Wood-Mizer® Sawmill

General Information

Basic concepts regarding sawing and drying lumber

Safety is our #1 concern! Read and understand all safety information and instructions before operating, setting up or maintaining this machine.

Form #601

Wood-Mizer
8180 West 10th Street
Indianapolis, Indiana 46214

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SECTION 1 SAWING METHODS

1.1 Quartersawing

This section will explain a cutting technique called quartersawing. You will learn when, why and how to quartersaw on a Wood-Mizer.

The Society of American Foresters defines quartersawn as:

"Timber converted so that the growth layers meet the face of any part at an angle not less than 45 degrees. When the angle is not less than 80 degrees, the timber is termed "fully quartersawn".

In other words, a fully quartersawn board has growth rings that are approximately perpendicular to the face of the board.

See Figure 1-1. The board is still quartersawn as long as the growth rings are not less than 45 degrees to the face of the board.

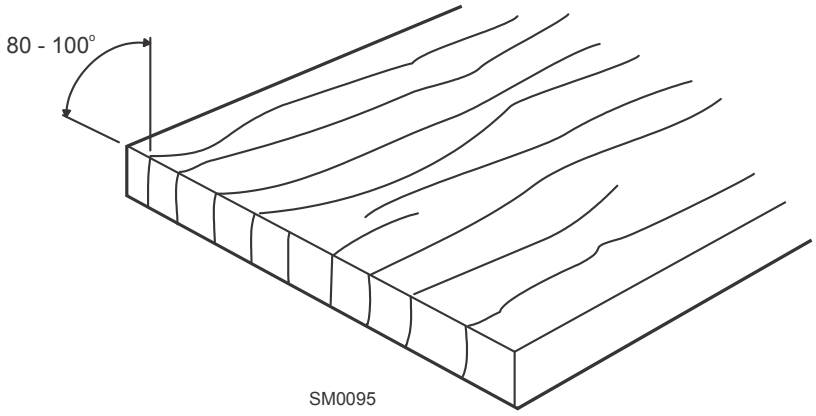

FIG. 1-1

See Figure 1-2. There are several reasons to consider quartersawing your lumber. In some hardwoods, the grain patterns are in great demand. Quartersawn oak has a different grain pattern and is more valuable than plainsawn oak. Quartersawn wood is also more dimensionally sound. It will not cup or dish while drying, and will shrink less than plainsawn boards. For these reasons, most cabinet makers, quality furniture shops, and craftsmen prefer quartersawn boards.

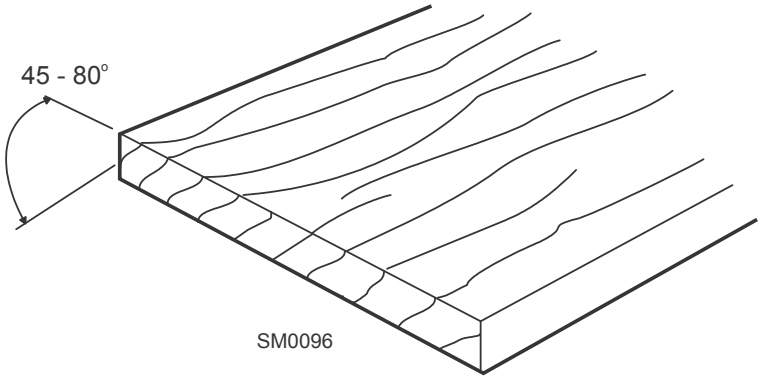

FIG. 1-2

Not all lumber will increase in value when quartersawn. Weigh the added handling and time involved against the added value of the quartersawn lumber. Quartersawing framing lumber isn't normally suggested. Quartersawing furniture-grade hardwoods makes sense.

Wood-Mizer makes commercial quartersawing simple and fast. Location of the first cut depends on your preferences and the shape of the log (oval, square, or round). The following example is our recommended approach to quartersawing on the Wood-Mizer.

See Figure 1-3. Shown is an end view of a log we will say is 17" (431.8 mm) in diameter. The first cut is made 11 1/2" (292.1 mm) above the bed. The top cant (A) is put aside. Six cuts of 1" (25.4 mm) (B) are made. Those boards are laid aside. The remaining cant (C) is rotated 90 degrees. Boards are cut starting 13" (330.2 mm) above the bed, down to 3" (76.2 mm) (D). These boards are acceptable as commercial-grade quartersawn lumber.

The two boards above and below are plainsawn. The boards (D) are placed vertically and edged. Cant (A) is handled the same way.

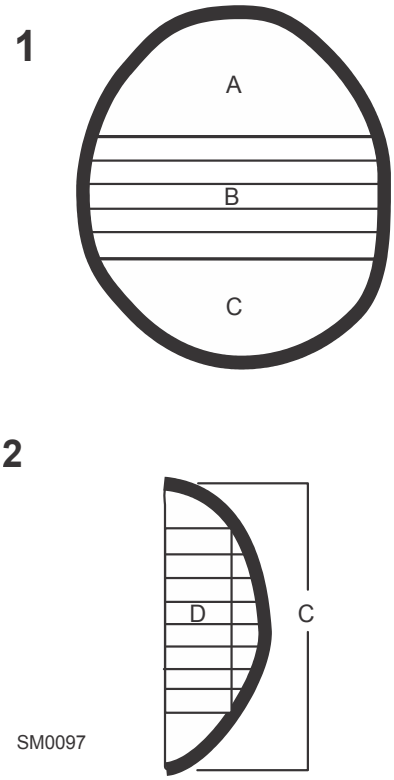

FIG. 1-3

See Figure 1-4. Boards (B) are then mounted vertically, sliced through the center, and edge. Using this approach, 60-70% of a good log can be efficiently sawn into the most valuable lumber.

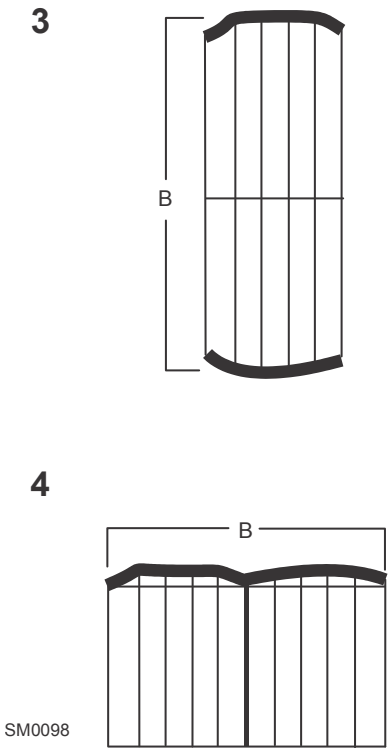

FIG. 1-4

1.2 Stress-Relief Sawing

Some species of wood have internal tension, called stress. When one side of the log is cut, unequal stress is created on the other. The result of this unequal stress is a bow in the log.

The amount of bowing depends on the species of wood, amount removed from one side, and ability to hold the log in place.

There are two methods used to cut logs with internal stress. The first is to avoid bowing by turning the log often as it is being sawn. Do not cut several boards from one side

before turning the log. Using this method releases stress gradually and evenly. It is used when sawing random widths and/or grade sawing.

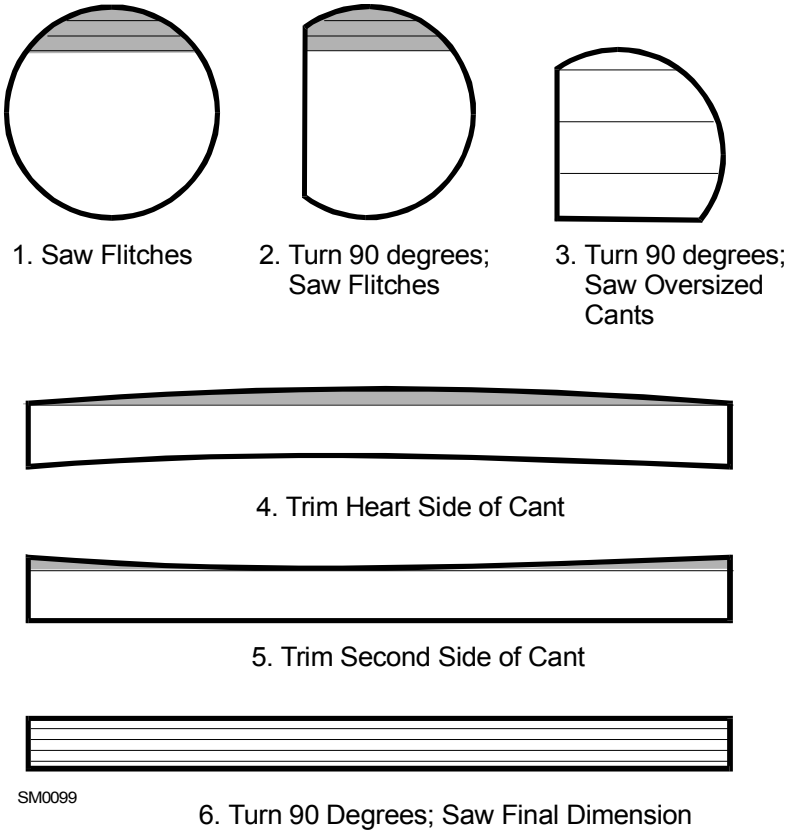

FIG. 1-5

The second method is to cut the log into oversized cants. Trim the cants. Then saw dimensional boards from the cants.

See Figure 1-6. When the log is cut into cants, most of the stress is released. If you oversize each cant, the bowed portions can be trimmed. The finished-dimension lumber can be sawn from the trimmed cant. As a rule, you should oversize each cant 1/16" for each foot of length.
Example: You plan to cut 1x5s from an 8' log.

1. Cut the log into 5 1/2" cants. (1/16" x 8 = 1/2"; 5" + 1/2" = 5 1/2").

2. Trim the 5 1/2" cant. Take 1/4" off of each side. Trim the heart side of the cant first. It will be bowed up and will not rock on the bed of the mill.

3. The trimmed cant can now be turned up on end and the 1" dimension sawn.

If you are sawing in metric dimensions, this means that you should oversize by 16 mm to get 8 cuts of 2 mm.

This method of stress-relief sawing produces mostly quartersawn boards. These will make more stable lengths of lumber.

SECTION 2 LUMBER SIZING AND VOLUME

2.1 Sizing Lumber (U.S. Only)

An important step in cutting lumber is determining the correct size. Lumber is usually sold by its **nominal** size. The size shows dimensions of the rough lumber in inches (1x2, 2x4, etc.). The first dimension is the thickness of the board. The second is its width. Boards are usually smoothed with a planer on all sides and dried. They are then **actual** size. **Example:** The actual size of a 2x4 is 1 1/2" x 3 1/2".

When cutting framing lumber, you should be able to cut its actual size (1 1/2" x 3 1/2" for a 2x4) directly on the mill. This avoids any planing-to-size. You may want to allow an over-cut of about 10% for shrinkage when dried.

See Table 2-1. This table compares the nominal and actual size of most common lumber sizes. Circular mills cut 1" hardwoods to be planed to 3/4". You can cut 15/16" lumber by dropping the carriage 1 full inch for each board.

Nominal Size	Actual Size (before planing)
1 x 2	25/32 x 1 5/8
2 x 2	1 5/8 x 1 5/8
1 x 3	25/32 x 2 5/8
2 x 3	1 5/8 x 2 5/8
1 x 4	25/32 x 3 5/8
2 x 4	1 5/8 x 3 5/8
1 x 5	25/32 x 4 5/8
1 x 6	25/32 x 5 5/8
2 x 6	1 5/8 x 5 5/8
1 x 8	25/32 x 7 1/2
1 x 10	25/32 x 9 1/2
2 x 10	1 5/8 x 9 1/2
1 x 12	25/32 x 11 1/2
2 x 12	1 5/8 x 11 1/2

TABLE 2-1

Example: A 15/16" board and 1/16" saw kerf = 1" drop. It is easy to get a planed 3/4" board because surface texture and accuracy are better with the Wood-Mizer.

2.2 Volume

Lumber is usually sold by a measurement of volume known as the board foot. To find the number of board feet in a board, multiply the nominal thickness times the nominal width times the actual length in feet, and divide by 12. A 1-foot-long 1x12 and a 2-foot-long 1x6 would both be sold as 1 board foot.

SECTION 3 LUMBER DRYING

3.1 General Wood Characteristics

After cutting, the ultimate value of your lumber depends on how it is processed. Many things will affect the amount of damage, or degrade, in the lumber. The most important of these is drying.

The two most common methods of drying wood are **kiln-drying** and **air-drying.** The kiln-drying process involves curing lumber in a closed chamber. Wood is dried to a chosen level by a carefully controlled combination of heat, relative humidity, and air circulation.

Wood-Mizer produces several sizes of solar kilns. The following sections describe the two types of Wood-Mizer kilns. Also included is a section on air-drying.

3.2 Solar Kiln-Drying

Wood-Mizer also offers a line of SolarDry Kilns in sizes for small operations up to larger commercial units. Drying times range from 5-8 weeks for 4/4 cherry and walnut, and 6-10 weeks for red and white oak. The natural conditioning cycle of the SolarDry allows these short drying times with less than 1% degrade. Drying times may also be reduced or maintained during colder, cloudy seasons by using back-up wood, gas or electric heating systems.

The SolarDry Kiln system uses a patented solar dehumidification process. The system has a double-walled solar collector. It allows a flow of air and moisture within the kiln to remove moisture from the wood. Heat of up to 150° F (65.5°C) circulates inside the chamber. A fan directs air to the cooler outside collector chamber. Moisture condenses and rolls down the surface of the outer panel of this chamber, where it exits.

SolarDry kits are available in 750-7200 board-foot (1.8-16.9 m^3) capacities. They are shipped complete, except for the foundation and wood chamber walls. Call a Customer Service Representative for more information regarding the Vacu-Kiln or SolarDry Kiln systems.

3.3 Air-Drying

Air-drying is the most common drying method used by most small mill operators. The following lines are paraphrased from the booklet "How to Dry Small Quantities of Lumber". It was prepared by the North Central Forest Experiment Station Forest Service, United States Department of Agriculture. Freshly-sawn hardwood lumber must be dried before use. Short lengths of green boards can be dried inexpensively at home. Green lumber up to 2" (50.8 mm) thick can be dried for use indoors in 1-4 months. The amount of time

depends on the species and wood thickness. Moisture content of dried lumber ranges from 6-11%, depending on conditions in the drying room. When using this method of drying, expect a large amount of defects.

Freshly cut lumber contains up to 1 pound (0.454 kilogram) of water for each pound of dry wood. If used in green condition, the lumber will continue to dry. This causes shrinking, decay, paint failure, and loosening of joints. To avoid these problems, the lumber must be dried.

When warm, dry air is moved over the surfaces of green wood, the wood absorbs heat from the air. This heat evaporates the water held in the wood.

Stack the wood in rows or tiers separated from each other by stickers. Stickers are pieces of dry lumber about 3/4" (19.0 mm) square. Line them up vertically to prevent sagging. Place the stack off of the ground. Put heavy weights on top of the stack to keep the boards flat.

Build the stack where warm, dry air can move through it. Heated or dehumidified indoor space or an attic above heated space are good locations. However, unheated sheds can be used for most of the drying. If no shed or indoor space is available to handle all of the lumber, you can build the stack outdoors. It must be protected from rain with a slightly sloping roof of plywood or other panel material. Stacks built outdoors or in unheated sheds will dry quickly in warm months, but much more slowly in cold winter months.

The stack will have to be moved into heated or dehumidified space to finish drying. Outdoor conditions will not dry the wood to the 6-10% moisture content needed for use indoors. Stack the wood indoors as previously described.

3.4 Drying Rate

Weigh a few boards from the stack at least once a week. When their weight stops dropping, the boards have stopped drying.

See Figure 3-1. An easy way to keep track of the wood's progress is by graphing the board weight as shown. The graph shows the weight-loss of white oak. It originally weighed 200 ounces (5670 grams). It was dried outdoors until the rate of weight-loss was low. The oak was then moved to heated indoor space. It was dried until there was no more weight-loss.

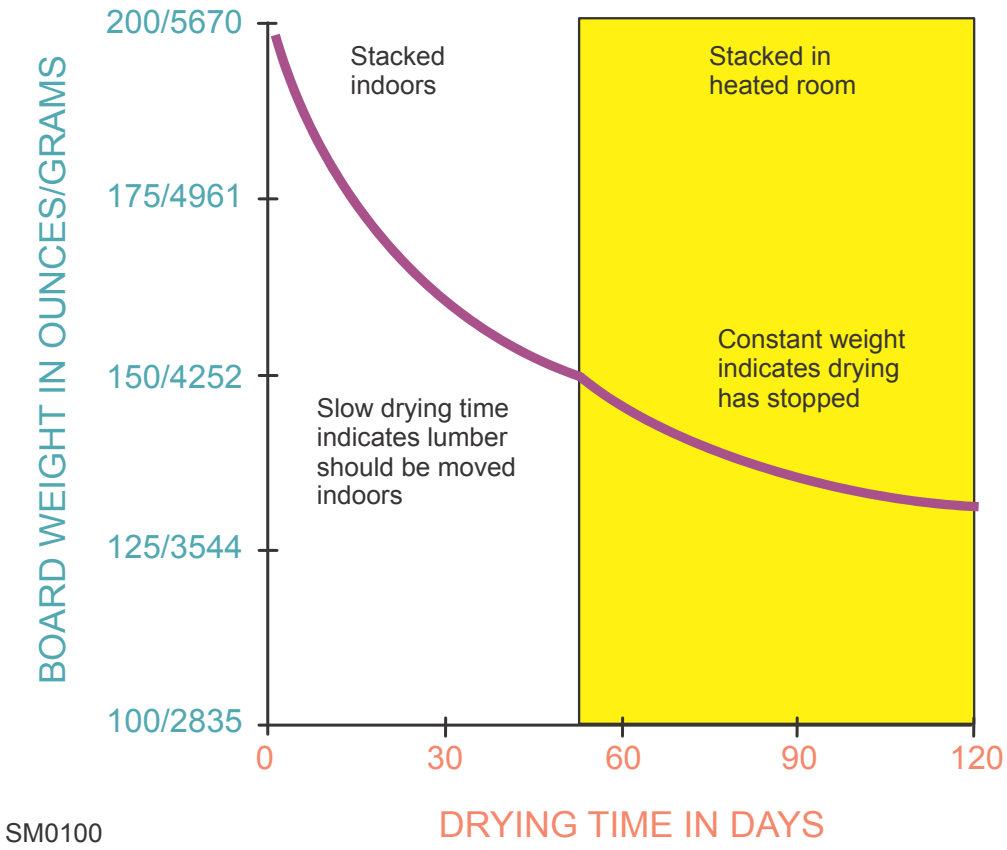

FIG. 3-1

Although a hard-to-dry species such as white oak took four months to dry, species like yellow poplar and silver maple can be dried in less than one month.

3.5 Drying Guidelines

End-coat your green logs and lumber with beeswax or a commercial sealer to reduce end checking.

Use light-colored wood for stickers to avoid staining the wood.

Stickers should be placed about 16" (406.4 mm) apart, and at both ends of the boards.

Keep dried lumber indoors in a dry place until you are ready to use it.

See Table 3-1 (next page). This table shows approximate time in days to air-dry green 1" (25.4 mm) lumber to 20% moisture content. The table gives you estimates of the time it takes to dry many different species of wood.

APPROXIMATE AIR DRYING TIME (1" GREEN LUMBER TO 20% MOISTURE CONTENT).			
Softwoods		**Hardwoods**	
Species	**Days**	**Species**	**Days**
Bald Cypress	100-300	Alder, Red	20-180
Douglas Fir:		Ash:	
Coast	20-200	Black	60-200
Interior North	20-180	Green	60-200
Interior South	10-100	White	60-200
Interior West	20-120	Aspen:	
Hemlock:		Bigtooth	50-150
Eastern	90-200	Quaking	50-150
Western	60-200	Basswood	40-150
Western Larch	60-120	Beech, American	70-200
Pine:		Birch:	
Eastern White	60-200	Paper	40-200
Jack	40-200	Sweet	70-200
Lodgepole	15-150	Yellow	70-200
Ponerosa	15-150	Butternut	60-200
Red	40-200	Cherry, Black	70-200
Southern Pine:		Cottonwood:	
Loblolly	30-150	Black	60-150
Longleaf	30-150	Eastern	60-150
Shortleaf	30-150	Elm:	
Slash	30-150	American	50-150
Sugar Pine:		Rock	80-180
Light	15-90	Hackberry	30-150
Sinker	45-200	Hickory	60-200
Western White	15-150	Magnolia	40-150
Redwood:		Maple:	
Light	60-185	Bigleaf	60-180
Sinker	200-365	Red	30-120
Spruce:		Silver	30-120
Engelmann	20-120	Sugar	50-200
Red	30-120	Oak:	
Sitka	40-150	Northern Red	70-200
White	30-120	Northern White	80-250
		Southern Red	100-300
		Southern White (Chestnut)	120-320
		Pecan	60-200
		Poplar, Yellow	40-150
		Sweetgum:	
		Heartwood	70-300
		Sapwood	60-200
		Sycamore, American	30-150
		Tanoak	180-365
		Tupelo:	
		Black	70-200

		Water	70-200
		Walnut, Black	70-200
		Willow, Black	30-150

SECTION 4 GRADING LUMBER

4.1 Standard Hardwood Grades

Rules for grading lumber change in different parts of the country and different parts of the world. Contact your area Lumber Association for more information.

Firsts And Seconds (FAS) Grade

Use: For long, wide cuttings (boards). As needed for fixtures and interior trim.

Board size: 6" (152.4 mm) and wider, 8' (2.03 mm) and longer.

Number of clear (without defect) face cuttings: Figured by Surface Measure (SM) of piece.

Size of clear face cuttings: 4" (101.6 mm) or wider by 5' (1.52 m) or longer, and 3" (76.2 mm) or wider by 7' (2.13 m) or longer.

Yield in board of clear face cuttings: 83 1/3% or more (amount of boards with no defects will not be less than 83 1/3%).

Select Grades

Use: For long, medium to narrow width cuttings, where only one good face will show. As needed for molding and wall paneling.

Board size: 4" (101.6 mm) and wider, 6' (1.83 m) and longer.

Clear face cuttings and yield: Same as FAS on better face. Lower-quality face will not grade below No. 1 Common.

No. 1 Common

Use: For medium length, narrow to wide cuttings. As needed for furniture manufacture.

Board size: 3" (76.2 mm) and wider, 4' (1.22 m) and longer.

Number of clear face cuttings: Figured by SM of piece.

Size of clear face cuttings: 4" (101.6 mm) or wider by 2' (0.61 m) or longer, and 3" (76.2 mm) or wider by 3' (0.91 m) or longer.

Yield in board of clear face cuttings: 66 2/3% or more.

Important Exceptions

Walnut, butternut, and all quartersawn woods are 5" (127.0 mm) and wider in FAS grade.

Minimum size of clear face cuttings in walnut and butternut are:

FAS: 4" (101.6 mm) or wider by 3' (0.91 m) or longer, and 3" (76.2 mm) or wider by 6' (1.83 m) or longer.

No. 1 Common: A clear face cutting shall not have less than 144 square inches (929 square millimeters). Minimum width 3" (76.2 mm) minimum length 2" (150.8 mm). No limit to number of cuttings.

FAS Poplar 8" (203.2 mm) and wider, not less than 66 2/3% heartwood on one side, not less than 50% on the other side. Pieces 7" (177.8 mm) wide allow 1" (25.4 mm) total sapwood on either or both faces. Pieces 6" (152.4 mm) wide must be all heartwood. Clear stock with too much sapwood is usually sold as SAPS, or sometimes as FAS Sap-No-Defect (SND).

4.2 Grades Of Western Pine

Select Grades

B AND BETTER SELECT (1 and 2 Clear). B and Better is the highest recognized grade of Pine. It is an almost-perfect grade. Although graded from the better side, even the backs of pieces in B and Better are of very high quality. For all practical purposes, the grade is clear.

B and Better Ponderosa Pine is used for finishing work of the highest quality. This includes interior trim, siding, paneling and cabinetry. It is also used for special industrial purposes where clear lumber in large pieces is needed.

C SELECT. The second grade of Pine finish lumber is C Select. It is a top-grade paint- finish wood. Many pieces have a B and Better face with backs of a slightly lower quality than are allowed in the higher grade. Other pieces look clear, but have small areas of torn grain, fine checks (cracks), or light pitch (sap). C Select can be used for high-quality work where totally clear lumber is not needed.

D SELECT. D Select includes pieces that look finished on one side. The backs of the boards will sometimes have knots, pitch, wane (bark left on the edges of the board), or a combination. In such cases, the face is of good quality. A type often seen is a high-quality piece needing a cut to get rid of a defect that cannot go into finished work. It is a useful grade for the small planing mill. It can be worked with little waste.

MOLDING GRADE. This is a special grade that has features of both Select and Factory grades. As the name suggests, the basis of the grade is a high yield in long, clear, narrow cuttings suitable for moldings. The price of Molding Grade is between D Select and Third Clear. The board will usually be too good for Third Clear and not good enough for D Select. It is a good buy for the custom woodworker, and can be used for most projects at a reasonable cost.

Common Grades

NUMBER 1 COMMON. No. 1 Common is the highest of five grades of the Pine Common classification. It has pieces with small knots. These knots are always sound, red or intergrown, and smooth. They are limited in size to a little more than 2" in diameter, depending upon the size of the piece. As a rule, the knots are much smaller and are well-distributed along the board. Only pieces that show smooth dressing around knots are allowed in No. 1 Common. Knots in No. 1 Common are usually round or oval in shape, and are not usually seen on the edges of the board.

NUMBER 2 COMMON. No. 2 Common is a very popular grade. A large amount of the total production of Ponderosa Pine lumber is graded as No. 2 Common. As a general-purpose utility grade, it can be used wherever a good grade of Common is needed. It has the same type of defects as No. 1, but in larger number. In narrow widths, knots are usually limited to 2 1/2" (63.5 mm) in diameter. In wider widths, knots are limited to 3 1/2" (88.9 mm). Knots usually do not get that large.

NUMBER 3 COMMON. No. 3 Common has pieces with more defects than the two higher Common grades. Some pieces of No. 1 or No. 2 quality will have one flaw that causes them to be Grade No. 3. Other pieces will show many rough knots, loose knots, or knotholes. A piece that has a knothole is usually high-quality, except for this flaw. Low-quality pieces of No. 3 may have a small amount of heart shake. Often seen is a piece with a No. 2 face and several skips that happened during planing.

SECTION 5 CUSTOM SAWING PRICING

How much should you charge when sawing wood for someone else? To answer this question, you must consider your region's current sawing fees, how much your competition charges, and the size, species, and condition of available timber.

This section covers the selling points and different pricing approaches to help you in determining pricing.

5.1 Wood-Mizer Advantages

Yield Per Log

The Wood-Mizer's high yield of usable lumber per log is one of its most important, and sometimes most overlooked, advantages. This higher yield has an easy-to-calculate real cost savings for every log cut. When cut with the Wood-Mizer, a 14"-18" (355.6-457.2 mm) diameter log (Doyle Scale) consistently produces as much as 50% over scale. This allows you to charge a much higher rate than a large mill. Also, you will have the same net cost as the larger mill per finished board foot). It is actually possible to charge twice the rate as other mills and still save a customer money. (See Section 1.5 for more information on lumber scales, log scales, and tree rules.)

An equation to calculate the cutting rate you can charge so the net cost per board foot is the same as other mills is: $$WR = \left(VL \times \left[\frac{1}{1+ERC}\right]\right) + CR + HF - \left(VL \times \left[\frac{1}{1+WRC}\right]\right)$$

Where:

VL	=	Value of the lumber in log form
ERC	=	Efficiency Rate of Competitor (Amount of usable lumber over scale the competitor's mill will cut.)
CR	=	Competitor's Rate (Rate that the competitor's mill charges.)
HF	=	Hauling fee to mill
ERW	=	Efficiency Rate of Wood-Mizer (Amount of usable lumber over scale the Wood-Mizer will cut.)
WR	=	Wood-Mizer Rate (Rate that you can charge to have the same net cost per board foot as the competitor's mill.)

Example 1: A customer has some prime poplar logs valued at $0.25 (VL) per board foot (m^3), or $250.00 per thousand. He can have lumber sawed at a circular mill for $.010 (CR) per board foot. The mill cuts about 15% (ERC) over scale. This means that for every 1000 board feet (2.36 m^3) by Doyle scale, 1100-1150 (2.59-2.71 m^3) usable board feet of lumber are produced. The hauling fee within 30 miles (38 km) of the mill is $0.04 per board foot. Most Wood-Mizer operations cut 50% (ERW) over Doyle scale on logs under 20" (508.0 mm) in diameter. The equation will give you sawing fees so the net cost per board foot is the same as the circular mills.

$$WR = \left(0.25 \times \left[\frac{1}{1+0.15}\right]\right) + 0.10 + 0.04 - \left(0.25 \times \left[\frac{1}{1+0.50}\right]\right)$$

$$WR = (0.25 \times [0.87]) + 0.10 + 0.04 - (0.25 \times [0.67])$$

$$WR = 0.218 + 0.10 + 0.04 - 0.168$$

$$WR = 0.19$$

This means that you can charge $0.19 (WR) per board foot ($80.50 per m^3) for the cutting job. It will not cost the customer any more than if his wood was hauled to a circular mill and cut at $0.10 per board foot. This is because you can cut 50% more usable lumber than scale volume compared to the 15% of circular mills.

Example 2: If your customer pays $250.00 for 100 scaled board feet (2.36 m^3) in log form, you can give him 1500 board feet (3.54 m^3) of usable lumber from those logs. This cuts the price he is paying for his lumber by 30-40%!

In this example, we don't mean to tell you to charge the $0.19 board foot fee for cutting. However, you could charge $0.17 and pass on the difference of $0.02 per board foot to the customer. Even when cutting pine worth $0.10 per board foot, you can compete at over $0.15 cents per board foot compared to $0.10 charged by a large mill. Calculate the savings in efficiency and hauling costs. Anything less than the $0.15 board foot is putting money in the customer's pocket.

The efficiency of the Wood-Mizer gives you advantages that increase as the value of the logs increase. If the customer has poplar worth $0.20 per board foot, you cut the net cost of lumber 30-40%. This is because you can give him 50% over scale volume in usable lumber. This is an $0.08 per board foot savings. If the wood were oak valued at $0.50 per board foot, you could cut his cost by $0.20 per board foot; walnut valued at $1.00 per board foot would reduce cost by $0.40, and so on. When cutting by volume or board foot, always charge for the amount of usable wood produced, instead of scale volume. When charging by scale volume, every board foot you cut past scale you are cutting for free. Determine your volume by output. Reduce risk of low-volume days by knowing what and when you will cut. Always charge a fee for anything that reduces your production. These guidelines can make cutting by volume a profitable arrangement.

5.2 Pricing By The Hour Or Day

Advantage: This type of pricing is used by many Wood-Mizer owners. The advantage is your income will not change with each type of cutting job.

Rates: Set a fee that will get you the income you want after expenses.

If you are cutting difficult wood or are set up at a location that doesn't allow fast handling of logs and finished lumber, the lower production rate will not affect your income. Instead, your income is fixed and the risk of a lower production rate is passed on to the customer.

Many owners who use this method require their customer to supply the manpower to handle all logs and lumber. If the customer wants higher production, he will supply more manpower or equipment to increase output. Some owners also charge a delivery fee based on miles (kilometers) to the site for mill setup.

5.3 Pricing By Board Foot (Cubic Meter) Or Volume

Advantage: This is the most common pricing approach in the logging industry. The customer pays a fixed rate, no matter what the production rate is. So, the more you cut, the more you make.

The Wood-Mizer has many advantages over circular mills. Many Wood-Mizer owners get premiums over the usual area rates by selling these advantages. You can compete with and beat the big mills in portability, lumber quality, versatility, total yield of usable lumber per log, and cost per unit of sawn lumber.

When pricing, keep in mind the following factors which can change your production rates:

1. **The length of time the logs have been down.** Generally, the longer wood has been down, the harder it is to cut. Find out how long the wood has been down, as well as the species, before quoting a bid.

2. **The size and shape of the logs.** Large-diameter logs can take extra time to handle. Stopping to trim side limbs or large flares at the butt also can lower total output. Very small logs can involve too much handling for the total yield produced.

3. **The condition of the logs.** Logs that have been dragged over rocks and mud will require more time to debark or clean. (Cutting through the mud or rocks will dull your blade in minutes.) Refuse to cut mud-laden logs or charge a fee per board foot or per hour to clean logs.

4. **The amount of wood to be cut.** Charge a premium and establish a minimum for very small jobs. Some operators charge a few cents per foot for jobs less than 1000 board feet (2.36 m^3).

5. **The size of lumber the customer wants.** Cutting 1 x 4's compared to 2 x 12's can more than triple the number of cuts needed to get the same volume of wood. Some mill owners charge a special handling fee for 1" or 2" (25.4 mm or 50.8 mm) boards. Extra-wide boards also take much more time to cut than narrower widths. Sawing boards that are 24" (609.6 mm) wide at a feed rate of less than 5' (1.52 m) per minute, takes more time and runs more risk of wavy cuts than sawing boards that are 8" (203.2 mm) wide at a feed rate of 20' (6.10 m) or more per minute.

6. **The cutting location.** Base your price on a setup where you can easily roll or load logs onto the mill without moving it. If you are asked to move the mill several times a day, charge a fixed amount per move.

5.4 Sawing For A Percentage Of The Wood You Cut

Advantage: You become a small-scale lumber yard. You can make money if there is a ready market for your lumber at a good price.

Rates: The percentage the sawyer keeps can range from 25-50%, depending on species and region.

5.5 Combination Pricing

Advantage: Being flexible on pricing can get you more jobs.

You can combine several of the above pricing approaches in your operation. For example, a customer who owns lots of standing timber may not care about higher yields from the Wood-Mizer. In this case, he may be willing to let you cut at the current large mill rate and keep some of the over-run lumber. For other jobs or wood types, you might want to cut on an hourly rate instead or a board foot rate. You also can also charge more or less per foot depending on how much labor the customer supplies.

SECTION 6 METRIC CONVERSIONS

To convert from U.S. measurements to metric measurements:

MULTIPLY	BY	TO OBTAIN
inches	2.54	centimeters
inches	25.4	millimeters
square inches	6.45	square centimeters
square inches	645.2	square millimeters
square feet	0.09	square meters
feet	0.3	meters
miles	1.61	kilometers
Fahrenheit -32	0.56	Celsius
pounds	453.59	grams
pounds	0.45	kilograms
ounces	28.35	grams

SECTION 7 BOARD-FOOT SCALES

There are various scales for determining the board feet in logs, standing trees, and cut lumber. This section covers some of those scales. The Wood-Mizer will get much more lumber (sometimes up to 30% more) than a scale shows. This is because most scales are based on the 1/4" (6.35 mm) saw kerf of larger circular mills.

Volume is deducted for defects like crooks, sweeps, and knots. Make sure you know the buyer's rules for deducting defects when you cut timber for sale.

7.1 Log Scales

See Table 7-1, 8-2, and 8-3. Board-foot log scales give the estimated volume of the log in board feet for a specified diameter and length. The three most well-known scales are the Doyle, International, and Scribner Decimal C. Commercial operations in the Eastern and Southern States generally use the Doyle Scale. The U.S. Forestry Service, other federal agencies, many scaling bureaus, and many private operators use the Scribner Decimal C Scale. The U.S. Forestry Service and some private operators use the International Scale. There is also a Spaulding, or Columbia, log scale that approximates the value of the Scribner Decimal C Log Scale.

Each of these scales uses a different formula to calculate the same thing: the amount of lumber in a log. It is important to note that all rules give the approximate volume of lumber in a log. Therefore, the volume will vary from one scale to another.

All log rules use two measurements to find volume. The first is length. The second measurement is Diameter Inside the Bark (DIB) on the small end of the log. On a round log, this is the width of the small end just inside the bark. To find the DIB, you must take two measurements and average them. On an oval log, measure the widest and the narrowest diameters. Add them together and divide by two.

Example: The small end of a log is oval and measures 18" (457.2 mm) at the widest point and 12" (304.8 mm) at the narrowest point. The scale DIB is (18" + 12") = 30" / 2 = 15". Metrically, this is (457.2 mm + 304.8 mm) = 762.0 mm / 2 = 381 mm.

Once you have the two measurements, use the scale to figure volume. Find the DIB on the left-hand scale. This line of numbers shows the amount of lumber for different length logs. Each column is marked on top with a log length. Match the DIB line with the column for the log length. That number is the volume in board feet.

Example: If a log is 12' (3.65 m) long and the DIB on the small end is 14" (355.6 mm), Doyle Scale is 75 board feet (0.177 m^3). The International Scale is 100 board feet (0.236 m^3). Scribner Decimal C Scale is 90 board feet (0.212 m^3).

DOYLE LOG SCALE						
DIB* (small end)	BOARD FEET PER LENGTH BELOW					
	6'	8'	10'	12'	14'	16'
6	2	2	3	3	4	4
7	3	5	6	7	8	9
8	6	8	10	12	14	16
9	9	13	16	19	22	25
10	14	18	23	27	32	36
11	18	25	31	37	43	49
12	24	32	40	48	56	64
13	30	41	51	61	71	81
14	38	50	63	75	88	100
15	45	61	76	91	106	121
16	54	72	90	108	126	144
17	63	85	106	127	148	169
18	74	98	123	147	172	196
19	84	113	141	169	197	225
20	96	128	160	192	224	256
21	108	145	181	217	253	289
22	122	162	203	243	284	324
23	135	181	226	271	316	361
24	150	200	250	300	350	400
25	165	221	276	331	386	441
26	182	242	303	363	424	481
27	198	265	331	398	463	529
28	216	288	260	432	504	576
29	234	313	391	469	547	625
30	254	338	423	507	592	676
*Diameter Inside Bark						

TABLE 7-1

SCRIBNER DECIMAL C LOG SCALE						
DIB* (small end)	BOARD FEET PER LENGTH BELOW					
	6'	8'	10'	12'	14'	16'
6	5	5	10	10	10	20
7	5	10	10	20	20	30

TABLE 7-2

8	10	10	20	20	20	30
9	10	20	30	30	30	40
10	20	30	30	30	40	60
11	20	30	40	40	50	70
12	30	40	50	60	70	80
13	40	50	60	70	80	100
14	40	60	70	90	100	110
15	50	70	90	110	120	140
16	60	80	100	120	140	160
17	70	90	120	140	160	180
18	80	110	130	160	190	210
19	90	120	150	180	21	240
20	110	140	170	210	240	280
21	120	450	190	230	270	300
22	130	170	210	250	290	330
23	140	190	230	280	330	380
24	150	210	250	300	350	400
25	170	230	290	340	400	460
26	190	250	310	370	440	500
27	210	270	340	410	480	550
28	220	290	360	440	510	580
29	230	310	380	460	530	610
30	250	330	410	490	570	660
*Diameter Inside Bark						

TABLE 7-2

INTERNATIONAL 1/4-INCH LOG SCALE						
DIB* (small end)	**BOARD FEET PER LENGTH BELOW**					
	6'	**8'**	**10'**	**12'**	**14'**	**16'**
6	5	10	10	16	15	20
7	10	10	15	20	25	30
8	10	15	20	25	35	40
9	15	20	30	35	45	50
10	20	30	35	45	55	65
11	25	35	45	55	70	80
12	30	45	55	70	85	95
13	40	55	70	85	100	115

TABLE 7-3

14	450	65	80	100	115	135
15	550	75	95	115	135	160
16	60	85	110	130	155	180
17	70	95	125	150	180	205
18	80	110	140	170	200	230
19	90	125	155	190	225	260
20	100	135	175	210	250	290
21	115	155	195	235	280	320
22	125	170	215	360	305	355
23	140	185	235	285	335	390
24	150	205	255	310	370	425
25	165	220	280	340	400	460
26	180	240	305	370	435	500
27	195	260	330	400	470	540
28	210	280	355	430	510	585
29	225	305	385	465	545	630
30	245	325	410	495	585	670

TABLE 7-3

7.2 Tree Scales

Tree scales show the volume of lumber in a standing tree. Measure the trunk diameter at 4 1/2' (1.37 m) above the ground. Then estimate the quantity of 16-foot (4.87 m) logs in the tree. Most sawyers do this by looking at the tree as it stands. Use your best judgment to estimate how many 16-foot (4.87 m) lengths are in the tree vertically. Measure by eye from stump to lower branches. If you decide to cut the tree, you can measure it with a tape to get a better estimate.

See Table 7-4. Example: A tree is 14" (355.6 mm) in diameter at 4 1/2' (1.37 m) above ground (DAG), and has two 16-foot (4.87 m) logs in it. The tree has 80 board feet (0.189 m^3), by the Doyle Tree Scale.

DOYLE TREE SCALE								
DAG*	NUMBER OF 16 FOOT LOGS IN TREE							
	0.5	1	1.5	2	2.5	3	3.5	4
12	20	30	40	50	60	---	---	---
14	30	50	70	80	90	100	---	---
16	40	70	100	120	140	160	180	190
18	60	100	130	160	200	220	240	260
20	80	130	180	220	260	300	320	360

TABLE 7-4

22	100	170	230	280	340	380	420	460
24	130	220	290	360	430	490	540	600
26	160	260	360	440	520	590	660	740
28	190	320	430	520	620	710	800	880
30	230	380	510	630	740	840	940	1040
32	270	450	590	730	860	990	1120	1220
34	300	510	680	850	1000	1140	1300	1440
36	350	580	780	970	1140	1310	1480	1640
38	390	660	880	1100	1290	1480	1680	1860
40	430	740	990	1230	1450	1660	1880	2080
42	470	830	1100	1370	1620	1860	2100	2320
*Diameter 4.5' above ground								

TABLE 7-4

See Table 7-5. The same tree has 140 board feet (0.330 m^3), by the International 1/4-Inch Tree Scale.

INTERNATIONAL 1/4-INCH TREE SCALE								
DAG*	NUMBER OF 16 FOOT LOGS IN TREE							
	0.5	1	1.5	2	2.5	3	3.5	4
12	30	60	80	100	120	---	---	---
14	40	80	110	140	160	180	---	---
16	60	100	150	180	210	250	280	310
18	70	140	190	240	280	320	360	400
20	90	170	240	300	350	400	450	500
22	110	210	290	360	430	490	560	610
24	130	250	350	430	510	590	660	740
26	160	300	410	510	600	700	790	880
28	190	350	180	600	700	810	920	1020
30	220	410	550	690	810	930	1060	1180
32	160	170	640	790	940	1080	1220	1360
34	290	520	730	900	1060	1220	1380	1540
36	330	600	820	1010	1200	1380	1560	1740
38	370	670	910	1130	1340	1560	1840	1940
40	420	740	1010	1250	1480	1700	1920	2160
42	460	820	1100	1360	1610	1870	2120	2360
*Diameter 4.5' above ground								

TABLE 7-5

7.3 Lumber Scale

See Table 7-6. A lumber scale shows the number of board feet in a piece of lumber after it is cut. One board foot equals a piece of lumber 1" (25.4 mm) thick, 12" (304.8 mm) wide, and 1' (3.04 m) long. This would be a 12" (304.8 mm) square of wood that is 1" (25.4 mm) thick.

LUMBER SCALE						
THICKNESS AND WIDTH	BOARD FEET PER LENGTH BELOW					
	6'	8'	10'	12'	14'	16'
1 X 3	1.4	2	2.5	3	3.5	4
1 X 4	2	2.6	3.3	4	4.6	5.3
1 X 5	2.5	3.3	4	5	6	6.6
1 X 6	3	4	5	6	7	8
1 X 7	3.5	4.6	6	7	8	9.3
1 X 8	4	5.3	6.6	8	9.3	10.6
1 X 10	5	6.6	8.3	10	11.6	13.3
1 X 12	6	8	10	12	14	16
2 X 4	4	5.3	6.6	8	9.3	10.6
2 X 6	6	8	10	12	14	16
2 X 8	8	10.6	13.3	16	18.6	21.3
2 X 10	10	13.3	16.6	20	23.3	26.6
2 X 12	12	16	20	24	28	32
2 X 14	14	18.6	23.3	28	32.6	37.3
3 X 6	9	12	15	18	21	24
3 X 8	12	16	20	24	28	32
3 X 10	15	20	25	30	35	40
3 X 12	18	24	30	36	42	48
4 X 4	8	10.6	13.3	16	18.6	21.3
6 X 6	18	24	30	36	42	48

TABLE 7-6

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