

BASICS OF Hardwood Lumber Grading

When working with hardwoods, understanding hardwood lumber grades is vital for both the production and sale of your product.

For sawyers, a knowledge of the rules helps you to maximize your value recovery when grade sawing. Knowledge of lumber grades assists you in determining which face to select and how deep to cut the opening face of a log, when to turn the log, and how deeply to saw into each face on the log. Once the lumber is cut, grading knowledge can help maximize value in edging and trimming decisions. The knowledge allows you to conform to the most common method of assigning quality and value for hardwood lumber. Commercial lumber operations use the hardwood grading rules developed by the National Hardwood Lumber Association located in Memphis, Tennessee, as a basis for most lumber transactions.

The Basics

With the exception of railroad ties, pallet cants, and other large timbers, most hardwood lumber is ultimately further processed to make a product. Most of this lumber is cut and ripped into pieces and the pieces assembled or made into the final product. Therefore, the lumber grades are based on how much of a board is clear, usable material with limits on the size and number of cuttings (pieces) that can be obtained from the board. There are other limitations for each grade, such as the acceptable size of boards and the size and number of cuttings allowed for each grade. More on this

later. The hardwood lumber grades in use today are listed in the top row of Table 1. The basic concept of lumber grading is to determine the grade by observing the poorest face (side) and determining the grade of this face based on the criteria presented in Table 1. Grading does require a look at the good face to determine if the cuttings are clear and occasionally fitting the criteria in Table 1 to both faces.

Terms

There are a few terms that are important to understand before we get too far into the actual grading process.

Surface Measure

- The surface measure of a board is the width of a board in inches multiplied by the length of the board in whole feet divided by 12. The length of a board is measured in whole feet, not rounded. Over length is not considered in determining the surface measure. Surface measure is rounded up or down. For two examples of determining surface measure see examples 1 and 2 below.

Board Foot

- A board foot is the common measurement used in hardwood lumber. It is the volume of a board 1 foot long, 1 foot wide by 1 inch thick. One method of determining the number of board feet in a board is to

Calculating Board Feet. Q&A



Example 1 of calculating board feet: A board 8 inches wide and 10 feet 3 inches long cut to 4/4-inch thickness has how many board feet?..... $8 \times 10 / 12 = SM$ of 7; 7×1 inch = 7 board feet.



Example 2 of calculating board feet: A board 10 inches wide and 12 feet 4 inches long is 8/4-inch thickness has how many board feet?..... $10 \times 12 / 12 = SM$ of 10; 10×2 inches = 20 board feet.

Table 1. Summary of Basic Grade Requirements for Standard Grades

	FAS	F1F	Select	#1 Com	# 2A & 2B ¹	#3A	#3B ¹
Min. Board Width	6 inches	6 inches	4 inches	3 inches	3 inches	3 inches	3 inches
Min. Board Length	8 feet	8 feet	8 feet	4 feet	4 feet	4 feet	4 feet
Min. Cutting Size	4 in. x 5 ft. 3 in. x 7 ft.	Poor Face must meet 1 Common Grade Good Face to Grade FAS Grade		4 in. x 2 ft. 3 in. x 3 ft.	3 in. x 2 ft.	3 in. x 2 ft.	Not less than 1-1/2 wide containing 36 sq. inches
Basic Yield	SM x 10 83-1/3%			SM x 8 66-2/3%	SM x 6 50%	SM x 4 33-1/3%	SM x 3 25%
Number of Cutting Units	SM/4 (4 max)			(SM+1) /3 (5 max)	SM / 2 (7 max) cuttings	Unlimited	Unlimited sound allowed
SM Needed to Take Extra Cutting	6-15 ft. SM			3-10 ft. SM	2-7 ft. SM		
Extra Cutting Yield	SM x 11 91-2/3%			SM x 9 75%	SM x 8 66-2/3%		

¹ Cuttings need only to be sound, not clear.

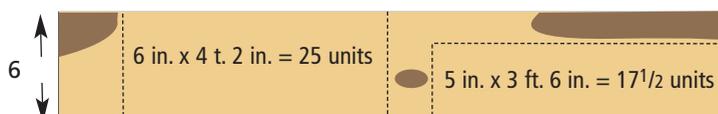
multiply the surface measure by the board's thickness. Note that the nominal thickness is used, not the actual thickness. For example, a 4/4 hardwood board when green is usually around 1.125 or 1-1/8 inches thick rough (actual) but its measurement for determining the board feet is 1 inch (nominal).

Cutting

- A portion of a board obtained by cross-cutting, by ripping, or both
- Diagonal cuttings are not permitted

Cutting Unit

• A cutting is 1 inch wide by 12 inches long. The number of units in a cutting is equal to the width in inches and fractions of an inch times the length in feet and fractions of a foot. Do not drop fractions and do not round up.



Example of calculating cutting units in a board with two cuttings.

Clear Face Cutting

• A cutting having one, Clear Face and the reverse side sound as defined below. This is the rule that most often requires you to look at the “good” face when grading a board.

Sound Cutting

• A cutting that is clear of rot, pith, shake, or wane.

Applying the Lumber Grading Rules

The NHLA lumber grading rules are based upon the cutting unit method. This method provides a mathematical comparison between the total amount of wood in a board and the amount of usable wood in the board. When applying the rules, you must be able to measure the length and width of the board. When learning the rules, it is also helpful to be able to measure the Clear-Face cuttings in the grading face. Let's start by looking at the steps in grading lumber and then go through some examples. For all of our examples, we will focus on Clear-Face cutting grades (FAS, F1F, Selects, No. 1 Common, No. 2A Common and No. 3 A Common) rather than the sound cutting grades (2B and 3B).

Steps in Grading Lumber

- Determine the species
- Determine the SM
- Determine poor side of board
- Assign a trial grade
- Determine the number of cuttings allowed by the trial grade
- Identify the number, size, and location of the Clear-Face cuttings
- Determine the total number of Clear-Face cutting units on poor face
- Compare the total number of cutting units in the board to the grade requirements
- If the board does not make grade, try a lower grade

- If the board does make grade, then tally SM by grade and thickness

Explaining the Steps

It is important to know the species as there are sometimes special rules for certain species. For example, walnut lumber has different lengths allowable in the grades. For this article, let's focus on the basic rules applied to the most common species. If you're interested in the specific rules for other species, check out the "Rules for the Measurement and Inspection of Hardwood and Cypress" by the National Hardwood Lumber Association. You can download the lumber grading rules in English, Spanish, French, and Mandarin from the NHLA website. <https://nhla.com/industry-services/rules/>

The surface measure is used to determine several other criteria in the grading rules. Note in Table 1 that the surface measure is used to determine how many cuttings are allowed and the required basic yield.

Since the grade of a board is usually determined by the poor face, it is important to make this determina-

tion. If you are not sure, then grade both faces and determine the poor face based on the assigned grade.

Follow the criteria listed in Table 1 to determine the number of cuttings allowed for the surface measure of the board and the trial grade. You have to understand what defects are and use rip- and cross-cuts to obtain the Clear-Face cuttings. Make sure you check the "good" face to make sure the cutting you have on the poor is truly a Clear-Face cutting. That is one that is sound, free of rot, pith, and wane, on the back side. One thing that often confuses my students is when grading the board, you don't have to know how someone will actually cut it up when using the board, you only have to focus on obtaining the maximum amount of clear material within the cuttings to make the grade. So, different size cuttings, requiring complex ripping and cross cutting, is fine for determining the grade of the board.

Next calculate the number of total Clear-Face units. Remember, do not round and keep your fractions. Those proficient at lumber grading are proficient at adding fractions. For practice, use a calculator! Check

to see that the total number of cutting units contained in the board meet the requirements in Table 1. You must have an equal or greater number. If you don't, then drop down a grade and try again.

Finally, tally the board by SM and thickness. Multiplying the surface measure by the thickness gives you the total number of board feet in the board.

Note that the FAS grade has the greatest number of limitations to the grade, including the first lineal foot rule, wane limitation, pith limitations, knot size limitation, and split limitations (See Table 2). There is also a wane limitation for F1F (Table 3) and Selects (Table 4).

Extra Cuttings

Note that for long boards, of a particular surface measure, you can take an extra cutting when needed! Be careful, since

Table 2. Other Limitations to FAS

Pith	SM in inches
Wane	1/2 the board length
Knot	Average diameter in inches may not exceed 1/3 SM
Warp	Entire board must be flat enough to surface standard thicknesses (see Rule Book)
Splits	Not to exceed 2 x SM or 12 inches, whichever is greater
Splits	Shall not diverge 1 inch in 12 inches
First Lineal	Applies to both ends of a board to contain not less than 50% clear wood, 25% sound wood

Table 3. F1F Wane Rules

On the FAS face, FAS limitation applies
On the 1 Com face, 1/3 the width or 1/2 the length
Add widest wane together
Length can be on both edges

Table 4. Select Wane Rules

Boards 6 inches and greater	On the FAS face, FAS limitation applies
	On the 1 Com face, 1/3 the width or 1/2 the length
	Add widest wane together
	Length can be on both edges
Boards 4 and 5 inches wide	1/3 the width or 1/2 the length
	Add widest wane together
	Add total length of wane from both edges

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using the extra cutting means that you must now have a greater clear-cutting yield, also listed in Table 1.

The best way to learn how to apply these rules is to grab a lumber crayon and measuring device, and head out to some rough-cut lumber. Go through the nine steps listed, but draw out your Clear-Face cuttings so you can see and measure them. When learning the grading rules, it is common to find different ways to “cut up” a board into clear cuttings. Remember, you are going for the largest cuttings you can get for the grade and not trying to determine how someone would actually use the board.

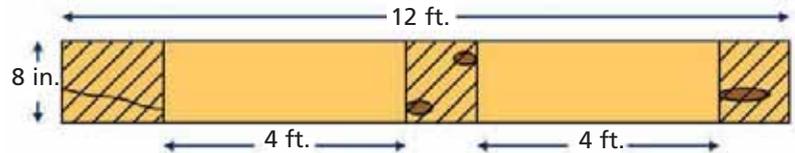
Need more assistance? The NHLA teaches hardwood lumber grading in Memphis, Tennessee, and occasionally has short courses around the country. Check their website for the latest information about the courses. Also, I will be teaching an *Introduction to Hardwood Lumber Grading* at this year’s Paul Bunyan Show in Ohio. Now, get out there with your measuring stick, calculator, and crayon to try your hand at hardwood lumber grading.

Examples of Applying the Rules

The steps:

- The species is red oak, so the standard rules apply.
- The SM is 8 inches x 12 feet / 12 = SM of 8.

- The poor side of the board is shown.
- Just looking at the amount of clear area, I think about 2/3 of the surface is clear, so let’s go for a 1 Common board. Trial grade is 1 Common.
- The number of cuttings allowed by the 1 Common grade is $(SM+1)/3$. So $(8+1)/3 = 3$ but I only have two that fit the minimum requirements of 4 inches x 2 feet and 3 inches x 3 feet.
- Two cuttings are shown. Cutting one is 8 inches by 4 feet. The second is 8 inches by 4 feet.
- Total the number of clear cutting units. We check to see that the material contained in these two cuttings meets the clear cutting requirements (free of rot, pith, and wane). They are, so we total them up. 8 inches x 4 feet = 32; 8 inches x 4 feet = 32; 32 units + 32 units = 64 total units.
- A 1 Common board must have 66-2/3% of the board clear, which we determine by comparing the number of required cutting units to what we determined for the board. The rule states: $SM \times 8$ for 1 Common. $8 \times$



Example 1 of Applying the Lumber Grades.

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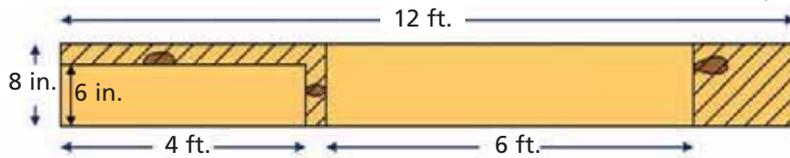
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8 = 64 cutting units needed. We have exactly 64, so this board makes a No. 1 Common.



Example 2 of Applying the Lumber Grades.

The steps:

- The species is red oak, so the standard rules apply.
- The SM is 8 inches x 12 feet / 12 = 8.
- The poor side of the board is shown.
- Just looking at the amount of clear area, I think about 2/3 of the surface is clear, so let's go for a 1 Common board. Trial grade is 1 Common.
- The number of cuttings allowed by the 1 Common grade is $(SM+1)/3$. So $(8+1)/3=3$, but I only have two that fit the minimum requirements of 4 inches x 2 feet and 3 inches x 3 feet.
- Two cuttings are shown. Cutting one is 6 inches by 4 feet. The second is 8 inches by 6 feet.
- Total the number of clear cutting units. We check to see that the material contained in these two cuttings meets the clear cutting requirements (free of rot, pith, and wane). They are, so we total them up. 8 inches x 4

feet = 32; 8 feet x 6 feet = 48; 48 units + 28 units = 80.

A 1 Common board must have 66-2/3% of the board clear, which we determine by comparing the number of required cutting units to what we determined for the board. $SM \times 8$ for 1 Common. $8 \times 8 = 64$ cutting units needed. We have 80, so this board makes a No. 1 Common.

Going a Little Further with This Board

With so many more cutting units than needed for a 1 Common board, should we try for a higher grade? An FAS board only requires 80 cutting units, which we have, and we can take two cutting units for the grade. $(SM/4) = (8/4=2)$. However, the one cutting does not meet the minimum size requirement of 4 inches x 5 feet or 3 inches x 7 feet. So, the board would not make FAS requirements. What about a F1F or Select? We would have to also grade the "good" face. If you could get 80 cutting units out of one or two cuttings in the "good" face and a 1 Common grade on the face shown, then this board would make a F1F grade. ■

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