

The Illustrated Guide to
**American Hardwood
Lumber Grades**



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Introduction

The purpose of this publication is to provide a simplified but thorough explanation of the grading rules for American hardwood lumber. They were established over 100 years ago by the newly formed National Hardwood Lumber Association (NHLA). Today the NHLA has over 2000 members worldwide, and the NHLA rules are still the national standard for the US hardwood industry and form the basis for grading of export lumber.

Wood is a natural material and by its very nature may contain different characteristics and defects that need to be understood and allowed for in any given application. The grading of sawn wood into categories as it is processed helps to determine to a large extent the value and potential use possible for each board of sawn lumber.

The NHLA grading rules provide both the buyer and seller with a consistent language to use in specifying hardwood lumber transactions. Although the NHLA grading rules are targeted for the US marketplace, a reasonable knowledge is essential for buyers worldwide in order to attain their expected degree of quality. The grade of lumber purchased by a manufacturer will determine both the cost and waste factor that is achieved. Because the grades are based on the percentage of clear wood in the board, many of the beautiful, natural characteristics found in hardwoods are not considered in calculating the clear yield. This fact is highlighted by photograph illustrations of the main grades, for 10 important US hardwood species, contained in this publication.

Hardwood lumber is usually graded on the basis of the size and number of cuttings (pieces) that can be obtained from a board when it is cut up and used in the manufacture of a hardwood product. The NHLA rules were designed with the furniture trade in mind to provide a measurable percentage of clear, defect-free wood for each grade. The upper grades provide the user with long clear pieces, while the Common grades are designed to be re-sawn into shorter clear pieces.

The upper grades, which will include FAS, FAS-One-Face (FAS/1F) and Selects, are most suitable for long clear mouldings, joinery products such as door frames, architectural interiors; and furniture applications, which require a heavy percentage of long wide cuttings.

The Common grades, primarily Number 1 Common (No. 1C) and Number 2A Common (No. 2AC), are likely to be most suitable for the kitchen cabinet industry, most furniture parts, and plank and strip flooring. Worth noting is the fact that once re-sawn, the cuttings obtained from the Common grades will be the same clear wood as the upper grades but in smaller (shorter and/or narrower) cuttings. The grade name simply designates the percentage of clear wood in the board, not the overall appearance.

The American hardwood temperate forest resource is the largest of its kind anywhere in the world, with a significant history of sustainability. Exploring the Common grades, where possible, is invaluable in achieving the most value both in lumber cost and yield. These efforts will also help to ensure the sustainability of the resource for generations.

Measurement

The NHLA lumber grading rules adopted by the US hardwood industry are based on an imperial measurement system using inches and feet. In contrast most export markets are more familiar with a metric standard. Additionally, the grade rules were developed with random width and length lumber in mind. Any selection for particular specifications should be discussed prior to ordering.

Board foot

A board foot (BF) is the unit of measurement for hardwood lumber. A board foot is 1 foot long x 1 foot wide x 1 inch thick. (1 foot = 0.305 metres, 1 inch = 25.4mm)

The formula for determining board feet in a board is:

(Width in inches x length in feet x thickness in inches) divided by 12

The percentages of clear wood required for each grade are based on this 12' unit of measure.

Surface measure

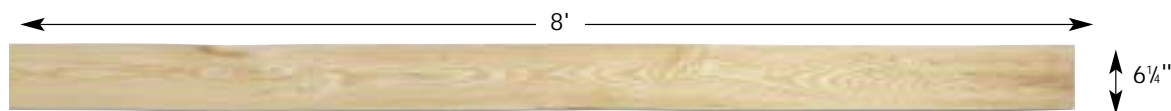
Surface measure (SM) is the surface area of a board in square feet. To determine surface measure, multiply the width of the board in inches by the length of the board in feet and divide the sum by 12 rounding up or down to the nearest whole number. The percentage of clear wood required for each grade is based on the surface measure, not the board feet, and because of this all boards, no matter what the thickness, are graded in the same way.

Some examples for surface measure calculations are as follows:

$$6\frac{1}{2}'' \times 8' \div 12 = 4\frac{1}{6} = 4' \text{ SM}$$

$$8'' \times 12' \div 12 = 8' \text{ SM}$$

$$10'' \times 13' \div 12 = 10\frac{10}{12} = 11' \text{ SM}$$



Example of SM and BF:

The board above is a 2" thick, 6 1/4" wide, and 8' long.

$6\frac{1}{4}'' \times 8' \div 12 = 4\frac{1}{4}$, thus the SM is 4'. Multiply the SM by the thickness 2" and the BF is 8'.

When preparing a bundle tally for export, the boards are recorded by their width and length. Random widths above or below the half inch are rounded to the nearest whole inch. Board widths falling exactly on the half inch are alternatively rounded up or down. Lengths that fall between whole foot increments are always rounded down to the nearest whole foot. For example a board 5 1/4" width and 8 1/2' long is tallied 5" and 8'.

Standard thickness for rough sawn lumber

Standard thickness for rough sawn lumber is expressed in quarters of an inch. For example 1" = 4/4. The majority of US hardwood lumber production is sawn between 1" and 2", although other thicknesses are available in more limited volumes. The standard thicknesses and their exact metric equivalent are shown below.

3/4	(3/4" = 19.0mm)	8/4	(2" = 50.8mm)
4/4	(1" = 25.4mm)	10/4	(2 1/2" = 63.5mm)
5/4	(1 1/4" = 31.8mm)	12/4	(3" = 76.2mm)
6/4	(1 1/2" = 38.1mm)	16/4	(4" = 101.6mm)

Standard thickness for surfaced (planed) lumber

When rough sawn lumber is surfaced (planed) to a finished thickness, defects such as checks, stain, and warp are not considered when establishing the grade of a board, **if they can be removed in the surfacing (planing) process**. The finished thickness for lumber of 1 1/2" and less can be determined by subtracting 3/64" from the nominal thickness. For lumber 1 3/4" and thicker, subtract 1/4".

Measurement of kiln dried lumber

Net tally: The actual board feet of kiln dried lumber measured after kiln drying.

Gross or green tally: The actual board feet measured before kiln drying. When kiln dried lumber is sold on this basis, the buyer can expect to receive approximately 7% less board feet because of shrinkage in the kiln drying process.

Estimating board feet in a bundle of lumber

To determine the board feet of one board, the procedure is to multiply the surface measure by the thickness. A bundle of lumber can be estimated in much the same manner. First, calculate the surface measure of one layer of boards. Do this by multiplying the width of the bundle, minus gaps, by the length of the bundle and divide the sum by 12. If there are several lengths in the bundle, use an average length. Once one layer is estimated, multiply this sum by the total number of layers.

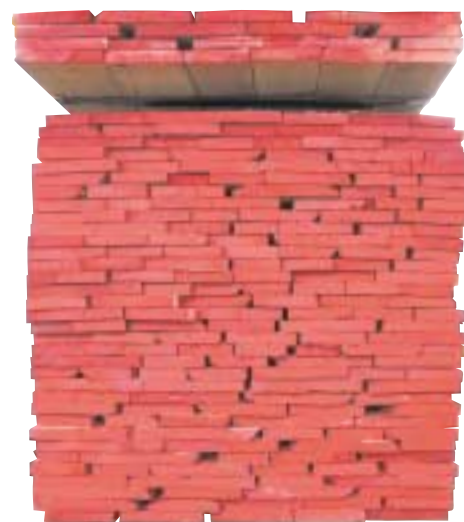
Example:

Average width of unit 40"
(lumber only, after allowing for gaps between boards)

Length of unit 10'

$$\begin{aligned}
 40'' \times 10' &= 400 \div 12 &&= 33.33 \\
 \text{Thickness of lumber } 8/4 &&&\times 2 \\
 &&&= 66.66 \\
 \text{Number of layers} &&&\times 10 \\
 &&&= 666.67 \\
 &&&\text{-----}
 \end{aligned}$$

Estimated board feet of the bundle 667 BF



Conversion factors

1": 25.4 millimetres (mm)
1m: 3.281 feet
1,000BF: (1MBF) 2.36 cubic metres (m³)

1m³: 424 board feet (BF)
1m³: 35.315 cubic feet (cu.ft)

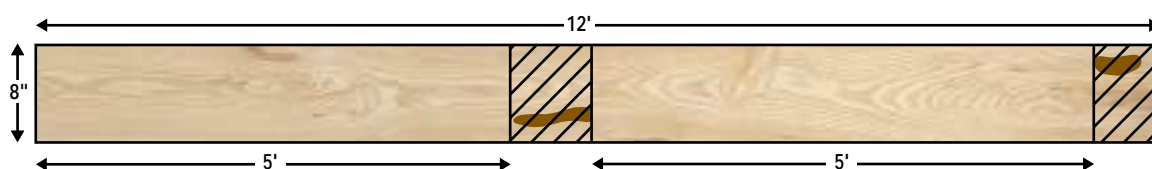
FAS and FAS One Face (Selects)

FAS

The FAS grade, which derives from an original grade "First And Seconds", will provide the user with long, clear cuttings - best suited for high quality furniture, interior joinery and solid wood mouldings. Minimum board size is 6" and wider and 8' and longer. The FAS grade includes a range of boards that yield from 83½% (10½ths) to 100% clear-wood cuttings over the entire surface of the board. The clear cuttings must be a minimum size of 3" wide by 7' long or 4" wide by 5' long. The number of these cuttings permitted depends on the size of the board with most boards permitting one to two. The minimum width and length will vary, depending on species and whether the board is green or kiln dried. **Both faces of the board must meet the minimum requirement for FAS.**



Note: Minimum yield 83½% clear wood cuttings on the poor face of the board.



FAS One Face (F1F)

This grade is nearly always shipped with FAS. The better face must meet all FAS requirements while the poor face must meet all the requirements of the Number 1 Common grade, thus ensuring the buyer with at least one FAS face. Often export shipments are assembled with an 80-20 mix, 80% being the percentage of FAS boards and 20% being the percentage of F1F boards. These percentages are strictly left to individual buyer and seller agreement.

Selects

This grade is virtually the same as F1F except for the minimum board size required. Selects allow boards 4" and wider and 6' and longer in length. The Selects grade is generally associated with the northern regions of the USA and is also shipped in combination with the FAS grade.

Often export shipments of upper grades are simply referred to as FAS. The conventional business practice for American hardwoods is to ship these upper grades in some combination. Working closely with the supplier will enable the buyer to be sure that the expected quality will be received. Whether FAS is combined with F1F (Face **A**nd **B**etter) or Selects (**S**el **A**nd **B**etter) every board in the shipment must have a minimum of one FAS face.

Prime grade: This grade has evolved from the NHLA grade of FAS for the export market. It is square edged and virtually wane free. The minimum clear yield will be select and better with appearance being a major factor. Minimum size of the boards varies, depending on the species, region, and supplier.

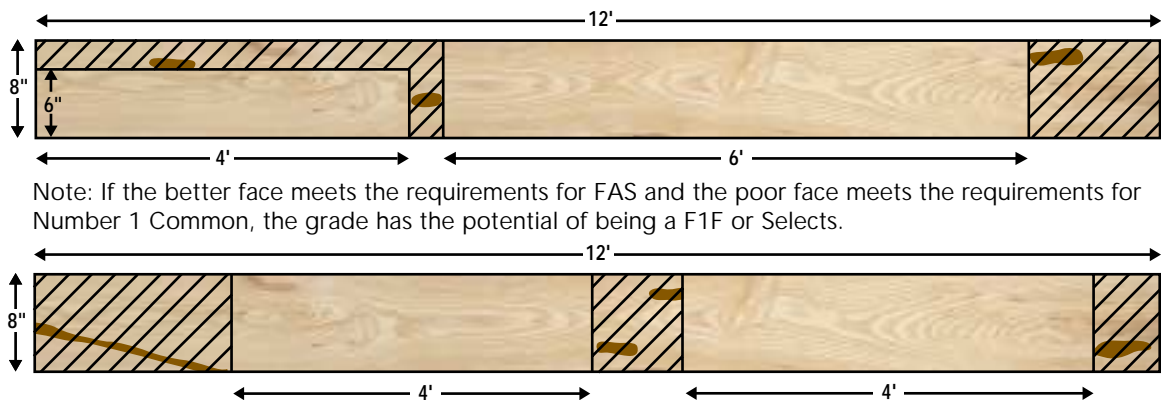
Comsel grade: This grade has evolved from the NHLA grades of Number 1 Common and Selects. For the export market the minimum clear yield should be Number 1 Common or slightly better with appearance a main factor. Minimum size of the boards varies, depending on the species, region and supplier.

Note: The terms Prime and Comsels are not standard NHLA definitions and therefore fall outside the official range of the NHLA grading rules.

No. 1 Common and No. 2A Common

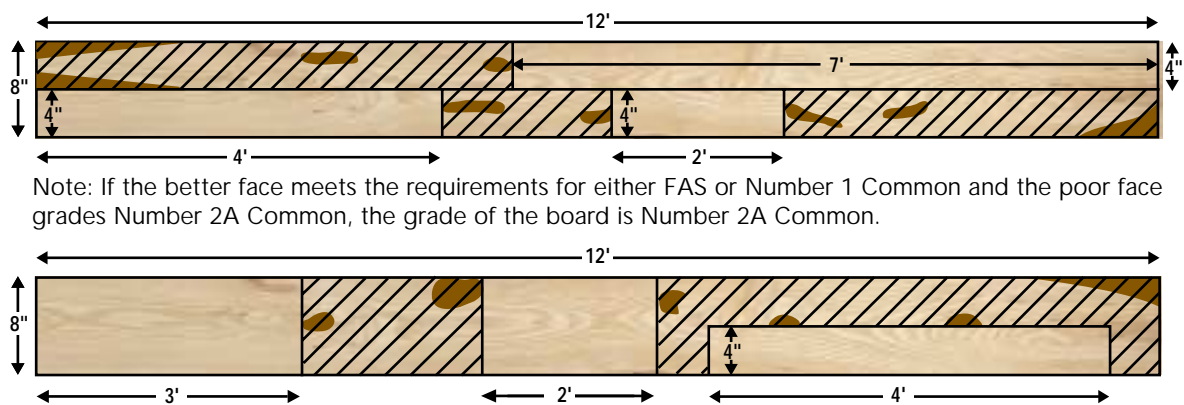
Number 1 Common (No. 1C)

The Number 1 Common grade is often referred to as the Cabinet grade in the USA because of its adaptability to the standard sizes of kitchen cabinet doors used throughout the United States. Number 1 Common is widely used in the manufacture of furniture parts as well for this same reason. The Number 1 Common grades includes boards that are a minimum of 3" wide and 4' long and will yield clear face cuttings from 66 $\frac{2}{3}$ % ($\frac{1}{2}$ ths) up to, but not including, the minimum requirement for FAS (83 $\frac{1}{3}$ %). The smallest clear cuttings allowed are 3" by 3' and 4" by 2'. The number of these clear cuttings is determined by the size of the board. **Both faces of the board must meet the minimum requirement for Number 1 Common.**



Number 2A Common (No. 2AC)

The Number 2A Common grade is often referred to as the Economy grade because of its price and suitability for a wide range of furniture parts. It is also the grade of choice for the US hardwood flooring industry. The Number 2A Common grade includes boards that are a minimum of 3" wide and 4' long that yield from 50% ($\frac{1}{2}$ ths) up to, but not including, the minimum requirement for Number 1 Common (66 $\frac{2}{3}$ %). The smallest clear cutting allowed is 3" by 2' and the number of these cuttings depends on the size of the board. If the poorest face meets the minimum requirements for Number 2A Common, it does not matter what the grade of the better face is.



There are lower NHLA grades than Number 2A Common but they are usually converted into dimension parts, flooring parts, or used domestically in the USA.

These Standard Grades form the framework by which all American hardwoods are traded. It is important to note that between buyer and seller any exception to these rules is permissible and even encouraged. For a complete description of the NHLA's "Rules for the Measurement and Inspection of Hardwoods and Cypress".

Characteristics and defects

The following pages show characteristics that occur in US hardwoods. Some are inherent to certain species and others are generic to all. These characteristics either occur naturally in the lumber or as a result of the drying process. As has already been discussed, the grades are based on the percentage of clear, defect free wood in the board.

The NHLA grading rules allow the following characteristics in the clear cutting percentages for all grades and they are therefore not considered defects.



HEARTWOOD and SAPWOOD:
Heartwood is the mature wood, which is often darker, extending from the sapwood to the pith. Sapwood is the lighter coloured wood growing from inside the bark to the heartwood.



BURL:
A swirl or twist in the grain of the wood that does not contain a knot.



GUM STREAKS:
Mineral-like streaks of colour naturally occurring only in cherry.



MINERAL STREAKS:
Streaks of colour ranging from olive to blackish-brown, which typically follow the grain pattern.



GLASSWORM:
Random mineral like tracts. Usually associated with ash



STICKER MARK:
The mark left on the board from a seasoning sticker, which can be removed in the surfacing planing process.

Note: Although the NHLA grading rules do not consider these characteristics as defects for the standard grades, allowances are made within the individual species. For example, species such as hard maple and ash are more desirable if there is a large portion of the board that is sapwood (white) and very little heartwood. The reverse is true when specifying species such as cherry, oak and walnut. It is essential that the buyers familiarise themselves not only with each species but the growing regions throughout the USA as well. Climate, soil and growing conditions such as hills and valleys all play an important role in the growth of the tree. As previously stated, the NHLA rules are the framework to begin the trading process. More information on characteristics found in individual species is available in other AHEC technical publications.

The NHLA grading rules do not allow the following characteristics in the clear cuttings for all grades and they are therefore considered defects.



BARK POCKET:
A bark-filled distortion in the grain pattern.



BIRD PECKS:
Small blemishes in the grain pattern resulting from birds pecking that sometimes contain ingrown bark. An exception to the rule is hickory and elm.



CHECK:
A lengthwise opening on the face of the board resulting from rapid or faulty drying.



DECAY OR ROT:
The breaking down of the wood substance by fungi. The discoloration of the sapwood indicates the initial evidence of decay.



UNSOUND KNOT:
A circular area that once formed the base of a branch or twig and has a pith centre. (In some cases the wood may be missing).



SOUND KNOT:
A knot solid across its face, which shows no indication of decay.



SPLIT:
A lengthwise separation of the wood created as the wood dries. Shake is a separation between the annual growth rings.



STICKER STAIN:
Stain that is typically grey in colour occurring from stickers used to season lumber.



WANE:
Bark or the lack of wood caused by the round nature of the tree or log.



WORM HOLES:
Holes in the wood ranging in size from $\frac{1}{16}$ " to over $\frac{1}{4}$ "



PITH:
The small soft core at the structural centre of the tree.



GRUB HOLES:
Holes larger than $\frac{1}{4}$ "

Common name:

American ash *Fraxinus spp*

Other names: **Northern ash, Southern ash**

FAS



No. 1C



No. 2AC

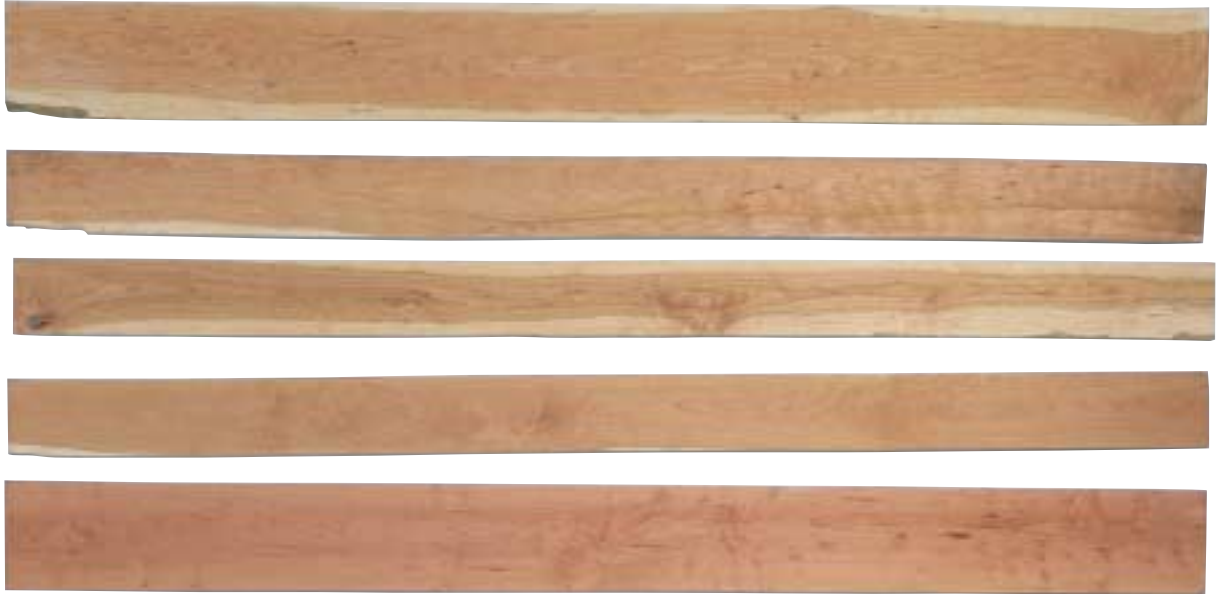


Common name:

American cherry *Prunus serotina*

Other names: **American black cherry**

FAS



No. 1C



No. 2AC



Common name:

American cottonwood *Populus deltoides*

Other names: Eastern cottonwood, Eastern poplar, Carolina poplar

FAS



No. 1C



No. 2AC



Common name:

American gum *Liquidamber styraciflua*

Other names: **Redgum, sappum, sweetgum**

FAS



No. 1C



No. 2AC



Common name:

American hard maple *Acer saccharum*, *A. nigrum*

Other names: **Sugar maple, black maple**

FAS



No. 1C



No. 2AC



Common name:

American soft maple *Principally Acer rubrum, A. saccharinum*

Other names: **Red maple, silver maple**

FAS



No. 1C



No. 2AC



Common name:

American red oak *Quercus spp*

Other names: **Northern red oak, Southern red oak**

FAS



No. 1C



No. 2AC



Common name:

American white oak *Quercus spp*

Other names: **Northern white oak, Southern white oak**

FAS



No. 1C



No. 2AC



Common name:

American tulipwood *Liriodendron tulipifera*

Other names: **Yellow poplar (USA), tulip poplar (USA), canary whitewood**

FAS



No. 1C



No. 2AC



Common name:

American black walnut *Juglans nigra*

Other names: **Black walnut, American walnut**

FAS



No. 1C



No. 2AC



Additional guidance

Regional exceptions to the standard NHLA grades

The NHLA grades cover the majority of commercial hardwood species growing in the USA. The following is a brief summary of various species and colour sorting that can be ordered from the American supplier.

Red alder

Grows exclusively in the Pacific Northwest between the vast stands of softwood timber such as Douglas fir and pine and is the most important commercial hardwood in this region. The grading rules for red alder are geared more for specific end uses and appearance. The rules were developed on the West Coast of the USA with those manufacturers and exports in mind. An exceptional cabinet wood typically sold surfaced (planed) and often cut to specific lengths and widths. Consult with your local supplier for a more detailed explanation of the alder grades and products available.

Walnut

Considered the elite of the American hardwoods, walnut is the favourite of the darker woods for fine furniture, interiors and gunstocks. Walnut grows in widely scattered stands throughout the eastern half of the United States, primarily in the Midwest. Historically, the grading rules for FAS walnut have been refined to encourage better use of this valuable species. Because of this, FAS Walnut grades allow for smaller boards, both in width and length. Natural characteristics are also admitted to a greater extent than the standard NHLA grade rules for other species. A detailed explanation can be found in the NHLA rules book. Consult with your local supplier for the walnut grades and products available.

Colour sorting

In addition to sorting for grades or selecting specific widths, various species are commercially sold at an added value when colour is also considered. It is important to note, colour in this explanation refers to sapwood and heartwood.

Number 1 and 2 white

A colour selection typically made on hard maple, but can be applied to any species where sapwood clear cuttings are desired, such as ash, birch, and soft maple.

Number 1 white means both faces and edges of the clear cuttings must be all sapwood.

Number 2 white means that one face and both edges of the clear cuttings must be sapwood and not less than 50% sapwood on the reverse face.

Sap and better

Commercially sold when only one face of the board needs to be sapwood. Usually applied to the same species as Number 1 and 2 White, although just a little less stringent. In Sap and Better every board should have a minimum of one sapwood face in the clear cuttings.

Red one face and better

Commercially sold when a minimum of one face of the board needs to be heartwood. Usually applied to species such as cherry, oak, walnut, gum, and even birch and maple in certain applications. What the producer is looking for in this specification is that all clear cuttings must have a minimum of one heartwood face.

There is a wide range of additional options open to American hardwood producers in sorting and selecting specific lengths, widths and even grain patterns. If these can be agreed individually between producers and buyers, there can be benefits by making modifications to the standard grades shown in this guide. This may also assist with improving the yield from each log and thus contribute to the sustainability of the forest. It may also reduce costs to both sides or add value to the delivery.

The steps in determining grade

1. Determine species.
2. Calculate the Surface Measure (SM).
3. Determine the poor side of the board.
4. From this poor face, calculate the percentage of clear wood available.
Note: If Number 1 Common is the grade of the poor face, check the better face to see if it will grade FAS for the F1F or Selects grades to be achieved.
5. Once the grade is determined, check for any special features such as sapwood or heartwood cuttings for special colour sorts.
6. Sort to bundles according to buyer and seller specifications.

Contacts and acknowledgments

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Summary of US hardwood lumber grades

	FAS	FAS 1 FACE	SELECTS	NO. 1 COMMON	NO. 2A & B COMMON
Minimum Board size	6" x 8'	Same as FAS for species being graded	4" x 6'	3" x 4'	3" x 4'
Minimum Cutting Size	4" x 5' 3" x 7'	Best face of board must grade FAS	Best face of board must grade FAS	4" x 2' 3" x 3'	3" x 2'
Minimum Yield	Surface measure x 10 83 $\frac{1}{8}$ %			Surface measure x 8 66 $\frac{2}{3}$ %	Surface measure x 6 50%
Formula to Determine Number of Clear Cuttings	$\frac{\text{Surface measure}}{4}$	Poor face of board must grade No 1 Common		$\frac{\text{Surface measure} + 1}{3}$	$\frac{\text{Surface measure}}{2}$

- Notes:**
- This chart summarises the main requirements for the standard grades. For complete information, consult the appropriate section of the NHLA Rule Book.
 - For kiln dried lumber, $\frac{1}{2}$ " shrinkage is permitted for the minimum size board in each grade.
 - No. 2A Common requires clear cuttings.
 - No. 2B Common is a utility grade requiring cuttings to be sound.
 - When specified for export shipment, a comparison can be made respectively between export grades of **PRIME** and **COMSEL** with the NHLA grades of FAS and No. 1 Common. It is necessary to consult with your supplier as to the exact specification being applied to these export grades.

