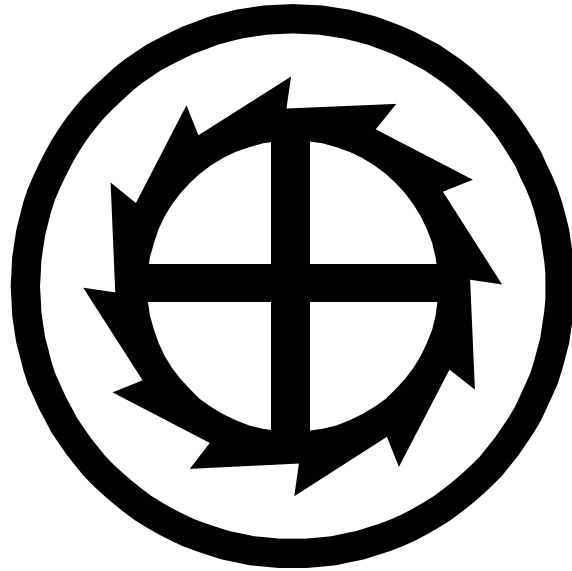


LSU ART & DESIGN



**DESIGN SHOP
SAFETY
MANUAL**

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GOLDEN RULES

- 1. Check in with the shop personnel when you are entering the Shop to work.**
2. The Design Shop is to be used for school projects **only**.
3. The Shop is only to be used with proper supervision: shop manger, shop monitor, or class instructor must be present.
4. You must complete the Shop Orientation **and** pass the orientation test before using equipment.
5. Make sure all guests [anyone not currently enrolled in the class] check in with the shop personnel and abide by all rules [including wearing safety precautions] while in the Shop. Guests may not work with the equipment.
6. Eye protection: safety glasses, goggles, or face shields are required to be worn at all times in the Shop.
7. Proper ear protection should be worn at all times while working in the Shop.
8. Use of a dust mask is recommended to while working in the Shop.
9. Wear Closed Toe Shoes Only! No flip-flops, sandals, high heels, etc. are to be worn while working in the Shop.
10. Loose clothing, hair, jewelry, etc are not permitted in the shop.
11. No Horseplay! Running, fooling around, etc may contribute to an accident.
12. Be Alert! Please consider the safety of all students while working in the Shop.
13. Report all accidents of any kind to Shop personnel.
14. Do not operate any tool while under the influence of drugs, alcohol or any medication.
15. Always clean your work area and check out before leaving the Shop.

Accidents

Any accident should be reported immediately and, if needed, first aid applied. First aid is the “immediate, temporary care given the victim of an accident of sudden illness until the services of a physician can be obtained.”

A recent consideration in first aid care is **Blood borne pathogens**.

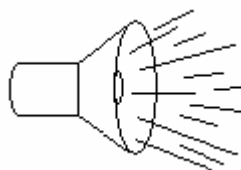
These include serious diseases such as the HIV virus that causes AIDS, and hepatitis B and C viruses.

To protect yourself, Universal Precautions must be observed. Universal Precautions mean treating all human blood/fluids as if it was infected, regardless of the person who is injured. If a blood spill occurs, notify the Instructor or Shop Supervisor immediately. Remember that serious accidents do not occur if workers are safety conscious and follow recommended precautions. (See Diagram).



Loud Noises

Exposure to loud noises can cause hearing loss. The loss of hearing is cumulative, and happens gradually so you may not realize you are damaging your hearing when you use loud equipment. Use of proper fitting and authorized earplugs or earmuffs is strongly recommended when using loud equipment for an extended period.



General Rules

- 1. SEEK INSTRUCTION AND ADVICE.** Never use any type of tool for which you have not received specific instruction on its proper and safe use by the shop supervisor, shop monitors, or class Instructor even if you have previous experience. You must know the tool's application and limitations, as well as the specific hazards of its operation before using any tool. If you are unfamiliar with any tools, ask one of the appropriate shop personnel to assist you.
- 2. KEEP WORK AREA CLEAN.** Cluttered areas and benches invite accidents. Keep book bags, extension cords and other material out of the walkways. Always be alert to other people in the area.
- 3. DO NOT PERFORM SET-UP OR LAYOUT WITH THE MACHINE RUNNING.** Turn the machine on only when ready to perform operation.
- 4. NEVER ADJUST THE MACHINE'S SETTINGS WITH THE TOOL RUNNING.**
- 5. FAMILIARIZE YOURSELF WITH THE MACHINE BEFORE USING IT.** Always know where the on/off switch is. If an emergency situation arises, turn off the power first (if possible).
- 6. ALWAYS CHECK MACHINE SETTINGS BEFORE USE.** The previous user may have left the settings wrong or loose. Always reset the tool to its zero position when done.
- 7. PERFORM A DRY RUN WITH THE MACHINE OFF AFTER CHANGING SETTINGS.** Make sure that all adjustments are tight and locked, and that movement is free.
- 8. USE THE RIGHT TOOL.** Don't force a tool or attachment to do a job for which it was not designed.
- 9. SECURE THE WORK.** Use clamps or a vise to hold the work when practical. It's safer than using your hand and frees both hands to operate the tool. The saw will likely throw the wood violently than cut it unless it is firmly fixed against the table and fence.
- 10. ALWAYS HOLD THE LONG SIDE OF THE CUT.** Keep hands a safe distance from the blade.
- 11. BOTH ENDS OF WOOD MUST BE SUPPORTED, EVEN AFTER THE CUT.** The free end of a cut must not bind with the blade after the cut is made.
- 12. DO NOT CUT SMALL PIECES ON CIRCULAR SAWS.** Always keep hands at least 6" away from circular blades. Clamp small pieces or fashion a jig or hold-down. Otherwise, use hand tools to make cuts on small pieces.
- 13. DO NOT CUT IRREGULARLY SHAPED, WARPED, OR SPLIT WOOD.** The wood must sit flat against the saw's table and fence.
- 14. DO NOT CUT WOOD CONTAINING NAILS OR OTHER FOREIGN MATERIALS.** Metal will dull blades, instantly cause sparks, and become dangerous projectiles.
- 15. USE CAUTION WHEN CUTTING THROUGH KNOTS.** Knots will often fragment unpredictably, turning into dangerous projectiles.

- 16. DO NOT START MOTORS WITH THE BLADE TOUCHING THE WOOD.**
Allow the blade to reach full speed before beginning the cut.
- 17. MAKE CUTS WITH SLOW STEADY FEED.** Do not try to cut too quickly or abruptly. Always be prepared to stop the cut. Sudden movements invite a loss of control.
- 18. KEEP HAND OUT OF THE CUT PATH AT ALL TIMES.** Always be aware of your hands in relation to the blade. Always be aware of the cut path.
- 19. Be Patient!** Always let machine come to a complete stop before removing scraps.
- 20. DO NOT OVERREACH.** Keep proper footing and balance at all times. Do not reach over or across blades and moving parts. Do not reach under machines that are on.
- 21. DO NOT USE DULL OR DAMAGED BLADES.** Stop cutting and alert shop personnel if cutting is difficult.
- 22. DISCONNECT TOOLS THAT APPEAR TO BE DAMAGED OR MALFUNCTIONING.** Alert shop personnel. Never reconnect tools found disconnected without the permission of shop personnel.
- 23. REDUCE THE RISK OF UNINTENTIONAL STARTING.** Make sure switch is in "OFF" position before plugging in power cord.
- 24. NEVER LEAN ON TOOL.** Serious injury could occur if the tool is tipped or if the cutting tool is accidentally contacted.
- 25. DIRECTION OF FEED.** Feed work into a blade or cutter against the direction of rotation of the blade or cutter only.
- 26. NEVER LEAVE TOOL RUNNING UNATTENDED. TURN POWER OFF.**
Don't leave tool until it comes to a complete stop. Do not turn your back on running tools.
- 27. TOOLS MUST BE CHECKED OUT BY SHOP PERSONNEL FOR USE OUTSIDE OF SHOP.** You must leave your Student ID.
- 28. NO TREATED LUMBER ALLOWED IN THE SHOP.**
- 29. REMOVE ALL NAILS FROM SALVAGED WOOD BEFORE WORKING.**
There is a metal detector, which can be used to locate any nails in the wood.
- 30. NO LEAD ALLOWED! DO NOT USE ANY MATERIALS CONTANING LEAD BASED PAINTS.** If you are unsure about the composition of the painted materials, it will be assumed that the paint is lead based.
- 31. KEEP AISLES AND WORK AREA CLEAN AND CLEAR.**

Flammables

**Store all flammable material in the Flammable storage Cabinets.
This includes: paint, paint thinner, spray paint, acetone, wood finish, etc.**



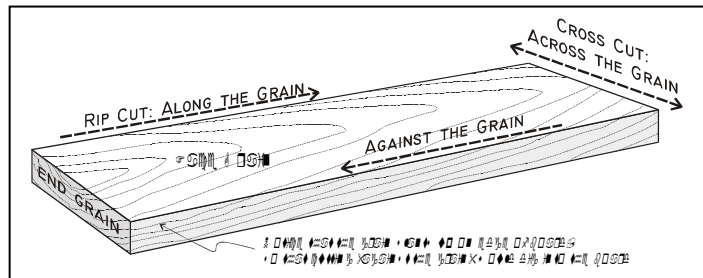
Personal Safety

Woodworking can be dangerous unless safe and proper operating procedures are followed. As with all machinery, there are certain hazards involved with the operation of power tools. Using the machines with respect and caution will considerably lessen the possibility of personal injury. However, if normal safety precautions are overlooked or ignored, personal injury to the operator may result. Safety equipment such as guards, push sticks, hold-downs, feather boards, eye protection, dust masks and hearing protection can reduce potential risks of injury. But even the best guard won't make up for poor judgment, carelessness or inattention. **Always use common sense** and exercise **caution** in the workshop. If a procedure feels dangerous, don't try it. When in doubt ask shop personnel for an alternative procedure that will be safe. **REMEMBER: Your personal safety is your responsibility.**

The best way to protect oneself from injury is to have a clear understanding of how the tools work and what are the potential dangers. If you understand the underlying forces at work, you will be able to foresee and avoid accidents caused by ignorance or carelessness.

General Terminology

Grain: the fibrous structure of the wood, evident in the light and dark streaking of the soft spring growth (light) and hard summer growth (dark) of the tree



Grain figure: the pattern formed by the grain on the surface of a longitudinal cut (along the grain); the character of this pattern depends on the cross-section of the wood

Knots: areas of dense, twisted grain that occur where limbs branch apart (literal knots in the grain)

Softwoods: wood of evergreen trees (not necessarily soft)

Hardwoods: wood of deciduous or broad-leafed trees (not necessarily hard)

Milled lumber: wood that has been processed (cut, planed, and sanded) into regular dimensions (also called stock)

Rip-cut: a cut in a board along its long dimension, with the grain

Crosscut: a cut in a board across its short dimension, across the grain

Kerf: the groove or cut made by a blade

Miter: refers to an angle; a miter joint is one in which both pieces are cut at an angle, and a miter gauge is a guide used hold the wood at a set angle

Fence: the metal bar used to guide the wood along a straight path, or against which the wood is held when making a cut

Butt joint: 90 degree joint in which the end of one piece abuts the side of another

Hold-down: a simple clamping mechanism used to hold a piece of wood while cutting

Jig: any specially constructed mechanism used to facilitate a specific cutting procedure

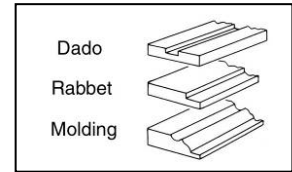
Blade Set: the alternating angled offset of the teeth of a blade

Kickback: the sudden backward force produced when the blade stalls or binds in the wood during a cut

Dado: a groove cut into a piece of flat wood

Rabbet: a step cut into the end or edge of a piece of flat wood (a half-dado)

Molding or millwork: shaped, decorative profiles cut into wood

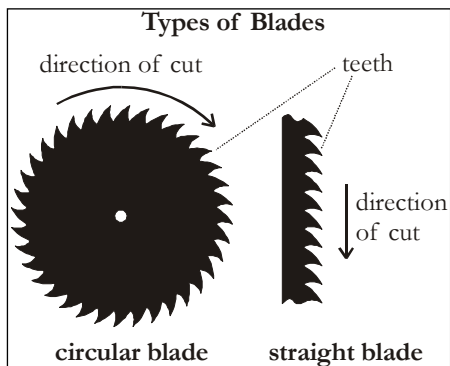


Understanding Power Tools

Obviously, the most dangerous parts of power tools are the moving parts. All of the machinery in this shop is powered by electric motors, and the radial forces produced by spinning shafts, pulleys, blades and belts can be particularly dangerous. **This danger arises from two effects of spinning parts: (1) outward forces—wood and debris can become violent projectiles when thrown by spinning blades, and (2) inward forces—loose clothing, jewelry, hair, and fingers can be grabbed, wound up, and pulled in and mangled by any spinning machinery.** Always be aware of the danger of these radial forces. Always wear eye protection, never stand in line with circular blades, and always maintain a safe distance from spinning parts when the tool is operating.

Understanding how saw blades cut will help you cut efficiently, accurately, and safely.

There are two basic types of saw blades: the circular blade and the straight (or band) blade. The blade cuts the wood with a series of sharp teeth along the cutting edge. Each tooth acts like a chisel that plows into the wood to make the cut, and these teeth are angled toward the direction that they rotate or slide. This is the direction that the force of the blade is exerted. **The teeth point in the direction in which the saw will push the wood if allowed, or will throw debris.**



As one tooth cuts into the wood, it makes a path for the following tooth. As long as the cut is made properly, each individual tooth is required to remove only a small amount of wood. No significant friction should ever occur between the side of the blade and the wood. **If the blade and/or the wood is twisted or becomes misaligned, the side of the blade will foul out against the wood and create friction. This will cause one of three things to happen: (1) the blade will heat up and dull or break, (2) the blade will stall out and kickback, or (3) the blade will**

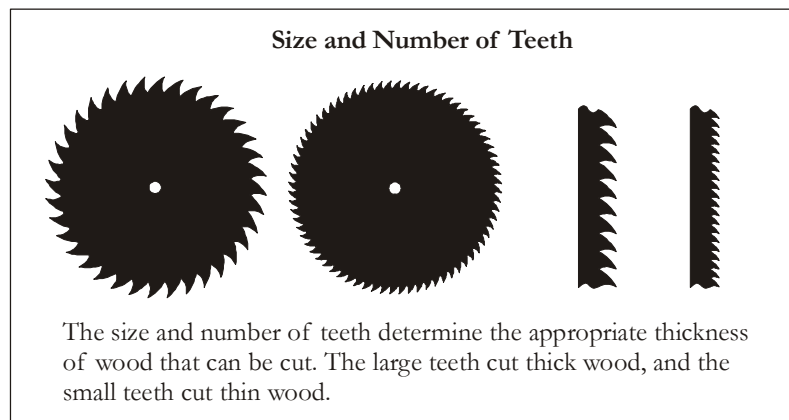
throw the wood. If the blade begins to bind, ease off the cut and try to correct the alignment. If the blade stalls out, hold the wood in place (or the saw in some cases) and turn off the motor. As you will not have time to react in the third possibility, preventive measures are critical. If the blade throws the wood, it will either throw it away from the machine, in which case you must not be in line with the blade, or it will pull the wood away from you toward the blade, in which case you do not want your hand too close as it will be pulled in after it. Wood that is irregularly shaped, warped, or split parallel to the cut will be prone to move as it is cut, creating a dangerous situation. Cutting through knots is also hazardous, as they are dense and brittle. When cut, knots can fragment unpredictably, creating debris that can become violent projectiles. When cutting, a slow

steady feed should be used. If excessive force is required, the blade is dull or not appropriate for the material being cut. Forcing a cut will overheat the blade and create the potential for it to bind in the wood.

The thickness of the blade, including any side-to-side offset of the teeth, is called the blade's set and determines the width of the slot or groove cut into the wood. This groove is known as a kerf, and generally measures between 1/16 and 1/8 inch. This groove is waste material, and must be taken into account for when marking a board for cutting. Every blade is designed to cut a specific kind of material and to make specific kinds of cuts. Using a blade to cut the wrong kind of material can result in damage to the blade and injury to the operator. **Circular blades can only be used to make straight cuts** (Never try to cut a curved cut with a circular blade). **Straight or band blades can cut both straight and curved cuts.** Blades designed to cut wood generally have larger teeth, and blades for metals and plastics have small teeth. Never try to cut metal with a wood cutting saw, and cut plastics only under direct supervision. Never cut wood that *might* contain nails or other foreign materials. Metal will instantly dull a wood cutting blade and potentially create hazardous debris.

The size of the teeth also determines the thickness of wood that can be cut with a blade. Blades with large teeth are used to cut thick wood; those with small teeth cut thin wood. Generally, it is not advisable to cut wood that is thinner than the space between a blade's teeth. This is true because the larger teeth tend to splinter and grab the thin wood instead of cutting it cleanly. The blades with small teeth can overheat and warp when cutting thick wood, so care must be taken when doing so. The size of the teeth of a blade is described in terms of the number of teeth, either as the number of teeth per blade in the case of circular blades, or teeth per inch in the case of straight blades.

Another characteristic important to straight blades is the width of the blade. The width of the blade determines the kinds of curves that can be cut with it. The more narrow the blade, the tighter the curve possible. Wide blades can only make straight or gently curving cuts,



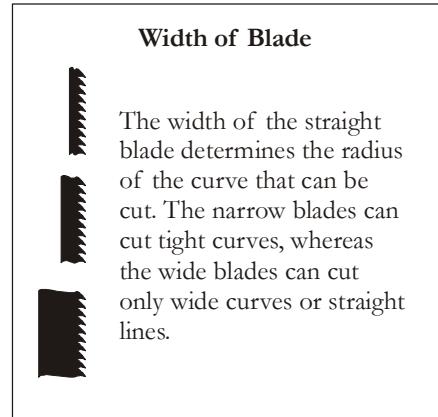
whereas a very narrow blade can make very tight curves with a small radius. If the blade binds up during a curved cut then the blade is too wide to make the turn. Trying to force a blade to curve too tightly will wear out the blade and the blade guides very quickly, potentially breaking the blade.

The grain of the wood will also affect the cut. **Wood cuts more cleanly along the grain than across the grain.** Crosscuts often result in the splintering and tear-out of the wood fibers along the trailing edge of the cut. As the blade's teeth emerge from the wood, they

tear the fibers rather than cut them off cleanly. Softwoods and veneers are most susceptible to tear-out. Blades with fine teeth cause less tear-out than coarse teeth. This tear-out can be minimized by making the cut slowly, especially as the blade cuts through the wood. Having a sacrificial board on the underside of the cut also helps, or taping the area to be cut before hand. If practical, cut outside the mark and sand down to the mark. Most importantly, use sharp, well-maintained blades appropriate for the material.

Listen to the sound of the machine as it cuts, and be aware of any changes in pitch as the cut progresses. You will usually hear the motor begin to strain if the blade begins to bind, even before you see or feel it. If you hear the machine having trouble, ease off and re-correct, or stop the cut. Try to identify the problem before proceeding.

Pay attention to the results of the cut. Watch for undue tear-out, splintering, or especially scorch marks on the cut surfaces. Scorch marks mean that friction is producing enough heat to burn the wood. These marks indicate that the blade is fouling out, the blade is dull, or the blade is not appropriate for the material. Be aware that woods with heavy resins can gum the blades and cause excessive friction. If the cut ever begins to smoke, stop the cut immediately and correct the cause before proceeding.



Stationary Power Tools

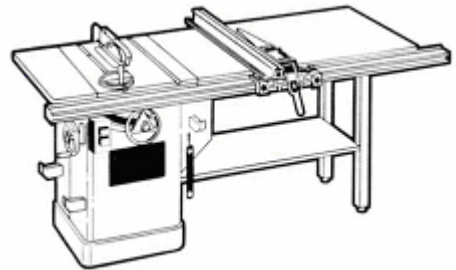
Circular Saws

Special care must be taken with tools that cut with a circular blade. These blades cut with tremendous forces, and the radial motion of the blades can both throw wood and debris outward and pull fingers and loose clothing inward. The wood being cut must be held securely at all times. If allowed, the blade will try to move the wood violently rather than cutting it.

**NEVER CUT FREEHAND WITH MOUNTED CIRCULAR SAWS
NEVER PLACE HANDS CLOSER THAN 6" TO A MOVING BLADE**

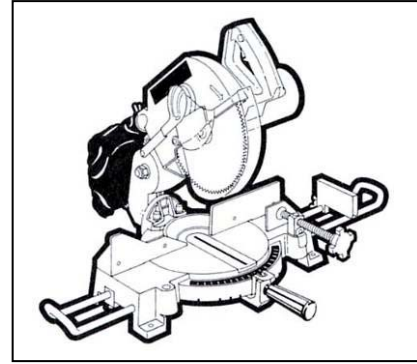
Table Saw: COMPLETELY OFF LIMITS TO STUDENTS

1. Configuration: circular blade mounted into table.
2. Cutting Action:
 - a. Wood is moved across tabletop either against fence or pushed with miter gauge: NEVER CUT FREEHAND
3. Adjustments:
 - a. Blade can be raised and lowered b. blade can be tilted to the right $0/45^\circ$ for bevel cuts
4. Cuts:
 - a. Straight cuts Rip cuts (along board's length) with fence
 - b. Cross- cuts on panels with panel attachment
 - c. Cross-cuts and miter cuts on short boards with miter gauge
 - d. Dado and mill work with fence
5. **Safety: STRICTLY OFF LIMITS**



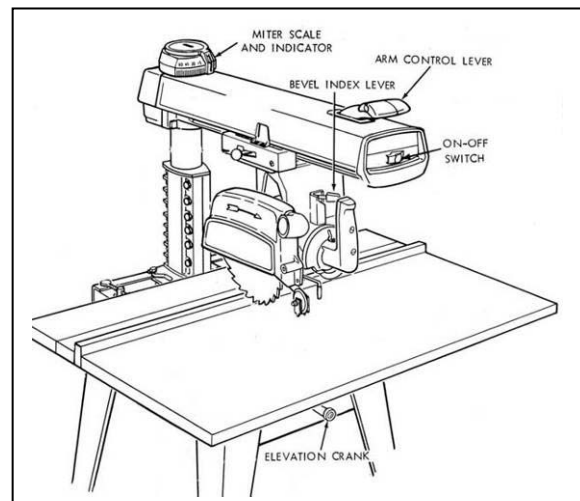
Miter Saw *Compound Miter Saw (Chop saw)*

1. Configuration: circular blade mounted on single action arm
2. Cutting Action:
 - a. Blade swings down in chopping motion
 - b. Wood is held in place while blade is moved
3. Adjustments:
 - a. Compound Miter Saw blade swivels for miter cuts
 - b. Compound Miter Saw blade tilts for bevel cuts
4. Cuts:
 - a. Crosscut and miters in long narrow boards
 - b. Compound Miter Saw cuts compound miters in long narrow boards
5. **Safety:**
 - a. **Firmly fix wood against table and fence: never cut freehand.**
 - b. **Hold wood with left hand, cut with saw in right hand.**
 - c. **Slow steady feed: DO NOT TRY TO CUT TOO QUICKLY.**
 - d. **Always check for square.**
 - e. **Tilted blade bevel cuts are most prone to binding and thus most dangerous.**
 - f. **Always return saw to its full start position after the cut.**
 - g. **Never “gang cut.” Never cut more than one piece at a time.**



Radial Arm Saw

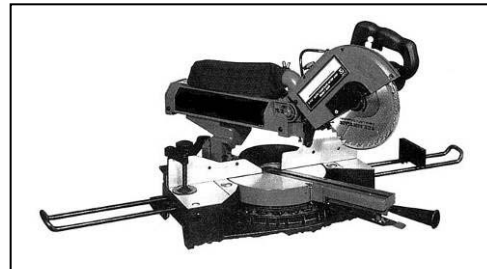
1. Configuration: circular blade mounted on overhead rail (arm)
2. Cutting Action:
 - a. Blade slides forward on rail, cutting on the pull stroke
 - b. Wood is held in place while blade is moved
3. Adjustments:
 - a. Blade assembly can be raised and lowered
 - b. Rail (arm) swings for miter cuts $45/0\backslash 45^\circ$
 - c. Blade assembly tilts for bevel cuts $0\backslash 45^\circ$
4. Cuts: straight cuts
 - a. Crosscuts and compound miters in long boards and narrow panels
 - b. Crosscut dados and rabbets
5. **Safety:**
 - a. **Firmly fix wood against table and fence: never cut freehand.**
 - b. **Hold wood with left hand, cut with saw in right hand.**



- c. **Slow steady feed: hold backpressure on saw: DO NOT TRY TO CUT TOO QUICKLY.**
- d. **Always check for square.**
- e. **Tilted blade bevel cuts are most prone to binding and thus most dangerous.**
- f. **Always return saw to its full rear position after the cut.**
- g. **Never “gang cut.” Never cut more than one piece at a time.**
- h. **Avoid cutting deeper than 1/16 inch into tabletop.**

Sliding Compound Miter Saw

- 1. Configuration: circular blade mounted on a double action arm
- 2. Cutting Action:
 - a. slides forward above wood
 - b. swings down in chopping motion
 - c. slides back on rails, cutting on the push stroke
 - d. rail assembly can be locked so that saw can only chop like a standard miter saw
 - e. Wood is held in place while blade is moved
- 3. Adjustments:
 - a. Blade assembly swivels for miter cuts $45/0\backslash45^\circ$
 - b. Blade assembly tilts for bevel cuts $0\backslash45^\circ$
- 4. Cuts: straight cuts
 - a. Compound crosscuts and miter cuts in long boards



5. Safety:

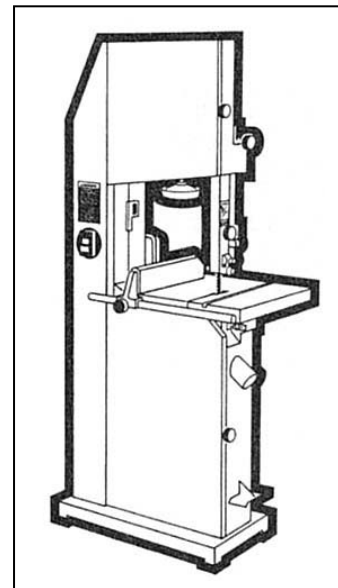
- a. **Firmly fix wood against table and fence: never cut freehand.**
- b. **Hold wood with left hand, cut with saw in right hand.**
- c. **Slow steady feed: DO NOT TRY TO CUT TOO QUICKLY.**
- d. **Always check for square.**
- e. **Tilted blade bevel cuts are most prone to binding and thus most dangerous.**
- f. **Always return saw to its full start position after the cut.**
- g. **Never “gang cut.” Never cut more than one piece at a time.**

Band Saws and Other Saws

Although straight blade saws such as the band saw are somewhat safer than circular saws, misuse can still result in serious bodily injury. Band saws are generally more versatile than circular saws, and they are able to make many of the same kinds of cuts as well as others. Unlike circular saws, cuts on band saws can be made free hand (without fence or miter gauge) as long as the pieces are given adequate and stable support throughout the cut. This means that curved cuts can be made as well as straight. However, the band saw does not cut as precisely as a circular saw and cannot cut dados and rabbets.

Large Band Saw

1. Configuration: long, continuous band blade looped around large upper and lower wheels
2. Cutting Action:
 - a. Wood is moved on table into blade
3. Adjustments:
 - a. Table top tilts for beveled cuts $0\text{--}45^\circ$
4. Cuts: straight cuts and wide curves
 - a. Versatile: rip-cuts, crosscuts, miters, re-saws, and long radius curves in medium size boards and panels
 - b. It cuts any size piece of wood that will fit through throat and on table
 - c. curves are cut freehand
 - d. rip-cuts are cut with fence
 - e. Crosscuts and miters are cut with miter gauge

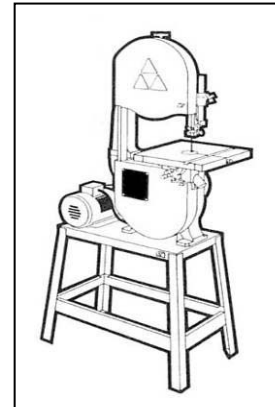


5. Safety:

1. **Wood must flat against table and stable.**
Never cut round or unstable wood without secondary support (such as a jig). The downward force of the blade will twist round or unstable stock as it cuts, causing the blade to bind, kink, and break.
2. **Set guard $\frac{1}{4}$ " above wood.**
3. **Never force a curved cut tighter than allowed by the blade width**
4. **Watch your fingers, especially at the end of the cut.**
5. **Never back out of long cuts with the machine running. Backward pressure can cause the blade to jump its guides, hang up, and break.**
6. **Plan your cuts before you begin cutting. Make sure the wood will clear the throat throughout the cut. Make release cuts before cutting long curves.**

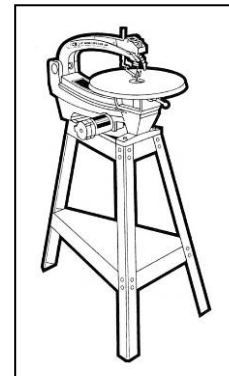
14" Band Saw

1. Configuration: long, continuous band blade looped around large upper and lower wheels
2. Cutting Action: Wood is moved on table into blade
3. Adjustments: Table top tilts for beveled cuts 0\45°
4. Cuts: straight cuts and wide curves
 - a. Versatile: rip-cuts, crosscuts, miters, and long radius curves.
 - b. Curves and rip-cuts are cut freehand
 - c. Cuts any size piece of wood that will fit through throat and on table
 - d. Crosscuts and miters are cut with miter gauge
5. **Safety:**
 - a. **Set guard 1/8" above wood.**
 - b. **Same as Large Band Saw**
 - c. **Watch your fingers**



Scroll saw

1. Configuration: a short thin blade held through the table by a long arm
2. Cutting Action: the blade reciprocates up and down, cutting on the down stroke
3. Adjustments
 - a. The table tilts for bevel cuts
 - b. The blade can be easily removed and inserted through a hole in the wood to allow trapped cuts
4. Cuts: intricate and delicate curves in flat, thin wood
5. **Safety:**
 - a. **Watch your fingers**
 - b. **Make sure blade has teeth pointing down**
 - c. **Make sure tension is adjusted properly on the blade**
 - d. **Do not push too hard on wood. You want only enough pressure to maintain good contact on the down stroke, not the up stroke.**



Sanders

The large stationary sanders are used primarily for shaping and coarse sanding. These sanders remove material very quickly and must be used very carefully. Deep gouges can be quickly cut into the wood surface, and edges can easily be sanded crooked. Always hold the piece securely, and sand with light, even pressure, moving the piece constantly. Use the tables and guides whenever a straight or beveled edge is required and use of such aids is possible. Trying to sand too quickly will result in poor accuracy and sloppy work. The primary danger of power sanders is that the users underestimate their hazard because there are no blades. They can however be just as dangerous as saws. **The hazards of power sanders include (1) the radial forces of the spinning parts, (2) the abrading power or the sanding surfaces, and (3) the fine particles of dust created.** Power sanders have been known to pull out hair by the roots and tear flesh away to the knuckles. Wood dust can be extremely flammable, and the dust created from sanding lead-based paints and other materials can pose long term health risks to both the operator and others in the area. Let me reiterate:

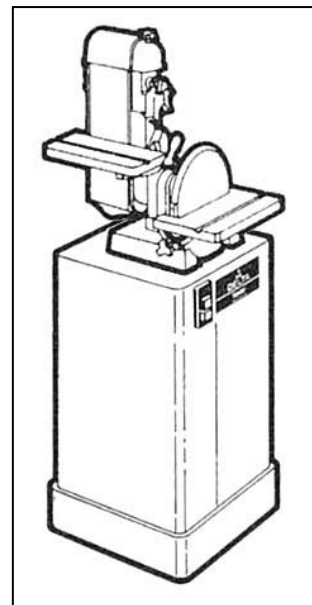
- NEVER LEAVE SANDERS RUNNING UNATTENDED.
- ALWAYS MAINTAIN SECURE FOOTING AROUND THE SANDER.
- NEVER WEAR GLOVES, LOOSE CLOTHING, JEWELRY, NECKTIES, OR LONG LOOSE HAIR NEAR SANDERS.
- NEVER LEAN OVER OR REACH UNDER RUNNING SANDERS.
- NEVER POWER SAND METALS, INCLUDING NAILS, SCREWS, OR OTHER FASTENERS IN THE WOOD. Sparks can ignite air borne sawdust. Countersink fasteners below wood surface before sanding.
- NEVER POWER SAND PAINTED WOOD OR OTHER MATERIALS IN THE DESIGN SHOP.
- ALWAYS RUN DUST COLLECTOR WHEN SANDING.

Belt/Disk Sander

1. Configuration: combination belt and disk sander
2. Action: rough sands and shapes
3. Adjustments:
 - a. Belt swivels from horizontal to vertical. **DO NOT CHANGE WITHOUT PERMISSION OF SHOP PERSONNEL.**
 - b. tables tilt 0\45°
 - c. Miter gauge can be used

4. Safety: (also see above)

- a. **Hold wood firmly, always be able to hold against the direction of sander.**
- b. **Never approach from attacking angle.**
- c. **Be aware of belt tracking and tension. Shut off machine and alert shop personnel if belt tracks wrong, especially if sparks are created.**



- d. **Do not use if belt or disk is loose or torn. Alert shop personnel.**
- e. **Keep hands away from abrasive surfaces, especially near intake gaps.**
- f. **Use tables to support material when sanding against a vertical belt or disk.**
- g. **Hold wood securely. Loose wood will be thrown violently.**
- h. **Do not stand in line with out feed of belt. Do not let others stand in line of the out feed.**
- i. **Never sand pieces too small to hold safely.**
- j. **Never use gloves or a rag to hold material.**
- k. **Use sanding disk on down side, not up side.**
- l. **Sand with the grain whenever possible.**
- m. **Keep work moving. Do not over sand in one place.**

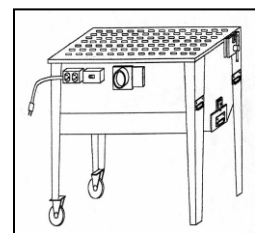
Oscillating Spindle Sander

1. Configuration: A cylindrical sanding spindle mounted in a table
2. Action: The spindle spins (and on some models oscillate up and down) while the wood is moved against the tabletop.
3. Adjustments: some models have interchangeable spindles of various diameter
4. **Safety:**
 - a. **Keep material flat against the tabletop.**
 - b. **Use light pressure. Do not burn out the sandpaper.**



Down Draft Table

1. Configuration: Self contained dust collection unit
2. Action: Use down draft table for any sanding, routing, or grinding.
3. Adjustments:
 - a. Push button cleaning
 - b. Mobile wheels
 - c. 110-volt receptacle
 - d. Add solid tabletop to use as a workbench



4. Safety:

- a. **Wear dust mask when sanding on table**
- b. **Do not lean over table when using push button cleaning.**
- c. **Do not use table as a workbench.**

Power Drills

The principle danger of power drill is the loss of control by the operator and the danger of loose material being twisted up onto the bit. Remember, the bit is spinning, creating the hazards of radial forces.

These examples are just a few of the many bits available. It is important to note which bits are appropriate for what materials. In general, wood cutting bits can be used only to cut wood, whereas metal cutting bits can cut both metal and wood.

- A. **Countersink:** creates an enlarged hole with an angled bottom to allow screw heads to set below the surface
- B. **Combination Bit:** a flat tapered bit with a shoulder for drilling and countersinking holes for wood screws
- C. **Forstner Bit:** a very precise bit for cutting large holes over ½ inch
- D. **Masonry Bit:** a bit for drilling holes into masonry or cement
- E. **Bullet Point Bit:** a woodcutting bit with a “bullet” point that reduces point drift and cuts a hole with a flat bottom (also called a Brad-point bit)
- F. **Reduced Shank Twist Bit:** a large twin-fluted bit with a smaller shaft
- G. **Twist Bit:** a twin fluted bit with a beveled point appropriate for general drilling in wood or metal
- H. **Spade Bit:** a flat, inexpensive bit for boring large holes over ½ inch wide. Not accurate and tend to tear-out the beginning and ends of cuts
- I. **Auger:** drills large deep holes with a brace or slow speed hand drill. The threaded point screws into the wood and pulls the bit deeper. IT CANNOT BE USED IN THE DRILL PRESS.
- J. **Fly Cutter:** an adjustable hole saw. IT CANNOT BE USED WITH A HAND DRILL, AND CAN ONLY BE USED IN THE DRILL PRESS.
- K. **Hole Saws:** for sawing large holes (1 to 3 inches) through wood no thicker than twice its length (3-½ inches max)

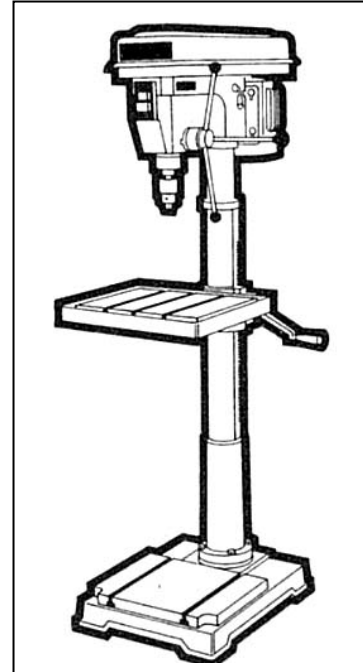


Floor Drill Press

1. Configuration: overhead drill mounted above adjustable table
2. Cutting Action:
 - a. Drill bit is mounted in a chuck, which travels up and down on the quill
 - b. Drills holes perpendicular to table
3. Adjustments:
 - a. Variable speed (change with drill on only)
 - b. Table elevation
 - c. Quill can be locked
 - d. Depth stop for setting hole depth

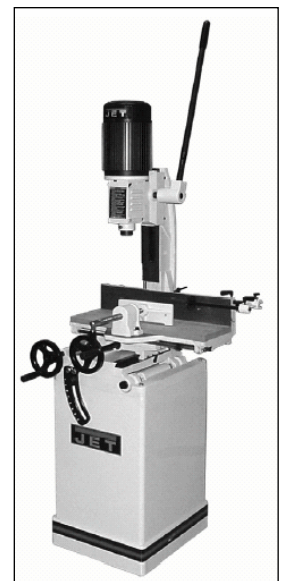
4. Safety:

- a. Use only bits appropriate for the material.
- b. Make sure that the bit tight and straight in chuck.
- c. Remove key from chuck before turning on.
- d. Secure wood, clamping it whenever possible.
- e. Do not drill into metal table.
- f. Place a scrap of wood under work to avoid tear-out.
- g. Check drill speed: faster for soft materials or small bits, slower for hard material or large bits. Adjust speed only with drill on.
- h. Never use auger bits in the drill press.
- i. Avoid awkward hand positions in which a sudden slip would cause hand to go into the cutting tool.
- j. Hold work in left hand and operate drill with right hand.
- k. Never wear gloves, neckties, jewelry, loose clothing, or long loose hair.



Hollow Chisel Mortiser

1. Configuration: Hollow square chisel with a drill bit in the center built in a press.
2. Cutting Action: Bores a squared hole
3. Adjustments:
 - a. Uses different sizes of chisels from 1/4" – 1"
 - b. Head can tilt at an angle
4. Safety:
 - a. Secure wood in vise
 - b. Use the proper chisel/ bit combination
 - c. Tighten bit and remove chuck
 - d. Do not over work chisel and bit
 - e. Do not mortise your hand



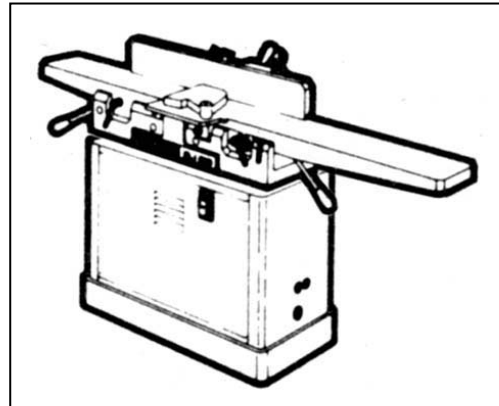
Shaping

Besides the general cutting and sanding tools, there are many other tools used for specialized shaping, such as jointing edges, planing surfaces, and cutting molding. For the most part, these power-shaping tools are some variation of a cutter blade (composed of knives or blades mounted on a spindle or shaft) and a guide surface or surfaces. Such tools include the jointer, the planer, the wood shaper, and the router. With the lathe, the wood is spun on spindles and the cutting instruments (the chisels or turning knives) are held stationary. Hand shaping is performed with a variety of chisels, knives, rasps and files, as well as small all-purpose devices such as the Dremel and rotary cutter.

The safety procedures for the shaping tools are essentially the same as those for the circular saws. Keep in mind, however, that the knives on the shaper cutters are generally much larger than the teeth of the saw blades and there for are more prone to grab loose clothing and throw large splinters.

Jointer

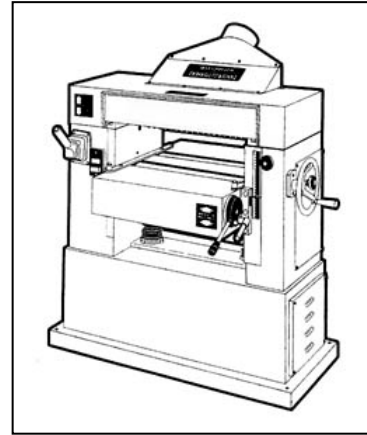
1. Configuration: a series of short knives mounted on a horizontal spindle set into a long flat table equipped with a fence
2. Action:
 - a. The jointer is used to true the edges of boards that is make them very straight at a constant angle to the face.
 - b. The wood is pushed on the table along the fence and into the spinning knives.
3. Adjustments:
 - a. Blade elevation
 - b. Out-feed table height
 - c. Fence can be tilted for beveled edge



4. **Safety:**
 - a. **Must have had proper instructions on how to use the jointer.**
 - b. **Shop personnel must supervise you when using it.**
 - c. **Use push blocks and push sticks to feed wood through cutters.**
 - d. **Be aware of where your fingers and hands are placed when using the jointer.**
 - e. **Keep in feed and out feed table clean and clear of debris.**

Thickness Planer: OFF LIMITS WITHOUT SPECIFIC PERMISSION, TRAINING, AND SUPERVISION

1. Configuration: a series of 15 inch knives mounted on a horizontal spindle set above a short table and equipped with self-feeding rollers
2. Action:
 - a. Planer is used make the faces of a board flat and parallel
 - b. The wood is fed between the spinning roller/knife assembly and the table.
3. Adjustments:
 - a. Table or blade elevation for thickness

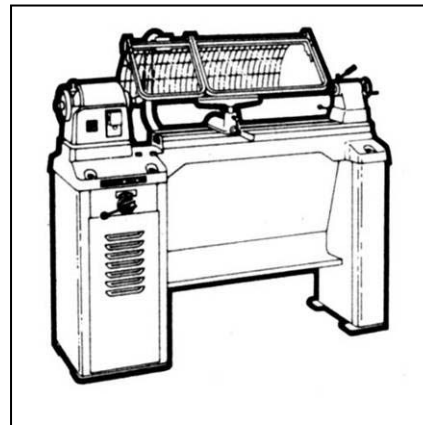


4. Safety:

- a. **Must have had proper instructions on how to use the thickness planer.**
- b. **Shop personnel must supervise you when using it.**
- c. **Wood must be free of all dirt or any metal and paint.**
- d. **Must wear face shields, dust mask, and ear protection when using the machine.**
- e. **Remove only a maximum 1/16 of an inch at a time.**

Wood Lathe: OFF LIMITS WITHOUT SPECIFIC PERMISSION, TRAINING, AND SUPERVISION

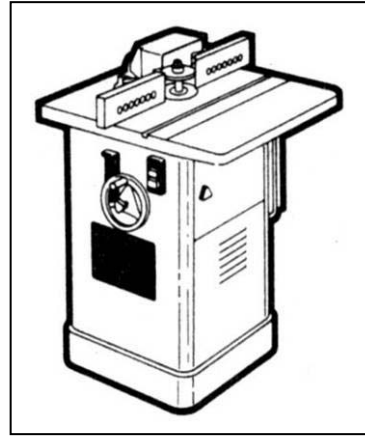
1. Configuration: two spindles equipped with a parallel tool rest
2. Action:
 - a. The lathe is used to “turn” or cut rectangular pieces into cylindrical forms
 - b. The wood is mounted between the spindles and spun, while turning chisels are used to cut the cylindrical profiles.
3. Adjustments:
 - a. Spindles accommodate various lengths
 - b. Variable speed
 - c. Adjustable tool rest
 - d. Variety of chisels



4. Safety: Do not use without specific permission, training, and direct supervision.

Wood Shaper/Router Table: OFF LIMITS
WITHOUT SPECIFIC PERMISSION, TRAINING, AND
SUPERVISION

1. Configuration:
 - a. a series of short knives mounted on a vertical spindle set into a short flat table equipped with a fence and miter gauge.
 - b. Or a Router mounted upside-down in a table with a fence
2. Action:
 - a. The shaper or router is used to “mold” the edges of boards, that is shape them into specific molding profiles
 - b. The wood is pushed on the table along the fence or with the miter gauge and into the spinning knives.
3. Adjustments:
 - a. Interchangeable cutters for different profiles
 - b. Blade elevation
 - c. Fence settings
4. **Safety:** Do not use without specific permission, training, and direct supervision.



Pneumatic Tools

Pneumatic tools are powered using compressed air and must be connected to the shop's air supply. Compressed air lines are throughout the shop at most work -stations in the form of hoses. Air hoses use a female fitting that will connect to the male fitting on the tools. **Before use of the tool, the tool should be oiled with proper air tool oil.**

Brad Nailer:

1. Configuration: pneumatic 18 or 16 gage
2. Nailing Action: Used only to fasten wood together
3. Adjustments: Nails vary from 5/8 of an inch to 2 ½ inches.
4. Loading: Clips must be pulled back and proper nail size must be placed in with heads up



5. Safety:

- a. Always wear eye protection.
- b. Keep all body parts a safe distance away from the area of nailing.
- c. NEVER POINT THE NAIL GUN IN THE DIRECTION OF OTHERS.
- d. Avoid nailing in areas of knots, metal, and/or other hard areas in the wood.
- e. Always have nailer pointed against the wood when nailing.

Framing Nailer:

1. Configuration: pneumatic chip nailer
2. Nailing Action: Used only to fasten wood together
3. Adjustments: Nails vary from 2 inches to 3 ¼ inches.
4. Loading: Clips must be pulled back and proper nail size must be placed in with heads up



5. Safety:

- a. Always wear eye protection.
- b. Keep all body parts a safe distance away from the area of nailing while in use.
- c. NEVER point the nail gun in the direction of others.
- d. Avoid nailing in areas of knots, metal, and/or other hard areas in the wood.
- e. Always have nailer pointed against the wood when nailing.

Orbital Sanders:

1. Configuration: 5 inch pneumatic sander with dust collector
2. Sanding Action: use for finish sanding on wood, plastic, foam, etc.
3. Adjustments:
 - a. Variable speed
 - b. Uses 5 hole, hook & loop sand paper

4. Safety:

- a. **Always wear dust mask**
- b. **Don't sand treated wood with lead paints**
- c. **Avoid damaging sanding pad**



Die Grinder:

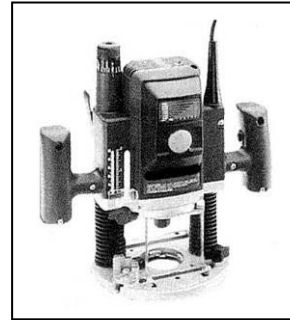
1. Configuration: Hand held rotary grinder.
2. Action: Uses different bits for many different grinding purposes
3. Bit Requirements: Use the proper bit for the proper material.
4. **Safety:**
 - a. **Safety glasses, dust mask, and ear protection are required for use of the tool.**
 - b. **Be aware of body parts near grinding bits.**
 - c. **Be aware of loose clothing and material.**
 - d. **Item in which you are grinding must be properly clamped or held down**



Hand-held Power Tools

Router: OFF LIMITS WITHOUT SPECIFIC PERMISSION, TRAINING, AND SUPERVISION

1. Configuration: essentially a smaller, hand held, inverted version of the wood shaper
2. Action:
 - a. The router is used to cut slots and dados, and to mould the edges of boards
 - b. The wood is secured and the router is moved by hand
3. Adjustments:
 - a. Interchangeable cutters (bits) for different cuts and profiles
 - b. Bit depth
 - c. Various guides, jigs, templates, straight edges, and accessories for specific procedures
4. **Safety: Do not use without specific permission, specific training, and direct supervision.**



Router Bits:

Router bits are essentially a smaller version of the wood shaper cutters. They come in a variety of shapes and profiles, each suited for a particular kind of cut. There are two types of router bits (1) plunge and (2) bearing. Plunge bits are used to cut in the center area of a board, whereas a bearing bit cuts around the edges.

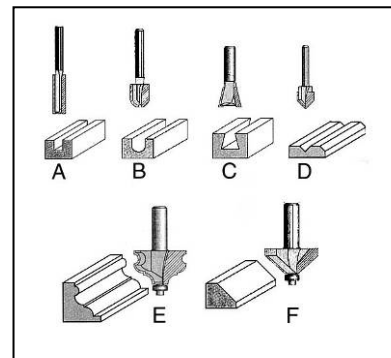
A few examples of router bits:

Plunge bits:

- A. **Straight:** cuts square slots or dados
- B. **Round nose:** cuts rounded slots
- C. **Dovetail:** cuts dovetail slots
- D. **V-groove:** cuts V shape grooves

Bearing bits:

- E. **Molding:** cuts a molding profile
- F. **Chamfer:** cuts a sloped corner



Circular Hand Saw: USE ONLY UNDER DIRECT SUPERVISION

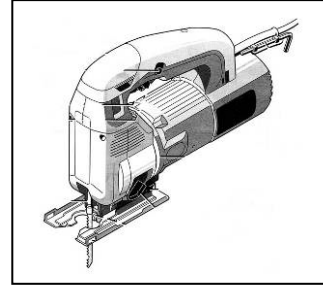
1. Configuration: hand held circular blade
2. Cutting Action:
 - a. Wood is held in place while blade is moved
3. Adjustments:
 - a. Blade can be raised or lowered for cut depth
 - b. Blade tilts for bevel cuts 0/45°
4. Cuts: straight cuts
 - a. Rips-cuts and crosscuts on stock too large to fit on table saw, radial arm saw, or miter saw



5. **Safety:**
 - a. **USE ONLY UNDER DIRECT SUPERVISION OF SHOP PERSONNEL**
 - b. **Set blade depth so that the teeth emerge completely from underside of cut.**
 - c. **Keep the blade aligned along straight path. Make sure you don't bind the blade.**
 - d. **Never cut "blind." Always ascertain that underside of cut is clear of obstructions.**
 - e. **Do not cut into tabletop or supports.**
 - f. **Make sure both sides of the cut are supported even after the cut is made.**
 - g. **Do not cut electrical cord.**
 - h. **Allow blade to stop spinning before placing saw down after cut is finished.**
 - i. **Take extreme care when making bevel cuts, as the angle between the blade and foot can bind the blade easily.**
 - j. **Always hold saw with both hands.**
 - k. **Secure small and/or thin work with clamps. The wood must not be allowed to move during the cut.**

Jig Saw

1. Configuration: hand held, with a short stout blade extending from bottom (foot)
2. Cutting Action: the blade reciprocates up and down, cutting on the up stroke
3. Adjustment: varies with model
 - a. Trigger can be locked on
 - b. Speed can be adjusted
 - c. Single action or orbiting blade
 - d. The foot tilts on some models
4. Cuts: straight or curved cuts in moderately thin wood (up to length of blade)

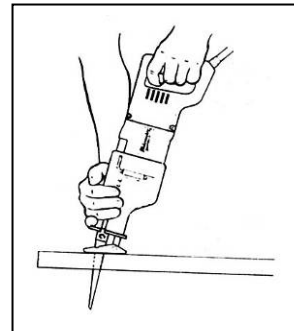


5. Safety:

- a. **Do not cut “blind”. Do not cut without ascertaining backside of cut is clear of obstructions.**
- b. **Do not cut into tabletop or support.**
- c. **Do not cut electrical cord.**
- d. **Keep electrical cord free of snags.**
- e. **Make sure blade extends completely through material throughout stroke**
- f. **Secure material before cutting. Small and/or thin material may flex or vibrate causing loss of control.**

Reciprocating Saw

1. Configuration: hand held, with a stout blade extending from end
2. Cutting Action: the blade reciprocates in and out, cutting on the in stroke
3. Adjustment:
 - a. The shoe is both hinged and removable
 - b. The blade can be reversed
 - c. Variable speed
4. Cuts: freehand rough cuts (up to length of blade)



5. Safety:

- a. **Do not cut “blind”. Do not cut without ascertaining backside of cut is clear of obstructions.**
- b. **Do not cut into tabletop or support.**
- c. **Do not cut electrical cord.**
- d. **Keep electrical cord free of snags.**
- e. **Make sure blade extends completely through material and beyond shoe throughout stroke**
- f. **Secure material before cutting. Small and/or thin material may flex or vibrate causing loss of control.**
- g. **Use both hands to hold the saw.**

Dremel

A small, all-purpose shaping device for very detailed work. It is similar in configuration to a router without a guide base, and can be utilized for shaping, sanding, grinding, and much more.

Dremel bits:

A – E. High speed rotary cutters: for general purpose shaping of wood, metal, or plastics.

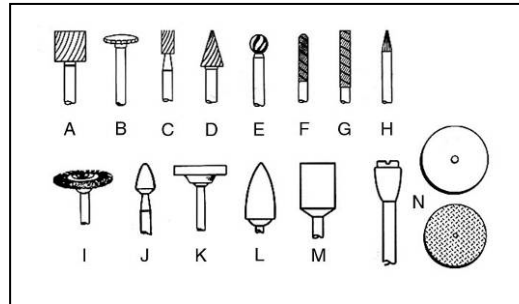
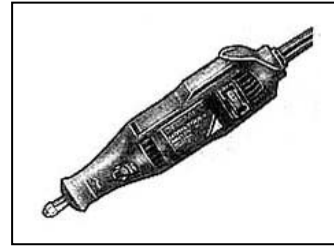
F – H. Tungsten carbide cutters: longer lasting cutters

I. Wire brush: for cleaning corrosion and rust on metals

J – M. Grinding points: for grinding metal

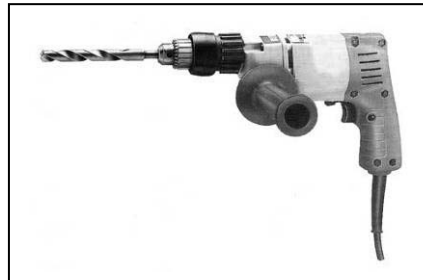
N. Cutting disks and Mandrel

SAFETY: WEAR EYE PROTECTION



Hand Drill

1. Configuration: hand held drill
2. Cutting Action:
 - a. Work is secured and drill moved by hand
 - b. Can be used to drive screw with special bits
3. Adjustment: varies with model
 - a. Trigger can be locked on
 - b. Speed can be adjusted
 - c. Direction can be reversed



4. Safety:

- a. **Do not drill “blind”. Do not drill without ascertaining backside of work is clear of obstructions.**
- b. **Do not drill into tabletop or support.**
- c. **Do not abuse electrical cord.**
- d. **Keep electrical cord free of snags.**

Use both hands on drill. If the bit binds up, the drill will try to wrench itself violently from your grip, so be prepared.

Hand Sanders

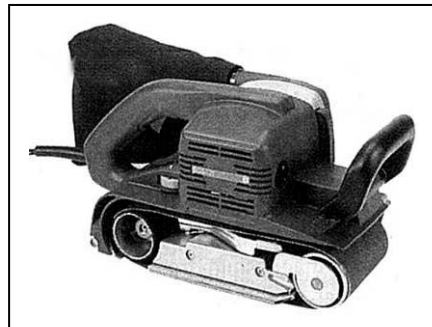
All of the same precautions taken with the large stationary sanders also apply to the smaller hand sanders, especially the hand belt sander. The finishing and random orbit sanders, however, produce far less force and are thus generally safer. Always wear a dust mask when sanding, especially when there is not a dust collector on the machine. **NEVER SAND WOOD PAINTED WITH LEAD-BASED PAINT IN THE DESIGN SHOP.** Special hazardous materials precautions must be taken with the dust produced from sanding lead-based paint. If you cannot determine with absolute certainty that a paint is not lead-based, treat it as if it were.

All hand sanders are equipped with trigger locks that lock the sander in the on position. Make sure the lock is off before plugging in the sander.

Some hand sanders are equipped with dust collecting bags. Always check these bags before and after use, and empty any dust inside.

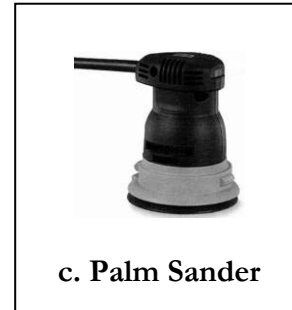
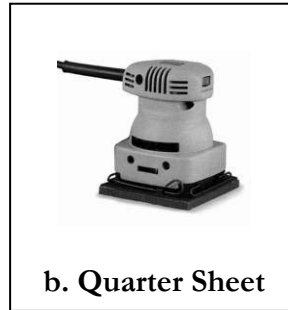
Hand Belt Sander

1. Configuration: small, hand held belt
2. Action: belt rotates around two pulleys; sander is moved while wood is held stationary
3. Safety:
 - a. Use both hands to hold the sander firmly. Always be able to hold against the direction of belt rotation.
 - b. Secure the wood. The sander will try to throw loose wood.
 - c. Never approach from attacking angle. Do not tear the belt on sharp corners.
 - d. Be aware of belt tracking and tension. Shut off machine and alert shop personnel if belt tracks wrong, especially if sparks are created.
 - e. Do not use if belt is loose or torn. Alert shop personnel.
 - f. Keep hands away from abrasive surfaces, especially near intake gaps.
 - g. Do not sand electrical cord, loose clothing and/ or cloth in the sanding area
 - h. Keep electrical cord free of snags.



Finishing Sanders

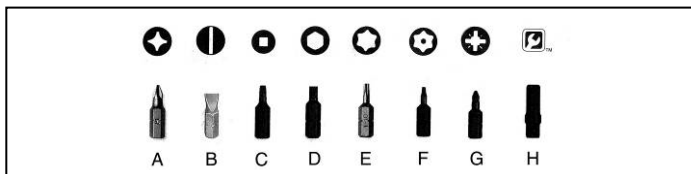
1. Configurations: small, hand held vibrating pad sander
 - a. Half Sheet Finish Sander: uses a half sheet of sandpaper
 - b. Quarter Sheet Palm Sander: uses a quarter sheet of sandpaper
 - c. Palm Sander: round pad
2. Action: sanding pad vibrates in a randomly changing circular motion



Cordless Drill

Similar to the hand drill, but battery powered and used primarily for driving screws. Cordless drills are often equipped with a clutch that slips when the screw is seated, preventing the head from being broken off or stripped out. Phillips head and square head screws work best.

A. Phillips Bit, **B.** Slotted Bit, **C.** Square Recess, **D.** Socket Hex Head, **E.** Star, **F.** Star Insert, **G.** POZIDRIV, **H.** Hand Drive Adapter for socket wrenches



Hand Tools

Hand Saws

Few tools are as useful or as often overlooked or misused as the handsaw. When used correctly, the handsaw is a quick and efficient way accomplishing precise cuts. When misused, the handsaw is tiresome and sloppy. The hand saw should be used any time a power tool would be difficult or dangerous to use.

Correct use of a handsaw:

A hand tool must be sharp to be useful. A dull saw will quickly tire the user after very little progress. If a saw is dull, either replace the blade (if possible), or inform a shop monitor.

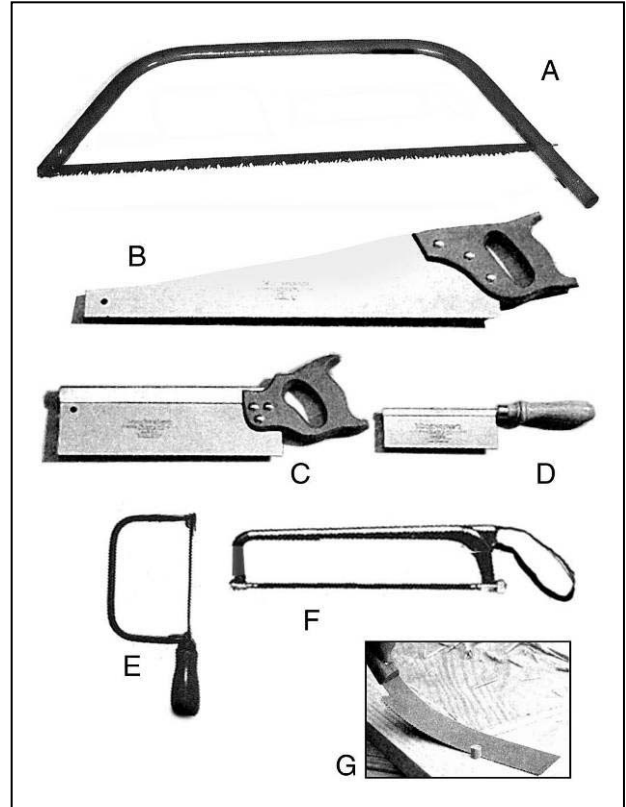
You will also find sawing much easier when the saw is held correctly. The work should be secured at a comfortable height, with the saw, your wrist, elbow and shoulder in line. The saw should be held at a 45-60° angle to the wood for general cutting, and level for precise cutting, with your elbow bent. You will want to stand so that you can look down at the saw on edge and in line with the cut. The saw should appear to be just a thin line, and you should be able to see both sides of the saw with only a slight movement of your head.

When you make a stroke, you should be able to keep the saw's cutting edge level without seesawing the end up and down. The motion should be smooth, steady, and comfortable. If not, reposition the work or your body. Remember to cut on the waste side of your mark. Hold the saw with a relaxed but secure grip, with your index finger pointing forward. This finger will help provide lateral control. To start a cut, begin with a few short strokes, steadying the saw with the thumb of your free hand. Be careful that you don't let the blade hop off the work and cut your hand. After a groove is started, continue sawing with long steady strokes. Long, even strokes are more efficient, producing a faster cutting action and better control. A short, jerky motion will wear out both you and the saw. You must not tense up your hand, arm, or body, especially as you begin to fatigue. You should concentrate on using only those muscles needed for steady control. Use just enough force to maintain contact with the wood. If you tense up or force the cut, you will upset the saw's balance, resulting in a crooked and uneven cut. A well-tuned saw will want to cut straight: let it. Concentrate on keeping the saw straight in line and level, not on cutting fast. Cutting through hard parts, such as knots, will require slower—not faster—strokes. Support the waste end until the cut is complete. Letting it fall off by itself will cause the work to split. Also, do not twist the saw to knock the waste piece away, as this will damage the saw's teeth.

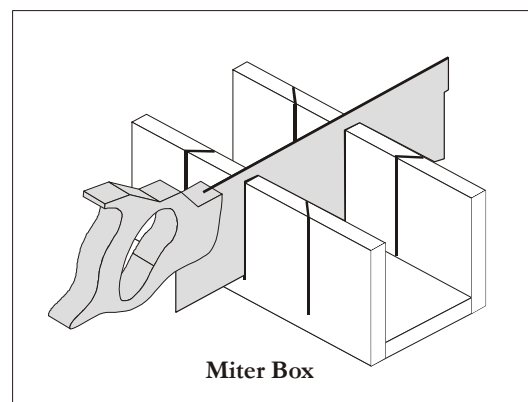
Kinds of Saws

Each kind of saw is design for a specific task. Using the wrong saw for any task means wasted effort and poor accuracy.

- A. **Bow Saw:** A large, double-action toothed band blade is held in tension like a bowstring. It is used for cutting limbs and rough lumber
- B. **Rip, Crosscut, or Panel Saw:** General-purpose saws. The teeth configuration determines whether the saw is appropriate for ripping, crosscutting, or sawing panels.
- C. **Back Saw:** A straight wide blade stiffened along the top edge for accuracy and that cuts on the push or “back” stroke. It is used for cutting miters (often with a miter box), tendons, and dovetails.
- D. **Gent Saw:** A smaller version of the back saw used for very precise work
- E. **Coping Saw:** A saw with a narrow, thin blade (cuts on the pull stroke) held in tension by a deep C-shaped arm. It is used for cutting intricate curves. The blade can be inserted through a hole in the piece to make a trapped cut.
- F. **Hack Saw:** A saw with a fine-toothed band saw blade held in tension. It is used for cutting metals and some plastics. The blade cuts on the push stroke.
- G. **Flush-cut Saw:** an extra thin, flexible blade that cuts on the pull stroke. It is used to cut wooden dowels and pins flush without marking the surface. Also useful for various detail cuts.



Miter Box: a box or jig that guides the back saw when making miter cuts.



Hammers

A hammer is a very basic tool for any carpenter. Hammers are made in various qualities. There are two shapes of claws on hammers. The **straight claw hammer** is better for prying or pulling wood apart. The claw wedges, like a chisel, in between two boards to loosen them. This straight claw hammer is preferred by framing carpenters and is usually a heavier weight (16oz. – 32oz.). The **curved claw hammer** is better for pulling nails. This curved claw hammer is preferred by finish carpenters and is usually lighter weight (13oz – 16oz.).

A. Hammer Safety

1. Use the proper size and type of hammer for the job.
2. Never throw a tool.
3. Check the head to see that it is securely fastened to the handle.

B. Most Common Hazards

1. Smashing thumbs and fingers.
2. Fumbling and dropping.
3. Being hit on the head during the back swing.



Chisels

A wood chisel is used to cut mortises into wood for hardware and other items. It is made of a steel blade heat treated throughout so it can be sharpened its entire length. Chisel sizes are determined by the width of the blade. Blades are available in 1/8" to 1", and in 1/4" increments from 1" to 2".

A chisel is made to either cut by hand or cut by holding the chisel and striking it with a hammer or mallet. Either way, the beveled side should be turned down. This enables you to prevent the chisel from cutting too deep by rocking it back on the bevel. This raises the cutting edge.

Chisel Safety:

1. Keep chisels sharp. A sharp tool is less dangerous than a dull one because less pressure needs to be used.
2. Drive wood chisels outward, away from your body.
3. Never put your hand in front of the cutting edge.
4. Remove nails or screws from the wood before you use a chisel on it.
5. Never use a wood chisel as a pry or wedge. The steel is hard and brittle and may break.
6. Always carry a chisel with the sharp end down.
7. Never carry sharp tools with points sticking up.

Screwdrivers

When selecting a screwdriver, remember the tip should fit snugly in the slot and be almost the full width of the screw head. Most hardware is supplied with Phillips screws. To drive these screws it takes more downward pressure to keep the tip in the slots. **The Phillips screwdriver is very much like the standard screwdriver. The difference is that the tip is shaped like an “x” so it will fit into slots in Phillips screws.**

There are two ways to size a screwdriver. The length of the blade is one size. Tip sizes are another way to size and are numbered #1 - #4. The most common size is #2 tip. Each tip fits a certain range of screw sizes, see the diagram below.

Screwdriver Safety:

1. Use a screwdriver only for its intended use, not as a punch, wedge, or pry bar.
2. Do not use a screwdriver with a broken handle, bent blade, or a dull twisted tip.
3. Keep your hands away from the work after the screw is started.
4. Never hold an object in the hand and press a screwdriver into it.

Block Plane

When using the block plane check to see that the blade is adjusted to the proper depth. Also, secure your work to keep it from moving around. Keep a firm grip on the plane and apply pressure downward and forward. This plane is mostly used to plane small pieces of wood and end grain such as fitting the ends of molding. Its small size makes it easy to control accurately.

How to use a Block Plane

1. First rest the palm of the hand to be used on the upper-most part of the plane; then grasp the sides of the plane between the thumb and second finger with the index finger resting in the hollow of the finger rest at the front of the plane.
2. Pressure should be applied down and forward at the beginning of the stroke.
3. Maintain uniform pressure throughout the stroke.



NOTE: ALWAYS PLANE WITH THE GRAIN. IF THE GRAIN IS IRREGULAR, IT MAY BE NECESSARY TO CHANGE THE DIRECTION OF PLANNING TO SUIT THE RUN OF THE GRAIN. IF CROSS OR CURLY GRAIN IS TO BE CUT, BE SURE THAT THE PLANE EDGE IS VERY SHARP AND SET FOR A FINE CUT. WHEN ANY PLANE IS NOT TEMPORARILY IN USE, SET IT ON ITS SIDE TO PROTECT THE BLADE.

Mark-up and Layout

- A. Accuracy: “Measure twice and cut once.” When unsure, cut a little long and physically check fit.
- B. When measuring for cuts, remember that blades have thickness and will turn a portion of the wood into sawdust.
- C. Cut on one side (waste side) of pencil mark
- D. **Tools for layout:**
 - 1. **Pencil** (*not shown*)
 - 2. **Scribe:** (*not shown*) A scribe is any kind of sharp, pointed metal marking tool. Because a pencil mark is not as thin as a scratch or knife cut, a scribe mark is more precise.
 - 3. **Tape measure** (*not shown*)
 - 4. **Square:** L-shaped, right-angle metal straight edge
 - 5. **Combination Square:** an adjustable 90 degree and 45 degree angle gauge with an a ruler on one side and an offset that can be set against the edge of a board for accuracy on the other
 - 6. **Compasses:** marks circle around a center point
 - 7. **Marking gauge:** an adjustable scribe that slides along the edge of a board to mark a set distance from that edge
 - 8. **Bevel:** an adjustable gauge for transferring variable angles
 - 9. **Calipers:** two prong measuring device similar to a compass (*from left to right: inside calipers, outside calipers, dividers*)
 - 10. **Chalk line:** a chalk impregnated string on a reel for snapping straight lines
 - 11. **Plumb bob:** a pointed weight on a string used for determining true vertical
 - 12. **Level:** (*not shown*) a rigid straightedge with bubble gauges for determining true vertical and true horizontal.

