



**AMERICAN
HARDWOOD
EXPORT
COUNCIL**

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 2,000 members worldwide and the NHLA rules are still the national standard for the U.S. 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 U.S. 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 nine important U.S. 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 U.S. 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:

$$\frac{W \times L \times D}{12} = \text{BF}$$

(width in inches) (length in feet) (thickness in inches)

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

Surface measure

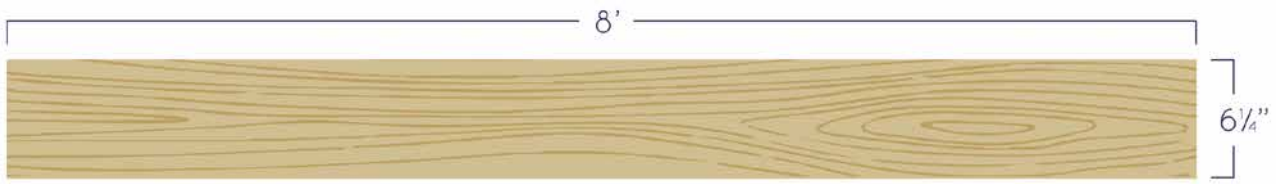
Surface measure (SM) is the surface area of a board in square feet. To determine surface measure, multiply the width of the board in inches by the length of the board in feet and divide the sum by 12, rounding up or down to the nearest whole number. The percentage of clear wood required for each grade 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.

$$\frac{W \times L}{12} = \text{SM}$$

(width in inches) (length in feet)

Example of SM and BF:

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



$$\frac{6 \frac{1}{4}'' \times 8'}{12} = 4 \frac{1}{6}''$$

thus the SM is 4'.

$$4' \times 2'' = 8'$$

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 U.S. 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, stains 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 3/16" 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.

Inspection of kiln dried lumber

The minimum widths and thicknesses mentioned in this publication are based on green or air dried lumber. The *Standard Kiln Dried Rule* listed in the NHLA Rules includes allowances for shrinkage after kiln drying and these are:

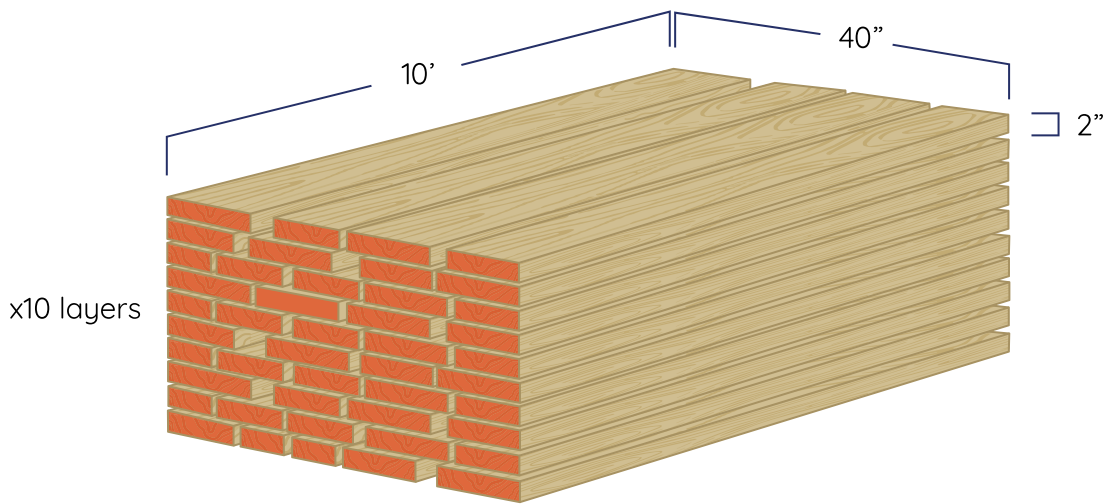
Rough kiln dried lumber specified 3/8" to 1 3/4" thick may be 1/16" scant of the nominal thickness; 2" and thicker may be 1/8" scant. The minimum widths mentioned in all grades may be 1/4" scant in width.

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)

SM of one layer $40'' \times 10' = \frac{400}{12} = 33.33$

BF of one layer (multiply SM by thickness) $33.33 \times 2'' = 66.66$

BF of bundle (multiply by number of layers) $66.66 \times 10 = 666.67$

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 metre (m ³)
1m ³	424 board feet (BF)
1m ³	35.315 cubic feet (cu.ft)

TOP TIPS:

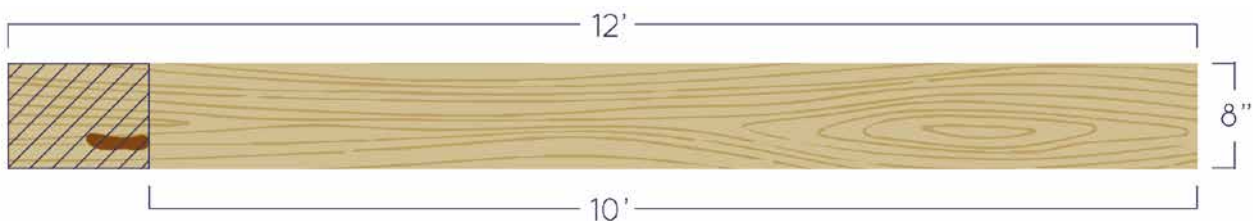
1. Standard thickness for rough sawn lumber is expressed in quarters of an inch.
2. Defects such as checks, stains and warp are not considered when establishing the grade of a board if they can be removed in the surfacing process.
3. If buying kiln dried lumber on a gross tally, the buyer can expect to receive approximately 7% less board footage.

The grades

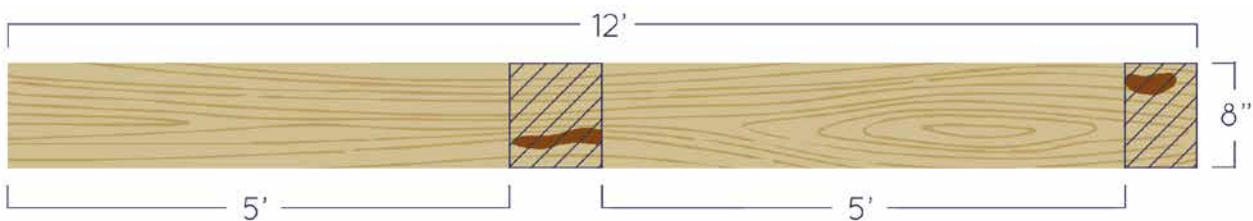
FAS

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 83 1/3% (10/12ths) 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 83 1/3 % 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. There is no standard percentage of FAS One Face that may be included in a shipment; this can vary between suppliers and shipments. If the amount included in a shipment is a concern, please consult the supplier for amount.

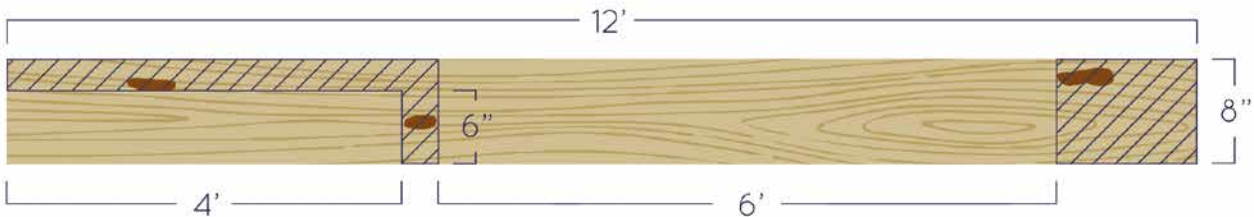
Selects

This grade is virtually the same as FAS 1F 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. When FAS is combined with F1F or Selects every board in the shipment must have a minimum of one FAS face.

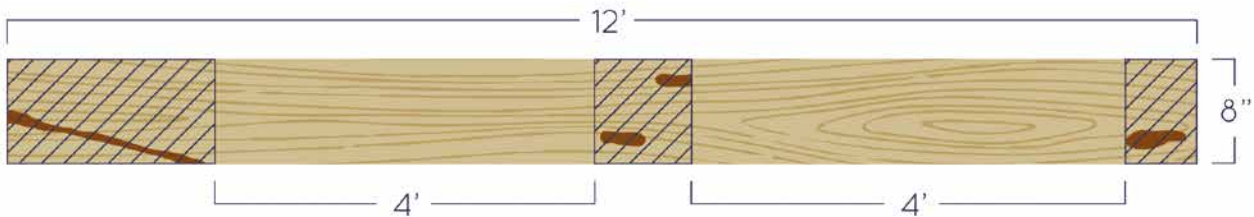
Number 1 Common (No. 1C):

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 ²/₃% (8⁸/₁₂ths) up to, but not including, the minimum requirement for FAS (83 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.



Note: If the better face meets the requirements for FAS and the poor face meets the requirements for Number 1 Common, the grade has the potential of being a F1F or Selects.

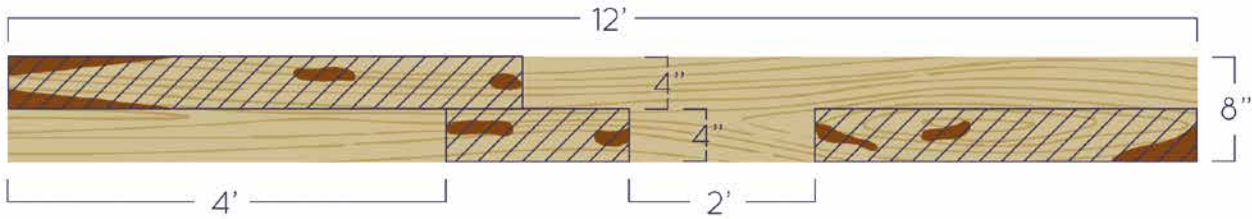


TOP TIPS:

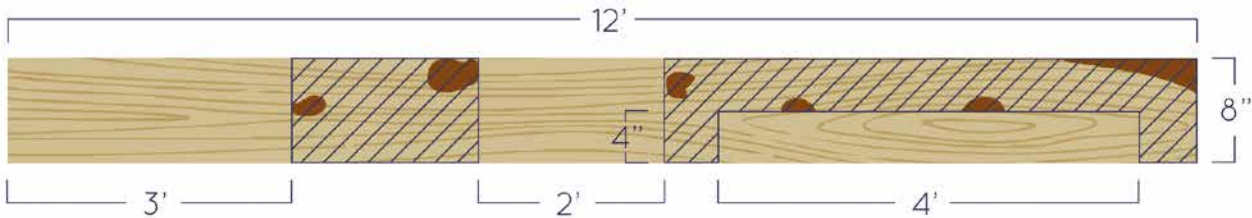
1. The FAS grade will provide the user with long, clear cuttings – best suited for high quality furniture, interior joinery and solid wood mouldings.
2. The better face of F1F grade must meet all FAS requirements while the poor face must meet all the requirements of the Number 1 Common grade.
3. The Selects grade is virtually the same as FAS 1F except the minimum board size allows boards 4" and wider and 6' and longer in length.
4. The Number 1 Common grade includes boards that are a minimum of 3" wide and 4' long. The smallest clear cuttings allowed are 3" by 3" and 4" by 2'.

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 U.S. hardwood flooring industry. The Number 2A Common grade includes boards that are a minimum of 3" wide and 4' long that yield from 50% ($\frac{6}{12}$ 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.



Note: If the better face meets the requirements for FAS and the poor face meets the requirements for Number 1 Common, the grade has the potential of being a F1F or Selects.



Note: If the better face meets the requirements for FAS and the poor face meets the requirements for Number 1 Common, the grade has the potential of being a F1F or Selects.

Number 2B Common (No. 2BC)

Number 2B Common has the same requirements as Number 2A Common with the exception that all required cuttings are only required to be sound.

Number 2 Common is a combination of Number 2A Common and Number 2B Common with no percentage of either grade required in any shipment.

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 grades, consult the NHLA's *Rules for the Measurement and Inspection of Hardwoods and Cypress*.

TOP TIPS:

1. If the poorest face of No. 2AC meets the minimum requirements for Number 2A Common, it does not matter what the grade of the better face is.

Characteristics

The following images show characteristics that occur in U.S. 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 previously mentioned, 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 colored 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 color naturally occurring only in cherry.



Mineral streaks

Streaks of color 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.



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 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 about the characteristics, physical properties and uses for individual species can be found at americanhardwood.org and in other AHEC technical publications.

Defects



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.



Sound knot

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



Sticker stain

Stain that is typically grey in color occurring from stickers used to season lumber.



Worm holes

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



Bark pocket

A bark-filled distortion in the grain pattern.



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).



Split

A lengthwise separation of the wood created as the wood dries.



Shake

A separation between the annual growth rings.



Wane

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



Pith

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



Grub holes

Holes larger than 1/4".

Note: The following defects are considered sound and are allowed in the clear cutting of 2B Common: bird pecks, sound knot, sticker stain and worm holes.

American ash

Fraxinus species, including *Fraxinus americana*
Other names: northern ash, southern ash

FAS



No. 1C



No. 2AC



American cherry

Prunus serotina
Other names: black cherry

FAS



No. 1C



No. 2AC



American hickory

Carya spp

Other names: often referred to as pecan in the South

FAS



No. 1C



No. 2AC



No. 2BC



American hard maple

Acer saccharum, *Acer nigrum*
Other names: sugar maple, rock maple, black maple

FAS



No. 1C



No. 2AC



American soft maple

Acer rubrum, *Acer saccharinum*
Other names: red maple, silver maple

FAS



No. 1C



No. 2AC



No. 2BC



American red oak

Quercus species, mainly *Quercus rubra*
Other names: northern red oak, southern red oak

FAS



No. 1C



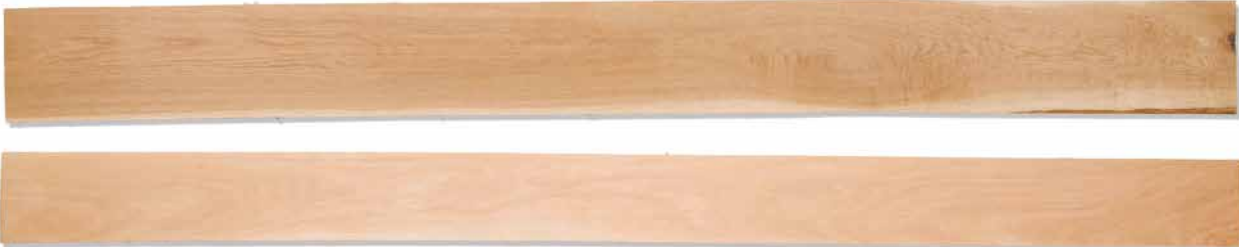
No. 2AC



American white oak

Quercus species, mainly *Q. alba*
Other names: northern white oak, southern white oak

FAS



No. 1C



No. 2AC



American tulipwood

Liriodendron tulipifera

Other names: yellow poplar, tulip poplar, canary whitewood;
not to be confused with European or Chinese poplar

FAS



No. 1C



No. 2AC



American walnut

Juglans nigra
Other names: black walnut

FAS



No. 1C



No. 2AC



No. 2BC



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 the various species and color sorting that can be ordered from the American supplier.

American 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. Alder is graded using *NHLA Pacific Coast Red Alder Rules* published in the *NHLA Rules for the Measurement & Inspection of Hardwood and Cypress*. The rules were developed on the West Coast of the USA with those manufacturers and exports in mind.

The key grading points include grading from the better face rather than poor side as in the standard NHLA Grading Rules; pin knots are regarded as character and no defect. The primary grades include Superior (Select & Better), Cabinet (No. 1 Common) and Frame (No. 2 Common) which are similar to the uses as for the standard NHLA grades. An exceptional cabinet grade would be 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.

American 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.

TOP TIPS:

1. U.S. red alder is graded using the better face rather than the poor side.
2. U.S. walnut grading rules allow for smaller boards both in width and length.

Color sorting

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

Number 1 white / Number 2 white

A color 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 white' and 'Number 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 is 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 contributing to the sustainability of the forest. It may also reduce costs to both sides or add value to the delivery.

Definition of sound cutting

A cutting free from rot, pith, shake and wane. Texture is not considered. It will admit sound knots, bird pecks, stains, streaks or their equivalent, season checks not materially impairing the strength of a cutting, pin, shot and spot worm holes. Other holes $\frac{1}{4}$ " or larger are admitted, but shall be limited as follows: one $\frac{1}{4}$ " in average diameter in each cutting of less than 12 units; two $\frac{1}{4}$ " or one $\frac{1}{2}$ " to each 12 units and on one side only of a cutting.

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.
5. If No.1C is the grade of the poor face, check the better face to see if it will grade FAS for the F1F or Select grades to be achieved.
6. Once the grade is determined, check for any special features such as sapwood or heartwood cuttings for special color sorts.
7. Sort to bundles according to buyer and seller specifications.

Summary of U.S. hardwood lumber grades

	FAS	FAS 1 Face	Selects	No. 1 Common	No. 2A & 2B 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 Poor face of board must grade No. 1 Common		4" x 2' 3" x 3'	3" x 2'
Minimum yield	SM x 10 83 $\frac{1}{3}$ %			SM x 8 66 $\frac{2}{3}$ %	SM x 6 50%
Formula to determine number of clear cuttings	$\frac{SM}{4}$			$\frac{SM + 1}{3}$	$\frac{SM}{2}$

Notes:

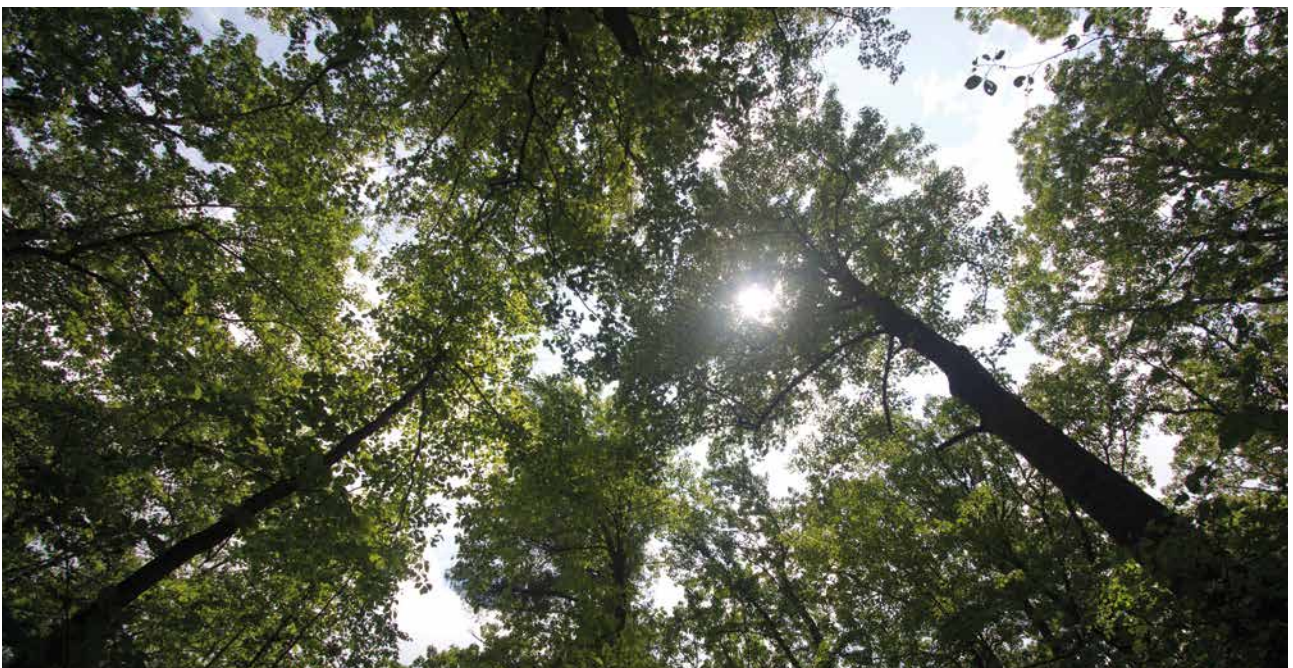
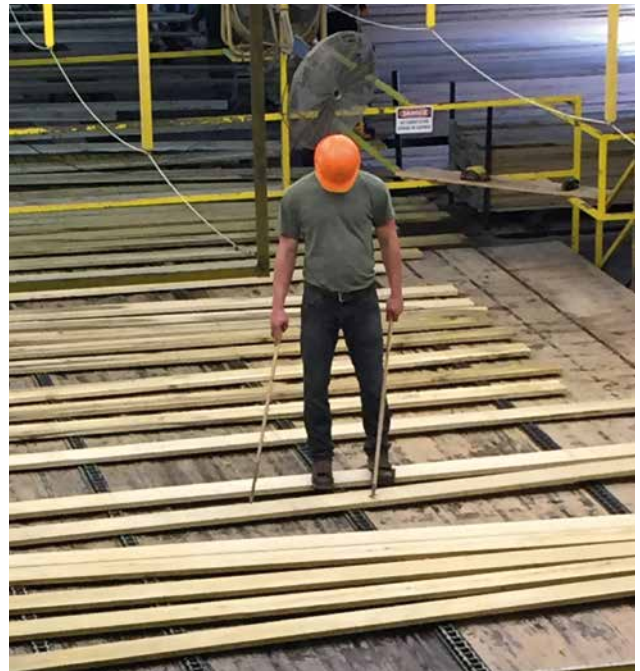
- This chart summarises the main requirements for the standard grades. For complete information, consult the appropriate section of the NHLA Rule Book.
- For kiln dried lumber, $\frac{1}{2}$ " shrinkage is permitted for the minimum size board in each grade.
- No. 2A Common requires clear cuttings.
- No. 2B Common is a utility grade requiring cuttings to be sound.

This publication has been put together in collaboration with the National Hardwood Lumber Association (NHLA) who developed and maintain the standard for grading American hardwood lumber. The information in this publication summarizes the most commercially utilized grades and provides illustrations to guide buyers in export markets. Copies of the full NHLA Rules book together with guidance on commercial issues relating to these grading rules should be directed to the NHLA.

www.nhla.com

For further detailed technical information on American hardwood species, products, grading and applications, please visit www.americanhardwood.org, where you can also download or order copies of other AHEC publications.

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