.3 | 58.7 | 61.0 | 63.3 | 65.7 | 68.0 | 70.4 | 72.7 | 75.1 | | | |
| 92 | 35.9 | 38.3 | 40.7 | 43.1 | 45.5 | 47.9 | 50.3 | 52.7 | 55.1 | 57.5 | 59.9 | 62.3 | 64.7 | 67.1 | 69.5 | 71.9 | 74.3 | | | | |
| 96 | 36.7 | 39.1 | 41.8 | 44.0 | 46.5 | 48.9 | 51.4 | 53.8 | 56.3 | 58.7 | 61.2 | 63.6 | 66.0 | 68.5 | 70.9 | 73.4 | 75.8 | | | | |
| 100 | 37.4 | 39.9 | 42.4 | 44.9 | 47.4 | 49.9 | 52.4 | 54.9 | 57.4 | 59.9 | 62.4 | 64.9 | 67.4 | 69.9 | 72.4 | 74.9 | | | | | |
| 110 | 39.3 | 41.9 | 44.6 | 47.2 | 49.8 | 52.4 | 55.0 | 57.7 | 60.3 | 62.9 | 65.5 | 68.1 | 70.8 | 73.4 | | | | | | | |
| 120 | 41.2 | 43.9 | 46.7 | 49.4 | 52.2 | 54.9 | 57.7 | 60.4 | 63.1 | 65.9 | 68.6 | 71.4 | 74.1 | | | | | | | | |
| 130 | 43.1 | 45.9 | 48.8 | 51.7 | 54.5 | 57.4 | 60.3 | 63.1 | 66.0 | 68.9 | 71.8 | | | | | | | | | | |
| 140 | 44.9 | 47.9 | 50.9 | 53.9 | 56.9 | 59.9 | 62.9 | 65.9 | 68.9 | 71.9 | | | | | | | | | | | |
| 150 | 46.8 | 49.9 | 53.0 | 56.2 | 59.3 | 62.4 | 65.5 | 68.6 | 71.8 | | | | | | | | | | | | |
| 160 | 48.7 | 51.9 | 55.2 | 58.4 | 61.7 | 64.9 | 68.1 | 71.4 | | | | | | | | | | | | | |
| 170 | 50.5 | 53.9 | 57.3 | 60.7 | 64.0 | 67.4 | 70.8 | | | | | | | | | | | | | | |
| 180 | 52.4 | 55.9 | 59.4 | 62.9 | 66.4 | 69.9 | | | | | | | | | | | | | | | |
| 190 | 54.3 | 57.9 | 61.5 | 65.1 | 68.8 | | | | | | | | | | | | | | | | |
| 200 | 56.2 | 59.9 | 63.6 | 67.4 | | | | | | | | | | | | | | | | | |
| Max *M* | 268 | 248 | 229 | 213 | 198 | 185 | 173 | 162 | 152 | 143 | 135 | 127 | 120 | 114 | 107 | 102 | 96 | 91 | 87 | 82 | 78 |
| Max *D* | 69.0 | 69.4 | 69.8 | 70.3 | 70.7 | 71.1 | 71.6 | 72.0 | 72.4 | 72.9 | 73.3 | 73.8 | 74.2 | 74.6 | 75.1 | 75.5 | 75.9 | 76.4 | 76.8 | 77.3 | 77.7 |

Exceeds maximum possible moisture content

[a]For $M$ < 30 percent, $D = 62.4G_b(1 + M/100)/(1 - 0.265aG_b)$, where $a = (30 - M)/30$; for $M > 30$ percent, $D = 62.4G_b(1 + M/100)$.

**Table 4—Results of Equation (9) in SI units**

| *M* | Density (kg/m$^3$) at various levels of specific gravity (ovendry weight/green volume)[a] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 326 | 350 | 374 | 398 | 423 | 447 | 473 | 498 | 524 | 550 | 576 | 603 | 630 | 658 | 685 | 713 | 742 | 771 | 800 | 829 | 859 |
| 4 | 335 | 359 | 384 | 408 | 433 | 458 | 483 | 509 | 535 | 561 | 587 | 614 | 641 | 668 | 696 | 724 | 752 | 780 | 809 | 838 | 867 |
| 8 | 344 | 369 | 393 | 418 | 443 | 468 | 494 | 520 | 546 | 572 | 598 | 625 | 652 | 679 | 706 | 734 | 761 | 789 | 818 | 846 | 875 |
| 12 | 353 | 378 | 403 | 428 | 453 | 478 | 504 | 530 | 556 | 582 | 608 | 635 | 662 | 689 | 716 | 743 | 770 | 798 | 826 | 854 | 882 |
| 16 | 361 | 386 | 412 | 437 | 463 | 488 | 514 | 540 | 566 | 592 | 618 | 645 | 671 | 698 | 725 | 752 | 779 | 806 | 834 | 861 | 889 |
| 20 | 370 | 395 | 421 | 446 | 472 | 498 | 523 | 549 | 575 | 602 | 628 | 654 | 680 | 707 | 734 | 760 | 787 | 814 | 841 | 868 | 895 |
| 24 | 378 | 404 | 429 | 455 | 481 | 507 | 533 | 559 | 585 | 611 | 637 | 663 | 689 | 716 | 742 | 768 | 795 | 821 | 848 | 875 | 901 |
| 28 | 386 | 412 | 438 | 464 | 490 | 516 | 542 | 568 | 594 | 620 | 646 | 672 | 698 | 724 | 750 | 776 | 802 | 829 | 855 | 881 | 907 |
| 32 | 396 | 422 | 449 | 475 | 502 | 528 | 554 | 581 | 607 | 634 | 660 | 686 | 713 | 739 | 766 | 792 | 818 | 845 | 871 | 898 | 924 |
| 36 | 408 | 435 | 462 | 490 | 517 | 544 | 571 | 598 | 626 | 653 | 680 | 707 | 734 | 762 | 789 | 816 | 843 | 870 | 898 | 925 | 952 |
| 40 | 420 | 448 | 476 | 504 | 532 | 560 | 588 | 616 | 644 | 672 | 700 | 728 | 756 | 784 | 812 | 840 | 868 | 896 | 924 | 952 | 980 |
| 44 | 432 | 461 | 490 | 518 | 547 | 576 | 605 | 634 | 662 | 691 | 720 | 749 | 778 | 806 | 835 | 864 | 893 | 922 | 950 | 979 | 1008 |
| 48 | 444 | 474 | 503 | 533 | 562 | 592 | 622 | 651 | 681 | 710 | 740 | 770 | 799 | 829 | 858 | 888 | 918 | 947 | 977 | 1006 | 1036 |
| 52 | 456 | 486 | 517 | 547 | 578 | 608 | 638 | 669 | 699 | 730 | 760 | 790 | 821 | 851 | 882 | 912 | 942 | 973 | 1003 | 1034 | 1064 |
| 56 | 468 | 499 | 530 | 562 | 593 | 624 | 655 | 686 | 718 | 749 | 780 | 811 | 842 | 874 | 905 | 936 | 967 | 998 | 1030 | 1061 | 1092 |
| 60 | 480 | 512 | 544 | 576 | 608 | 640 | 672 | 704 | 736 | 768 | 800 | 832 | 864 | 896 | 928 | 960 | 992 | 1024 | 1056 | 1088 | 1120 |
| 64 | 492 | 525 | 558 | 590 | 623 | 656 | 689 | 722 | 754 | 787 | 820 | 853 | 886 | 918 | 951 | 984 | 1017 | 1050 | 1082 | 1115 | 1148 |
| 68 | 504 | 538 | 571 | 605 | 638 | 672 | 706 | 739 | 773 | 806 | 840 | 874 | 907 | 941 | 974 | 1008 | 1042 | 1075 | 1109 | 1142 | 1176 |
| 72 | 516 | 550 | 585 | 619 | 654 | 688 | 722 | 757 | 791 | 826 | 860 | 894 | 929 | 963 | 998 | 1032 | 1066 | 1101 | 1135 | 1170 | 1204 |
| 76 | 528 | 563 | 598 | 634 | 669 | 704 | 739 | 774 | 810 | 845 | 880 | 915 | 950 | 986 | 1021 | 1056 | 1091 | 1126 | 1162 | 1197 | 1232 |
| 80 | 540 | 576 | 612 | 648 | 684 | 720 | 756 | 792 | 828 | 864 | 900 | 936 | 972 | 1008 | 1044 | 1080 | 1116 | 1152 | 1188 | 1224 | |
| 84 | 552 | 589 | 626 | 662 | 699 | 736 | 773 | 810 | 846 | 883 | 920 | 957 | 994 | 1030 | 1067 | 1104 | 1141 | 1178 | 1214 | | |
| 88 | 564 | 602 | 639 | 677 | 714 | 752 | 790 | 827 | 865 | 902 | 940 | 978 | 1015 | 1053 | 1090 | 1128 | 1166 | 1203 | | | |
| 92 | 576 | 614 | 653 | 691 | 730 | 768 | 806 | 845 | 883 | 922 | 960 | 998 | 1037 | 1075 | 1114 | 1152 | 1190 | | | | |
| 96 | 588 | 627 | 666 | 706 | 745 | 784 | 823 | 862 | 902 | 941 | 980 | 1019 | 1058 | 1098 | 1137 | 1176 | 1215 | | | | |
| 100 | 600 | 640 | 680 | 720 | 760 | 800 | 840 | 880 | 920 | 960 | 1000 | 1040 | 1080 | 1120 | 1160 | 1200 | | | | | |
| 110 | 630 | 672 | 714 | 756 | 798 | 840 | 882 | 924 | 966 | 1008 | 1050 | 1092 | 1134 | 1176 | | | | | | | |
| 120 | 660 | 704 | 748 | 792 | 836 | 880 | 924 | 968 | 1012 | 1056 | 1100 | 1144 | 1188 | | | | | | | | |
| 130 | 690 | 736 | 782 | 828 | 874 | 920 | 966 | 1012 | 1058 | 1104 | 1150 | | | | | | | | | | |
| 140 | 720 | 768 | 816 | 864 | 912 | 960 | 1008 | 1056 | 1104 | 1152 | | | | | | | | | | | |
| 150 | 750 | 800 | 850 | 900 | 950 | 1000 | 1050 | 1100 | 1150 | | | | | | | | | | | | |
| 160 | 780 | 832 | 884 | 936 | 988 | 1040 | 1092 | 1144 | | | | | | | | | | | | | |
| 170 | 810 | 864 | 918 | 972 | 1026 | 1080 | 1134 | | | | | | | | | | | | | | |
| 180 | 840 | 896 | 952 | 1008 | 1064 | 1120 | | | | | | | | | | | | | | | |
| 190 | 870 | 928 | 986 | 1044 | 1102 | | | | | | | | | | | | | | | | |
| 200 | 900 | 960 | 1020 | 1080 | | | | | | | | | | | | | | | | | |
| Max *M* | 268 | 248 | 229 | 213 | 198 | 185 | 173 | 162 | 152 | 143 | 135 | 127 | 120 | 114 | 107 | 102 | 96 | 91 | 87 | 82 | 78 |
| Max *D* | 1105 | 1112 | 1119 | 1126 | 1133 | 1140 | 1147 | 1154 | 1161 | 1168 | 1175 | 1182 | 1189 | 1196 | 1203 | 1210 | 1217 | 1224 | 1231 | 1238 | 1245 |

Exceeds maximum possible moisture content

[a]For $M$ < 30 percent, $D = 1000G_b(1 + M/100)/(1 - 0.265aG_b)$, where $a = (30 - M)/30$; for $M$ > 30 percent, $D = 1000G_b(1 + M/100)$.

**Table 5—Wood density based on volume at 12 percent moisture content**

| *M* | Density (lb/ft$^3$) at various levels of specific gravity[a] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 19.3 | 20.7 | 22.0 | 23.4 | 24.7 | 26.1 | 27.4 | 28.8 | 30.2 | 31.6 | 32.9 | 34.3 | 35.7 | 37.1 | 38.6 | 40.0 | 41.4 | 42.8 | 44.3 | 45.7 | 47.2 |
| 4 | 19.9 | 21.2 | 22.6 | 24.0 | 25.3 | 26.7 | 28.1 | 29.5 | 30.9 | 32.2 | 33.6 | 35.0 | 36.4 | 37.8 | 39.2 | 40.7 | 42.1 | 43.5 | 44.9 | 46.4 | 47.8 |
| 8 | 20.4 | 21.8 | 23.2 | 24.6 | 26.0 | 27.3 | 28.7 | 30.1 | 31.5 | 32.9 | 34.3 | 35.7 | 37.1 | 38.5 | 39.9 | 41.3 | 42.7 | 44.1 | 45.5 | 47.0 | 48.4 |
| 12 | 21.0 | 22.4 | 23.8 | 25.2 | 26.6 | 28.0 | 29.4 | 30.8 | 32.1 | 33.5 | 34.9 | 36.3 | 37.7 | 39.1 | 40.5 | 41.9 | 43.3 | 44.7 | 46.1 | 47.5 | 48.9 |
| 16 | 21.5 | 22.9 | 24.3 | 25.7 | 27.1 | 28.6 | 30.0 | 31.4 | 32.8 | 34.2 | 35.6 | 37.0 | 38.4 | 39.7 | 41.1 | 42.5 | 43.9 | 45.3 | 46.7 | 48.1 | 49.4 |
| 20 | 22.0 | 23.4 | 24.9 | 26.3 | 27.7 | 29.1 | 30.5 | 32.0 | 33.4 | 34.8 | 36.2 | 37.6 | 38.9 | 40.3 | 41.7 | 43.1 | 44.5 | 45.8 | 47.2 | 48.6 | 49.9 |
| 24 | 22.5 | 23.9 | 25.4 | 26.8 | 28.3 | 29.7 | 31.1 | 32.5 | 33.9 | 35.3 | 36.7 | 38.1 | 39.5 | 40.9 | 42.3 | 43.6 | 45.0 | 46.4 | 47.7 | 49.1 | 50.4 |
| 28 | 23.0 | 24.5 | 25.9 | 27.4 | 28.8 | 30.2 | 31.7 | 33.1 | 34.5 | 35.9 | 37.3 | 38.7 | 40.1 | 41.4 | 42.8 | 44.2 | 45.5 | 46.9 | 48.2 | 49.6 | 50.9 |
| 32 | 23.6 | 25.1 | 26.6 | 28.0 | 29.5 | 31.0 | 32.4 | 33.9 | 35.3 | 36.7 | 38.2 | 39.6 | 41.0 | 42.4 | 43.7 | 45.1 | 46.5 | 47.8 | 49.2 | 50.5 | 51.9 |
| 36 | 24.3 | 25.8 | 27.4 | 28.9 | 30.4 | 31.9 | 33.4 | 34.9 | 36.4 | 37.8 | 39.3 | 40.8 | 42.2 | 43.6 | 45.1 | 46.5 | 47.9 | 49.3 | 50.7 | 52.1 | 53.5 |
| 40 | 25.0 | 26.6 | 28.2 | 29.7 | 31.3 | 32.9 | 34.4 | 35.9 | 37.4 | 39.0 | 40.5 | 42.0 | 43.4 | 44.9 | 46.4 | 47.9 | 49.3 | 50.7 | 52.2 | 53.6 | 55.0 |
| 44 | 25.7 | 27.4 | 29.0 | 30.6 | 32.2 | 33.8 | 35.4 | 37.0 | 38.5 | 40.1 | 41.6 | 43.2 | 44.7 | 46.2 | 47.7 | 49.2 | 50.7 | 52.2 | 53.7 | 55.1 | 56.6 |
| 48 | 26.4 | 28.1 | 29.8 | 31.4 | 33.1 | 34.7 | 36.4 | 38.0 | 39.6 | 41.2 | 42.8 | 44.4 | 45.9 | 47.5 | 49.0 | 50.6 | 52.1 | 53.6 | 55.2 | 56.7 | 58.2 |
| 52 | 27.2 | 28.9 | 30.6 | 32.3 | 34.0 | 35.7 | 37.3 | 39.0 | 40.7 | 42.3 | 43.9 | 45.6 | 47.2 | 48.8 | 50.4 | 52.0 | 53.5 | 55.1 | 56.7 | 58.2 | 59.7 |
| 56 | 27.9 | 29.6 | 31.4 | 33.1 | 34.9 | 36.6 | 38.3 | 40.0 | 41.7 | 43.4 | 45.1 | 46.8 | 48.4 | 50.1 | 51.7 | 53.3 | 54.9 | 56.5 | 58.1 | 59.7 | 61.3 |
| 60 | 28.6 | 30.4 | 32.2 | 34.0 | 35.8 | 37.5 | 39.3 | 41.1 | 42.8 | 44.5 | 46.2 | 48.0 | 49.7 | 51.3 | 53.0 | 54.7 | 56.3 | 58.0 | 59.6 | 61.3 | 62.9 |
| 64 | 29.3 | 31.2 | 33.0 | 34.8 | 36.7 | 38.5 | 40.3 | 42.1 | 43.9 | 45.6 | 47.4 | 49.2 | 50.9 | 52.6 | 54.3 | 56.1 | 57.8 | 59.4 | 61.1 | 62.8 | 64.5 |
| 68 | 30.0 | 31.9 | 33.8 | 35.7 | 37.6 | 39.4 | 41.3 | 43.1 | 44.9 | 46.8 | 48.6 | 50.3 | 52.1 | 53.9 | 55.7 | 57.4 | 59.2 | 60.9 | 62.6 | 64.3 | 66.0 |
| 72 | 30.7 | 32.7 | 34.6 | 36.5 | 38.5 | 40.4 | 42.3 | 44.1 | 46.0 | 47.9 | 49.7 | 51.5 | 53.4 | 55.2 | 57.0 | 58.8 | 60.6 | 62.3 | 64.1 | 65.9 | 67.6 |
| 76 | 31.4 | 33.4 | 35.4 | 37.4 | 39.4 | 41.3 | 43.2 | 45.2 | 47.1 | 49.0 | 50.9 | 52.7 | 54.6 | 56.5 | 58.3 | 60.2 | 62.0 | 63.8 | 65.6 | 67.4 | 69.2 |
| 80 | 32.2 | 34.2 | 36.2 | 38.2 | 40.2 | 42.2 | 44.2 | 46.2 | 48.1 | 50.1 | 52.0 | 53.9 | 55.9 | 57.8 | 59.6 | 61.5 | 63.4 | 65.2 | 67.1 | 68.9 | 70.7 |
| 84 | 32.9 | 35.0 | 37.0 | 39.1 | 41.1 | 43.2 | 45.2 | 47.2 | 49.2 | 51.2 | 53.2 | 55.1 | 57.1 | 59.0 | 61.0 | 62.9 | 64.8 | 66.7 | 68.6 | 70.5 | 72.3 |
| 88 | 33.6 | 35.7 | 37.8 | 39.9 | 42.0 | 44.1 | 46.2 | 48.2 | 50.3 | 52.3 | 54.3 | 56.3 | 58.3 | 60.3 | 62.3 | 64.3 | 66.2 | 68.1 | 70.1 | 72.0 | 73.9 |
| 92 | 34.3 | 36.5 | 38.6 | 40.8 | 42.9 | 45.1 | 47.2 | 49.3 | 51.4 | 53.4 | 55.5 | 57.5 | 59.6 | 61.6 | 63.6 | 65.6 | 67.6 | 69.6 | 71.6 | 73.5 | 75.5 |
| 96 | 35.0 | 37.2 | 39.5 | 41.6 | 43.8 | 46.0 | 48.2 | 50.3 | 52.4 | 54.5 | 56.6 | 58.7 | 60.8 | 62.9 | 64.9 | 67.0 | 69.0 | 71.0 | 73.1 | 75.1 | |
| 100 | 35.7 | 38.0 | 40.3 | 42.5 | 44.7 | 46.9 | 49.1 | 51.3 | 53.5 | 55.7 | 57.8 | 59.9 | 62.1 | 64.2 | 66.3 | 68.4 | 70.4 | 72.5 | 74.5 | | |
| 110 | 37.5 | 39.9 | 42.3 | 44.6 | 47.0 | 49.3 | 51.6 | 53.9 | 56.2 | 58.4 | 60.7 | 62.9 | 65.2 | 67.4 | 69.6 | 71.8 | 74.0 | | | | |
| 120 | 39.3 | 41.8 | 44.3 | 46.7 | 49.2 | 51.6 | 54.0 | 56.5 | 58.8 | 61.2 | 63.6 | 65.9 | 68.3 | 70.6 | 72.9 | | | | | | |
| 130 | 41.1 | 43.7 | 46.3 | 48.9 | 51.4 | 54.0 | 56.5 | 59.0 | 61.5 | 64.0 | 66.5 | 68.9 | 71.4 | | | | | | | | |
| 140 | 42.9 | 45.6 | 48.3 | 51.0 | 53.7 | 56.3 | 59.0 | 61.6 | 64.2 | 66.8 | 69.4 | 71.9 | | | | | | | | | |
| 150 | 44.7 | 47.5 | 50.3 | 53.1 | 55.9 | 58.7 | 61.4 | 64.2 | 66.9 | 69.6 | 72.3 | | | | | | | | | | |
| 160 | 46.5 | 49.4 | 52.3 | 55.2 | 58.1 | 61.0 | 63.9 | 66.7 | 69.5 | | | | Excess maximum possible moisture content | | | | | | | | |
| 170 | 48.2 | 51.3 | 54.3 | 57.4 | 60.4 | 63.4 | 66.3 | 69.3 | | | | | | | | | | | | | |
| 180 | 50.0 | 53.2 | 56.4 | 59.5 | 62.6 | 65.7 | 68.8 | | | | | | | | | | | | | | |
| 190 | 51.8 | 55.1 | 58.4 | 61.6 | 64.8 | 68.1 | | | | | | | | | | | | | | | |
| 200 | 53.6 | 57.0 | 60.4 | 63.7 | 67.1 | 70.4 | | | | | | | | | | | | | | | |
| Max *M* | 284 | 263 | 245 | 229 | 214 | 201 | 189 | 178 | 168 | 159 | 151 | 143 | 136 | 129 | 123 | 118 | 112 | 107 | 102 | 98 | 94 |
| Max *D* | 68.7 | 69.1 | 69.4 | 69.8 | 70.2 | 70.6 | 71.0 | 71.4 | 71.8 | 72.1 | 72.5 | 72.9 | 73.3 | 73.6 | 74.0 | 74.4 | 74.7 | 75.1 | 75.4 | 75.8 | 76.2 |

[a]For $M < 30$ percent, $D = 62.4G_b(1 + M/100)/(1 - 0.265aG_b)$, where $a = (30 - M)/30$ and $G_b = G_{12}(1 - 0.265aG_{12}/(1 + 0.265aG_{12}))$; for $M > 30$ percent, $D = 62.4G_b(1 + M/100)$.

**Table 6—SI values for data in Table 5**

| *M* | Density (kg/m$^3$) at various levels of specific gravity[a] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 310 | 331 | 353 | 374 | 396 | 418 | 440 | 462 | 484 | 506 | 528 | 550 | 573 | 595 | 618 | 641 | 664 | 687 | 710 | 733 | 756 |
| 4 | 319 | 340 | 362 | 384 | 406 | 428 | 450 | 472 | 494 | 517 | 539 | 561 | 584 | 606 | 629 | 652 | 674 | 697 | 720 | 743 | 766 |
| 8 | 327 | 350 | 372 | 394 | 416 | 438 | 460 | 483 | 505 | 527 | 550 | 572 | 595 | 617 | 640 | 662 | 685 | 707 | 730 | 752 | 775 |
| 12 | 336 | 358 | 381 | 403 | 426 | 448 | 470 | 493 | 515 | 538 | 560 | 582 | 605 | 627 | 650 | 672 | 694 | 717 | 739 | 762 | 784 |
| 16 | 344 | 367 | 390 | 412 | 435 | 458 | 480 | 503 | 525 | 548 | 570 | 592 | 615 | 637 | 659 | 682 | 704 | 726 | 748 | 770 | 792 |
| 20 | 353 | 376 | 398 | 421 | 444 | 467 | 489 | 512 | 535 | 557 | 580 | 602 | 624 | 646 | 669 | 691 | 713 | 735 | 757 | 779 | 800 |
| 24 | 361 | 384 | 407 | 430 | 453 | 476 | 499 | 521 | 544 | 566 | 589 | 611 | 633 | 655 | 678 | 700 | 721 | 743 | 765 | 787 | 808 |
| 28 | 368 | 392 | 415 | 438 | 462 | 485 | 507 | 530 | 553 | 575 | 598 | 620 | 642 | 664 | 686 | 708 | 730 | 751 | 773 | 794 | 815 |
| 32 | 378 | 402 | 426 | 449 | 473 | 496 | 520 | 543 | 566 | 589 | 611 | 634 | 656 | 679 | 701 | 723 | 745 | 767 | 788 | 810 | 831 |
| 36 | 389 | 414 | 439 | 463 | 487 | 511 | 535 | 559 | 583 | 607 | 630 | 653 | 676 | 699 | 722 | 745 | 768 | 790 | 812 | 835 | 857 |
| 40 | 401 | 426 | 452 | 477 | 502 | 527 | 551 | 576 | 600 | 624 | 648 | 672 | 696 | 720 | 743 | 767 | 790 | 813 | 836 | 859 | 882 |
| 44 | 412 | 438 | 464 | 490 | 516 | 542 | 567 | 592 | 617 | 642 | 667 | 692 | 716 | 740 | 765 | 789 | 813 | 836 | 860 | 884 | 907 |
| 48 | 424 | 451 | 477 | 504 | 530 | 557 | 583 | 609 | 634 | 660 | 686 | 711 | 736 | 761 | 786 | 811 | 835 | 860 | 884 | 908 | 932 |
| 52 | 435 | 463 | 490 | 518 | 545 | 572 | 598 | 625 | 652 | 678 | 704 | 730 | 756 | 782 | 807 | 833 | 858 | 883 | 908 | 933 | 957 |
| 56 | 447 | 475 | 503 | 531 | 559 | 587 | 614 | 642 | 669 | 696 | 723 | 749 | 776 | 802 | 828 | 854 | 880 | 906 | 932 | 957 | 983 |
| 60 | 458 | 487 | 516 | 545 | 573 | 602 | 630 | 658 | 686 | 714 | 741 | 768 | 796 | 823 | 850 | 876 | 903 | 929 | 956 | 982 | 1008 |
| 64 | 470 | 499 | 529 | 558 | 588 | 617 | 646 | 674 | 703 | 731 | 760 | 788 | 816 | 843 | 871 | 898 | 926 | 953 | 980 | 1006 | 1033 |
| 68 | 481 | 512 | 542 | 572 | 602 | 632 | 661 | 691 | 720 | 749 | 778 | 807 | 835 | 864 | 892 | 920 | 948 | 976 | 1003 | 1031 | 1058 |
| 72 | 493 | 524 | 555 | 586 | 616 | 647 | 677 | 707 | 737 | 767 | 797 | 826 | 855 | 884 | 913 | 942 | 971 | 999 | 1027 | 1055 | 1083 |
| 76 | 504 | 536 | 568 | 599 | 631 | 662 | 693 | 724 | 754 | 785 | 815 | 845 | 875 | 905 | 935 | 964 | 993 | 1022 | 1051 | 1080 | 1109 |
| 80 | 515 | 548 | 581 | 613 | 645 | 677 | 709 | 740 | 772 | 803 | 834 | 865 | 895 | 926 | 956 | 986 | 1016 | 1046 | 1075 | 1105 | 1134 |
| 84 | 527 | 560 | 594 | 627 | 659 | 692 | 724 | 757 | 789 | 821 | 852 | 884 | 915 | 946 | 977 | 1008 | 1038 | 1069 | 1099 | 1129 | 1159 |
| 88 | 538 | 572 | 606 | 640 | 674 | 707 | 740 | 773 | 806 | 838 | 871 | 903 | 935 | 967 | 998 | 1030 | 1061 | 1092 | 1123 | 1154 | 1184 |
| 92 | 550 | 585 | 619 | 654 | 688 | 722 | 756 | 790 | 823 | 856 | 889 | 922 | 955 | 987 | 1020 | 1052 | 1084 | 1115 | 1147 | 1178 | 1209 |
| 96 | 561 | 597 | 632 | 667 | 702 | 737 | 772 | 806 | 840 | 874 | 908 | 941 | 975 | 1008 | 1041 | 1074 | 1106 | 1139 | 1171 | 1203 | |
| 100 | 573 | 609 | 645 | 681 | 717 | 752 | 787 | 822 | 857 | 892 | 926 | 961 | 995 | 1028 | 1062 | 1095 | 1129 | 1162 | 1195 | | |
| 110 | 601 | 639 | 677 | 715 | 753 | 790 | 827 | 864 | 900 | 937 | 973 | 1009 | 1044 | 1080 | 1115 | 1150 | 1185 | | | | |
| 120 | 630 | 670 | 710 | 749 | 788 | 827 | 866 | 905 | 943 | 981 | 1019 | 1057 | 1094 | 1131 | 1168 | | | | | | |
| 130 | 659 | 700 | 742 | 783 | 824 | 865 | 906 | 946 | 986 | 1026 | 1065 | 1105 | 1144 | | | | | | | | |
| 140 | 687 | 731 | 774 | 817 | 860 | 903 | 945 | 987 | 1029 | 1070 | 1112 | 1153 | | | | | | | | | |
| 150 | 716 | 761 | 806 | 851 | 896 | 940 | 984 | 1028 | 1072 | 1115 | 1158 | | | | | | | | | | |
| 160 | 744 | 792 | 839 | 885 | 932 | 978 | 1024 | 1069 | 1114 | | | | | | | | | | | | |
| 170 | 773 | 822 | 871 | 919 | 968 | 1015 | 1063 | 1110 | | | | | | | | | | | | | |
| 180 | 802 | 853 | 903 | 953 | 1003 | 1053 | 1102 | Excess maximum possible moisture content | | | | | | | | | | | | | |
| 190 | 830 | 883 | 935 | 987 | 1039 | 1091 | | | | | | | | | | | | | | | |
| 200 | 859 | 914 | 968 | 1022 | 1075 | 1128 | | | | | | | | | | | | | | | |
| Max *M* | 284 | 263 | 245 | 229 | 214 | 201 | 189 | 178 | 168 | 159 | 151 | 143 | 136 | 129 | 123 | 118 | 112 | 107 | 102 | 98 | 94 |
| Max *D* | 1100 | 1107 | 1113 | 1119 | 1125 | 1132 | 1138 | 1144 | 1150 | 1156 | 1162 | 1168 | 1174 | 1180 | 1186 | 1192 | 1198 | 1203 | 1209 | 1215 | 1220 |

[a]For $M < 30$ percent, $D = 1000G_b(1 + M/100)/(1 - 0.265aG_b)$, where $a = (30 - M)/30$ and $G_b = G_{12}(1 + 0.265aG_{12})$; for $M > 30$ percent, $D = 1000G_b(1 + M/100)$.

**Table 7—Wood density based on ovendry volume**

| *M* | Density (lb/ft$^3$) at various levels of specific gravity[a] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 18.7 | 20.0 | 21.2 | 22.5 | 23.7 | 25.0 | 26.2 | 27.5 | 28.7 | 30.0 | 31.2 | 32.4 | 33.7 | 34.9 | 36.2 | 37.4 | 38.7 | 39.9 | 41.2 | 42.4 | 43.7 |
| 4 | 19.3 | 20.5 | 21.8 | 23.1 | 24.3 | 25.6 | 26.9 | 28.1 | 29.4 | 30.6 | 31.9 | 33.1 | 34.4 | 35.6 | 36.9 | 38.1 | 39.4 | 40.6 | 41.9 | 43.1 | 44.3 |
| 8 | 19.8 | 21.1 | 22.4 | 23.7 | 24.9 | 26.2 | 27.5 | 28.8 | 30.0 | 31.3 | 32.5 | 33.8 | 35.1 | 36.3 | 37.5 | 38.8 | 40.0 | 41.3 | 42.5 | 43.7 | 45.0 |
| 12 | 20.3 | 21.6 | 22.9 | 24.2 | 25.5 | 26.8 | 28.1 | 29.4 | 30.7 | 31.9 | 33.2 | 34.4 | 35.7 | 36.9 | 38.2 | 39.4 | 40.7 | 41.9 | 43.1 | 44.3 | 45.5 |
| 16 | 20.8 | 22.2 | 23.5 | 24.8 | 26.1 | 27.4 | 28.7 | 30.0 | 31.3 | 32.5 | 33.8 | 35.1 | 36.3 | 37.6 | 38.8 | 40.0 | 41.3 | 42.5 | 43.7 | 44.9 | 46.1 |
| 20 | 21.3 | 22.7 | 24.0 | 25.3 | 26.7 | 28.0 | 29.3 | 30.6 | 31.9 | 33.1 | 34.4 | 35.7 | 36.9 | 38.2 | 39.4 | 40.6 | 41.8 | 43.1 | 44.3 | 45.5 | 46.6 |
| 24 | 21.8 | 23.2 | 24.5 | 25.9 | 27.2 | 28.5 | 29.8 | 31.1 | 32.4 | 33.7 | 35.0 | 36.2 | 37.5 | 38.7 | 40.0 | 41.2 | 42.4 | 43.6 | 44.8 | 46.0 | 47.2 |
| 28 | 22.3 | 23.7 | 25.0 | 26.4 | 27.7 | 29.1 | 30.4 | 31.7 | 33.0 | 34.3 | 35.5 | 36.8 | 38.0 | 39.3 | 40.5 | 41.7 | 42.9 | 44.1 | 45.3 | 46.5 | 47.7 |
| 32 | 22.9 | 24.3 | 25.7 | 27.1 | 28.4 | 29.8 | 31.1 | 32.5 | 33.8 | 35.1 | 36.4 | 37.6 | 38.9 | 40.2 | 41.4 | 42.6 | 43.9 | 45.1 | 46.3 | 47.5 | 48.6 |
| 36 | 23.6 | 25.0 | 26.5 | 27.9 | 29.3 | 30.7 | 32.1 | 33.4 | 34.8 | 36.1 | 37.5 | 38.8 | 40.1 | 41.4 | 42.7 | 43.9 | 45.2 | 46.4 | 47.7 | 48.9 | 50.1 |
| 40 | 24.3 | 25.8 | 27.2 | 28.7 | 30.2 | 31.6 | 33.0 | 34.4 | 35.8 | 37.2 | 38.6 | 39.9 | 41.3 | 42.6 | 43.9 | 45.2 | 46.5 | 47.8 | 49.1 | 50.3 | 51.6 |
| 44 | 25.0 | 26.5 | 28.0 | 29.5 | 31.0 | 32.5 | 34.0 | 35.4 | 36.8 | 38.3 | 39.7 | 41.1 | 42.4 | 43.8 | 45.2 | 46.5 | 47.8 | 49.2 | 50.5 | 51.8 | 53.1 |
| 48 | 25.7 | 27.2 | 28.8 | 30.4 | 31.9 | 33.4 | 34.9 | 36.4 | 37.9 | 39.3 | 40.8 | 42.2 | 43.6 | 45.0 | 46.4 | 47.8 | 49.2 | 50.5 | 51.9 | 53.2 | 54.5 |
| 52 | 26.4 | 28.0 | 29.6 | 31.2 | 32.7 | 34.3 | 35.8 | 37.4 | 38.9 | 40.4 | 41.9 | 43.3 | 44.8 | 46.3 | 47.7 | 49.1 | 50.5 | 51.9 | 53.3 | 54.6 | 56.0 |
| 56 | 27.1 | 28.7 | 30.4 | 32.0 | 33.6 | 35.2 | 36.8 | 38.4 | 39.9 | 41.5 | 43.0 | 44.5 | 46.0 | 47.5 | 48.9 | 50.4 | 51.8 | 53.3 | 54.7 | 56.1 | 57.5 |
| 60 | 27.7 | 29.5 | 31.1 | 32.8 | 34.5 | 36.1 | 37.7 | 39.3 | 40.9 | 42.5 | 44.1 | 45.6 | 47.2 | 48.7 | 50.2 | 51.7 | 53.2 | 54.6 | 56.1 | 57.5 | 59.0 |
| 64 | 28.4 | 30.2 | 31.9 | 33.6 | 35.3 | 37.0 | 38.7 | 40.3 | 42.0 | 43.6 | 45.2 | 46.8 | 48.3 | 49.9 | 51.4 | 53.0 | 54.5 | 56.0 | 57.5 | 59.0 | 60.4 |
| 68 | 29.1 | 30.9 | 32.7 | 34.5 | 36.2 | 37.9 | 39.6 | 41.3 | 43.0 | 44.6 | 46.3 | 47.9 | 49.5 | 51.1 | 52.7 | 54.3 | 55.8 | 57.4 | 58.9 | 60.4 | 61.9 |
| 72 | 29.8 | 31.7 | 33.5 | 35.3 | 37.1 | 38.8 | 40.6 | 42.3 | 44.0 | 45.7 | 47.4 | 49.1 | 50.7 | 52.3 | 54.0 | 55.6 | 57.2 | 58.7 | 60.3 | 61.8 | 63.4 |
| 76 | 30.5 | 32:4 | 34.3 | 36.1 | 37.9 | 39.7 | 41.5 | 43.3 | 45.0 | 46.8 | 48.5 | 50.2 | 51.9 | 53.6 | 55.2 | 56.9 | 58.5 | 60.1 | 61.7 | 63.3 | 64.8 |
| 80 | 31.2 | 33.1 | 35.0 | 36.9 | 38.8 | 40.6 | 42.4 | 44.3 | 46.1 | 47.8 | 49.6 | 51.3 | 53.1 | 54.8 | 56.5 | 58.1 | 59.8 | 61.5 | 63.1 | 64.7 | 66.3 |
| 84 | 31.9 | 33.9 | 35.8 | 37.7 | 39.6 | 41.5 | 43.4 | 45.2 | 47.1 | 48.9 | 50.7 | 52.5 | 54.2 | 56.0 | 57.7 | 59.4 | 61.1 | 62.8 | 64.5 | 66.2 | 67.8 |
| 88 | 32.6 | 34.6 | 36.6 | 38.6 | 40.5 | 42.4 | 44.3 | 46.2 | 48.1 | 50.0 | 51.8 | 53.6 | 55.4 | 57.2 | 59.0 | 60.7 | 62.5 | 64.2 | 65.9 | 67.6 | 69.3 |
| 92 | 33.3 | 35.3 | 37.4 | 39.4 | 41.4 | 43.3 | 45.3 | 47.2 | 49.1 | 51.0 | 52.9 | 54.8 | 56.6 | 58.4 | 60.2 | 62.0 | 63.8 | 65.6 | 67.3 | 69.0 | 70.7 |
| 96 | 34.0 | 36.1 | 38.1 | 40.2 | 42.2 | 44.2 | 46.2 | 48.2 | 50.1 | 52.1 | 54.0 | 55.9 | 57.8 | 59.6 | 61.5 | 63.3 | 65.1 | 66.9 | 68.7 | 70.5 | 72.2 |
| 100 | 34.7 | 36.8 | 38.9 | 41.0 | 43.1 | 45.1 | 47.2 | 49.2 | 51.2 | 53.1 | 55.1 | 57.0 | 59.0 | 60.9 | 62.7 | 64.6 | 66.5 | 68.3 | 70.1 | 71.9 | 73.7 |
| 110 | 36.4 | 38.7 | 40.9 | 43.1 | 45.2 | 47.4 | 49.5 | 51.6 | 53.7 | 55.8 | 57.9 | 59.9 | 61.9 | 63.9 | 65.9 | 67.8 | 69.8 | 71.7 | 73.6 | | |
| 120 | 38.2 | 40.5 | 42.8 | 45.1 | 47.4 | 49.6 | 51.9 | 54.1 | 56.3 | 58.5 | 60.6 | 62.7 | 64.9 | 66.9 | 69.0 | 71.1 | 73.1 | | | | |
| 130 | 39.9 | 42.3 | 44.8 | 47.2 | 49.5 | 51.9 | 54.2 | 56.6 | 58.8 | 61.1 | 63.4 | 65.6 | 67.8 | 70.0 | 72.2 | | | | | | |
| 140 | 41.6 | 44.2 | 46.7 | 49.2 | 51.7 | 54.2 | 56.6 | 59.0 | 61.4 | 63.8 | 66.1 | 68.4 | 70.7 | 73.0 | | | | | | | |
| 150 | 43.4 | 46.0 | 48.7 | 51.3 | 53.9 | 56.4 | 59.0 | 61.5 | 64.0 | 66.4 | 68.9 | 71.3 | | | | | | | | | |
| 160 | 45.1 | 47.9 | 50.6 | 53.3 | 56.0 | 58.7 | 61.3 | 63.9 | 66.5 | 69.1 | 71.6 | | | | | | | | | | |
| 170 | 46.8 | 49.7 | 52.5 | 55.4 | 58.2 | 60.9 | 63.7 | 66.4 | 69.1 | 71.7 | | | | | | | | | | | |
| 180 | 48.6 | 51.5 | 54.5 | 57.4 | 60.3 | 63.2 | 66.0 | 68.8 | | | | | | | | | | | | | |
| 190 | 50.3 | 53.4 | 56.4 | 59.5 | 62.5 | 65.4 | 68.4 | | | | | | | | | | | | | | |
| 200 | 52.0 | 55.2 | 58.4 | 61.5 | 64.6 | 67.7 | 70.7 | | | | | | | | | | | | | | |
| Max *M* | 295 | 274 | 256 | 239 | 225 | 211 | 200 | 189 | 179 | 170 | 162 | 154 | 147 | 140 | 134 | 128 | 123 | 118 | 113 | 109 | 104 |
| Max *D* | 68.5 | 68.8 | 69.2 | 69.6 | 69.9 | 70.3 | 70.7 | 71.0 | 71.4 | 71.7 | 72.0 | 72.4 | 72.7 | 73.0 | 73.4 | 73.7 | 74.0 | 74.4 | 74.7 | 75.0 | 75.3 |

Excess maximum possible moisture content

[a]For $M < 30$ percent, $D = 62.4G_b(1 + M/100)/(1 - 0.265aG_b)$, where $a = (30 - M)/30$ and $G_b = G_0(1 + 0.265aG_0)$; for $M > 30$ percent, $D = 62.4G_b(1 + M/100)$.

**Table 8—SI values for data in Table 7**

| *M* | Density (kg/m$^3$) at various levels of specific gravity[a] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (%) | 0.30 | 0.32 | 0.34 | 0.36 | 0.38 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.58 | 0.60 | 0.62 | 0.64 | 0.66 | 0.68 | 0.70 |
| 0 | 300 | 320 | 340 | 360 | 380 | 400 | 420 | 440 | 460 | 480 | 500 | 520 | 540 | 560 | 580 | 600 | 620 | 640 | 660 | 680 | 700 |
| 4 | 309 | 329 | 349 | 370 | 390 | 410 | 430 | 451 | 471 | 491 | 511 | 531 | 551 | 571 | 591 | 611 | 631 | 651 | 671 | 691 | 710 |
| 8 | 317 | 338 | 359 | 379 | 400 | 420 | 441 | 461 | 481 | 501 | 522 | 542 | 562 | 582 | 602 | 622 | 641 | 661 | 681 | 701 | 720 |
| 12 | 326 | 347 | 368 | 388 | 409 | 430 | 450 | 471 | 491 | 512 | 532 | 552 | 572 | 592 | 612 | 632 | 652 | 671 | 691 | 710 | 730 |
| 16 | 334 | 355 | 376 | 397 | 418 | 439 | 460 | 481 | 501 | 521 | 542 | 562 | 582 | 602 | 622 | 642 | 661 | 681 | 700 | 720 | 739 |
| 20 | 342 | 363 | 385 | 406 | 427 | 448 | 469 | 490 | 511 | 531 | 551 | 571 | 592 | 612 | 631 | 651 | 671 | 690 | 709 | 728 | 748 |
| 24 | 350 | 372 | 393 | 415 | 436 | 457 | 478 | 499 | 520 | 540 | 561 | 581 | 601 | 621 | 640 | 660 | 679 | 699 | 718 | 737 | 756 |
| 28 | 357 | 380 | 401 | 423 | 445 | 466 | 487 | 508 | 529 | 549 | 570 | 590 | 610 | 630 | 649 | 669 | 688 | 707 | 726 | 745 | 764 |
| 32 | 367 | 389 | 412 | 434 | 456 | 477 | 499 | 520 | 541 | 562 | 583 | 603 | 624 | 644 | 664 | 683 | 703 | 722 | 742 | 761 | 779 |
| 36 | 378 | 401 | 424 | 447 | 470 | 492 | 514 | 536 | 558 | 579 | 600 | 622 | 642 | 663 | 684 | 704 | 724 | 744 | 764 | 784 | 803 |
| 40 | 389 | 413 | 437 | 460 | 483 | 506 | 529 | 552 | 574 | 596 | 618 | 640 | 661 | 683 | 704 | 725 | 746 | 766 | 786 | 807 | 827 |
| 44 | 400 | 425 | 449 | 473 | 497 | 521 | 544 | 567 | 590 | 613 | 636 | 658 | 680 | 702 | 724 | 745 | 767 | 788 | 809 | 830 | 850 |
| 48 | 411 | 437 | 462 | 486 | 511 | 535 | 559 | 583 | 607 | 630 | 653 | 676 | 699 | 722 | 744 | 766 | 788 | 810 | 831 | 853 | 874 |
| 52 | 422 | 448 | 474 | 500 | 525 | 550 | 574 | 599 | 623 | 647 | 671 | 695 | 718 | 741 | 764 | 787 | 809 | 832 | 854 | 876 | 898 |
| 56 | 434 | 460 | 487 | 513 | 539 | 564 | 590 | 615 | 640 | 664 | 689 | 713 | 737 | 761 | 784 | 808 | 831 | 854 | 876 | 899 | 921 |
| 60 | 445 | 472 | 499 | 526 | 552 | 579 | 605 | 630 | 656 | 681 | 706 | 731 | 756 | 780 | 804 | 828 | 852 | 876 | 899 | 922 | 945 |
| 64 | 456 | 484 | 512 | 539 | 566 | 593 | 620 | 646 | 672 | 698 | 724 | 750 | 775 | 800 | 824 | 849 | 873 | 897 | 921 | 945 | 968 |
| 68 | 467 | 496 | 524 | 552 | 580 | 608 | 635 | 662 | 689 | 715 | 742 | 768 | 794 | 819 | 845 | 870 | 895 | 919 | 944 | 968 | 992 |
| 72 | 478 | 507 | 536 | 565 | 594 | 622 | 650 | 678 | 705 | 732 | 759 | 786 | 813 | 839 | 865 | 890 | 916 | 941 | 966 | 991 | 1016 |
| 76 | 489 | 519 | 549 | 578 | 608 | 637 | 665 | 694 | 722 | 749 | 777 | 804 | 831 | 858 | 885 | 911 | 937 | 963 | 989 | 1014 | 1039 |
| 80 | 500 | 531 | 561 | 592 | 621 | 651 | 680 | 709 | 738 | 767 | 795 | 823 | 850 | 878 | 905 | 932 | 959 | 985 | 1011 | 1037 | 1063 |
| 84 | 511 | 543 | 574 | 605 | 635 | 665 | 695 | 725 | 754 | 784 | 812 | 841 | 869 | 897 | 925 | 953 | 980 | 1007 | 1034 | 1060 | 1086 |
| 88 | 522 | 555 | 586 | 618 | 649 | 680 | 711 | 741 | 771 | 801 | 830 | 859 | 888 | 917 | 945 | 973 | 1001 | 1029 | 1056 | 1083 | 1110 |
| 92 | 534 | 566 | 599 | 631 | 663 | 694 | 726 | 757 | 787 | 818 | 848 | 877 | 907 | 936 | 965 | 994 | 1022 | 1051 | 1079 | 1106 | 1134 |
| 96 | 545 | 578 | 611 | 644 | 677 | 709 | 741 | 772 | 804 | 835 | 865 | 896 | 926 | 956 | 985 | 1015 | 1044 | 1073 | 1101 | 1129 | 1157 |
| 100 | 556 | 590 | 624 | 657 | 690 | 723 | 756 | 788 | 820 | 852 | 883 | 914 | 945 | 975 | 1005 | 1035 | 1065 | 1094 | 1123 | 1152 | 1181 |
| 110 | 584 | 619 | 655 | 690 | 725 | 759 | 794 | 828 | 861 | 894 | 927 | 960 | 992 | 1024 | 1056 | 1087 | 1118 | 1149 | 1180 | | |
| 120 | 611 | 649 | 686 | 723 | 760 | 796 | 831 | 867 | 902 | 937 | 971 | 1005 | 1039 | 1073 | 1106 | 1139 | 1172 | | | | |
| 130 | 639 | 678 | 717 | 756 | 794 | 832 | 869 | 906 | 943 | 979 | 1015 | 1051 | 1087 | 1122 | 1156 | | | | | | |
| 140 | 667 | 708 | 749 | 789 | 829 | 868 | 907 | 946 | 984 | 1022 | 1060 | 1097 | 1134 | 1170 | | | | | | | |
| 150 | 695 | 737 | 780 | 822 | 863 | 904 | 945 | 985 | 1025 | 1065 | 1104 | 1143 | | | | | | | | | |
| 160 | 723 | 767 | 811 | 854 | 898 | 940 | 983 | 1025 | 1066 | 1107 | 1148 | | | | | | | | | | |
| 170 | 750 | 796 | 842 | 887 | 932 | 976 | 1020 | 1064 | 1107 | | | | | | | | | | | | |
| 180 | 778 | 826 | 873 | 920 | 967 | 1013 | 1058 | 1103 | | | | | | | | | | | | | |
| 190 | 806 | 855 | 905 | 953 | 1001 | 1049 | 1096 | | | | | | | | | | | | | | |
| 200 | 834 | 885 | 936 | 986 | 1036 | 1085 | | | | | | | | | | | | | | | |
| Max *M* | 295 | 274 | 256 | 239 | 225 | 211 | 200 | 189 | 179 | 170 | 162 | 154 | 147 | 140 | 134 | 128 | 123 | 118 | 113 | 109 | 104 |
| Max *D* | 1097 | 1103 | 1109 | 1115 | 1121 | 1127 | 1132 | 1138 | 1144 | 1149 | 1155 | 1160 | 1165 | 1171 | 1176 | 1181 | 1186 | 1192 | 1197 | 1202 | 1207 |

Excess maximum possible moisture content

[a]For $M < 30$ percent, $D = 1000G_b(1 + M/100)/(1 - 0.265aG_b)$, where $a = (30 - M)/30$ and $G_b = G_0((1 + 0.265aG_0)$; for $M > 30$ percent, $D = 1000G_b(1 + M/100)$.

# Appendix. Relationship of Specific Gravity Values

In this appendix, we describe the general relationship between basic specific gravity and specific gravity values baaed on volume at other moisture content levels.

Basic specific gravity is defined as

$$G_b = (W_d/V_d)/p_w \qquad (1a)$$

where $W_d$ is oven-dry weight of wood, $V_d$ is volume of dry wood, and $p_{w_w}$ is density of water.

Specific gravity baaed on volume at any other moisture content $M$ is defined as

$$G_M = (W_d/V_M)/p_w \qquad (2a)$$

Equating Equations (1a) and (2a) through $W_d$

$$G_M = G_b V_g/V_M \qquad (3a)$$

where $V_g$ is volume of green wood.

Volumetric shrinkage S from ≥30 percent to <30 percent moisture content is

$$S = (V_g - V_M)/V_M$$

or

$$V_M = V_g(1 - S) \qquad (4a)$$

Substituting Equation (4a) into Equation (3a)

$$G_b = G_M(1 - S) \qquad (5a)$$

Assuming the linear shrinkage of Equation (6) in the text ($S = aS_t$)

$$G_b = G_M(1 - aS_t) \qquad (6a)$$

where a is (30 - M)/30.

The next step is to express $S_t$ in Equation (6a) in terms of $G_M$. Substituting Equation (6a) into Equation (8) ($S_t = 0.265\ G_b$) in the text

$$S_t = 0.265G_M(1 - aS_t) \qquad (7a)$$

Solving for $S_t$

$$S_t = \frac{0.265G_M}{1 + 0.265aG_M} \qquad (8a)$$

and substituting Equation (8a) into Equation (6a)

$$G_b = \frac{G_M}{1 + 0.265aG_M} \qquad (9a)$$

which can be substituted into Equation (9) in the text to calculate density based on the volume at any moisture content. Equation (9a) can also be used to calculate the graphical relationship between moisture content, basic specific gravity, and specific gravity based on volume at any moisture content, as shown in Figure 1 of the text.

The value of $M$ in the term a ($(30 - M)/30$) in Equation (9a) is the moisture content for the volume base of the specific gravity. The value of $M$ in the term $a$ in Equation (9) in the text is the moisture content at which the density is calculated (that is, 0 to 200 percent in Tables 5 and 7). If this latter value of $M$ is taken as the moisture content of the specific gravity volume base, the resulting density values will be baaed on the specific gravity at the volume of the tabulated moisture content, that is, the same as that in the tables in the *Wood Handbook.* Note also in Equation (9a) that when $M = 30$, $a = 0$, and $G_M = G_b$, text Equation (9) reverts to text Equations (3) and (4).



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