



The UNIVERSITY of OKLAHOMA
College of Architecture

Creating/Making Lab

Safety Manual

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Introduction

The OU College of Architecture Creating/Making Lab is a 5000+sft lab for student, faculty and staff in the college. The Creating/Making Lab is located a few blocks from campus at 1425 George Ave. It was once a racket ball facility with four courts and now has three woodworking courts and more. Users are required to go through two levels of safety training before they can use all of the shop. There is also a metals lab, laser cutter lab, plastics/toxics lab, paint booth, lecture area, and photo documentation room.

The Creating/Making Lab is more than hand saws and continues to grow towards the future with technology and sustainability. The shop has two laser cutters which allow users to cut and engrave materials up to a ¼" thick on an 18" x 32" bed from their Auto CAD drawings. Recently the College bought a CNC Router for the Creating/Making Lab which has allowed user to cut materials up to 48" x 96". The dust collector for the shop is controlled by Ecogate, a computerized dust control system, which automatically turns the collector on and off when a user turns on a machine. This cuts back on noise and dust pollution in the shop. The Creating/Making Lab also offers its users locally harvested woods that are processed by the Shop's sawmill and solar kiln. A variety of straight-grain and figured walnut, pecan, sycamore, oak, maple, cedar and osage orange are available for students, faculty and staff for various departmental projects.

The Creating/Making Lab is committed to safety and proper use of the shop. All users must have scheduled training on all machinery before they can be given permission to use. Level 1 training covers shop basics, media cutter, panel saw, miter saw, band saw, belt and disc sanders, drill press, mortising machine and a few hand held power tools. Level 2 training covers tables saw, joiner, planer and surface sander. Laser training covers the basics, file setups and user interface. Metal shop, wood lathe and CNC router training is on an as need basis.

Delivery Address:
OU College of Architecture Creating/Making Lab
1425 George Ave.
Norman, OK 73072

Creating/Making Lab Manager Office	(405) 325-0382
Creating/Making Lab Tool Room	(405) 307-0856
College of Architecture Office	(405) 325-2444

Policies and Procedures

Policies

1. The University of Oklahoma, College of Architecture Creating/Making Lab is open to all students, faculty and staff in the college.
2. The University of Oklahoma, College of Architecture Creating/Making Lab users must have completed Creating/Making Lab Orientation and Level 1 training.
3. The Faculty must schedule orientations and training with Creating/Making Lab manager before the first day of each semester.
4. Creating/Making Lab Orientation will be given by Creating/Making Lab manager or Creating/Making Lab staff only.
5. The Maximum number of users in the Creating/Making Lab is 40, with each supervisor monitoring no more than 15 students.
6. Faculty who plan to use the Creating/Making Lab should schedule their semester with Creating/Making Lab management before the first day of each semester.
7. Faculty must be present during scheduled studio time in the Creating/Making Lab unless given permission otherwise beforehand from Shop Manager, Division Head, or Dean.
8. Creating/Making Lab is only to be used for studio/class projects.
9. Use for research and grants must be pre-approved by the Dean or his/her designee.
10. Projects must be complete by the end of final exam week. Any extension for incompletes must have approval from director and faculty. Students will have to schedule with Creating/Making Lab manager for shop use.
11. All tools must remain in the Creating/Making Lab unless you are given permission by Creating/Making Lab staff.
12. Any materials or projects left in the Creating/Making Lab after the end each semester are subject to disposal or Creating/Making Lab scrap. Please inform Creating/Making Lab personal if you plan to use materials, projects or teaching aids in following semesters.
13. The Creating/Making Lab harvested lumber is available for fine woodworking studio projects under the supervision of Creating/Making Lab personnel.

14. Creating/Making Lab management will only consider extended or extra Creating/Making Lab operation hours if requests are from College of Architecture Faculty. The Dean must approve all extended hour requests.
15. Faculty members requiring Creating/Making Lab use are required to give **notice** to the Shop Manager for scheduling purposes. The faculty member must work with the Creating/Making Lab manager to coordinate and schedule the most optimum and safest time for students to use the Creating/Making Lab or receive training.

Training Procedures

Level 1 Training

Level 1 training consists of the explanation of general rules, Level 1 tools, and tour of the Creating/Making Lab. Level 1 Tools: Media cutter, panel saw, miter saws, band saw, scroll saw, belt/disc sanders, spindle sander, edge sander, down draft table, hand drill, drill press, mortising machine, and nail guns. Approximately 2-3 hours. Maximum capacity is 20.

Level 2 Training

Level 2 training focuses on Level 2 tools and rough lumber to milled molding. Students will learn to take a rough board and flatten it, make it parallel in thickness, give a straight edge, rip it true, finish sand it and rout it. Level 2 Tools: Joiner, planer, tables saw, wide belt sander, routers and router table. Approximately 2-3 hours. Maximum capacity is 20.

Laser Training

Laser possibilities, file setups, file imports, laser interface. This must be completed by all students, faculty and staff before using the laser cutters. Once training has been completed, your Sooner OneCard will be activated and required for use. Please see Laser Manual on Creating/Making Lab website for more info. Approximately 30 minutes -1 hour. Maximum capacity is 8.

CNC Router Training

CNC Router possibilities, file setups, file imports, creating tool paths, material hold downs, router interface and demo. Approximately 1 hour. Maximum capacity is 10.

Plastic Vacuum Former

The Centroform Ezform vacuum forming machine is available in the Creating/Making Lab's plastics lab. The required sheet size is 21.25" x 30.25", with a forming area 18" x 27". Please see Centroform Ezform manual and Creating/Making Lab Staff for assistance.

Metal Shop training

The Metal Shop has limited capabilities of cutting, bending, grinding, soldering and welding. Please see Creating/Making Lab Staff for onsite training and guidance in the metal shop.

Accident Procedures

1. Administer first aid to injured individual. Ask for help if needed. Call 911 if beyond your ability to help or life threatening.
2. All accidents will be reported to College of Architecture office - **325-2444**.
3. Close Creating/Making Lab if needed.
4. Bring injured individual to student health center or emergency room or urgent care.
5. Blood and body fluids should be cleaned by Creating/Making Lab employees, not students, with proper cleaners. Available in first aid cabinet.
6. Fill out accident report.
7. OU Emergency Procedures <http://www.ou.edu/content/provost/emergency.html>.

Creating/Making Lab Safety Manual

Creating/Making Lab Safety Manual was adapted, written and compiled from tool manufactures owner's manuals and the Creating/Making Lab Staff. Some of the images of tools and machines are not the model or brand of what the Creating/Making Lab has. This manual is strictly a guide to accompany an in shop safety training.

Creating/Making Lab Rules

1. Check in with the Creating/Making Lab personnel when you are entering the Shop to work.
2. Always clean your work area and check out before leaving the Creating/Making Lab.
3. The Creating/Making Lab is to be used for school projects only.
4. The Creating/Making Lab is only to be used with proper supervision: Creating/Making Lab manager, Creating/Making Lab monitor, or class instructor must be present.
5. You must complete the Creating/Making Lab Orientation and pass the Level 1 test before using equipment.
6. All guests check in with the Creating/Making Lab personnel and abide by all rules, including wearing safety precautions, while in the Creating/Making Lab. Guests may not work with any tools, machines or other shop equipment.
7. **EYE PROTECTION:** safety glasses, goggles, or face shields are required to be worn at all times in the Creating/Making Lab work areas.
8. Proper ear protection should be worn at all times while working in the Creating/Making Lab. 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 equipment for an extended period.
9. Use of a dust mask is recommended while working in the Creating/Making Lab.
10. Wear **CLOSED TOE SHOES ONLY!** No flip-flops, sandals and high heels are to be worn while working in the Creating/Making Lab.
11. Loose clothing, long hair, jewelry, earbuds/music headphones are not permitted in the Creating/Making Lab. Long sleeve should be rolled up, long hair pulled back or tied up, and tucked in or remove neckties, dangly jewelry and hoodie strings.
12. No horse playing, running, or fooling around.
13. Be alert! Please consider the safety of all students while working in the Creating/Making Lab.
14. Report all accidents or injuries of any kind to Creating/Making Lab personnel.
15. Do not operate any tool while under the influence of drugs, alcohol or any medication. This also includes drowsiness and sleep deprivation.
16. **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.
17. **NO TREATED LUMBER ALLOWED IN THE Creating/Making Lab** unless given permission.
18. **REMOVE ALL NAILS, STAPLES, AND METAL FROM SALVAGED WOOD BEFORE WORKING.**
19. **NO LEAD ALLOWED! DO NOT USE ANY MATERIALS CONTAINING LEAD BASED PAINTS.** If you are unsure about the composition of the painted materials, it will be assumed that the paint is lead based.
20. **STORE ALL FLAMMABLE MATERIAL IN THE FLAMMABLE STORAGE CABINETS IN PAINT STORAGE ROOM.**
This includes: paint, paint thinners, spray paint, acetone, wood finish, etc.
21. Dispose of all oily, varnish, and paint thinner soaked rags in red metal containers.

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** while working Creating/Making Lab. If a procedure feels dangerous, don't try it. When in doubt ask Creating/Making Lab personnel for an alternative procedure that will be safe.

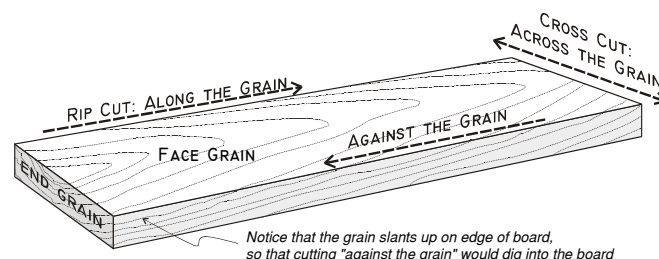
REMEMBER: Your personal safety is your responsibility. The best way to protect oneself from injury is to have a clear understanding of how the tools work and what are the potential dangers. If you understand the underlying forces at work, you will be able to foresee and avoid accidents caused by ignorance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

Creating/Making Lab Machine and Tool Rules

1. **Always wear eye protection** when working in the Creating/Making Lab.
2. **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 Creating/Making Lab supervisor, Creating/Making Lab 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 Creating/Making Lab personnel to assist you.
3. **USE THE RIGHT TOOL.** Don't force a tool or attachment to do a job for which it was not designed.
4. **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).
5. **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.
6. **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.
7. **DO NOT PERFORM SET-UP OR LAYOUT WITH THE MACHINE RUNNING.** Turn the machine on only when ready to perform operation.
8. **DIRECTION OF FEED.** Feed work into a blade or cutter against the direction of rotation of the blade or cutter only.
9. **NEVER ADJUST THE MACHINE'S SETTINGS WITH THE TOOL RUNNING.**
10. **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.
11. **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.
12. **ALWAYS HOLD THE LONG SIDE OF THE CUT.** Keep hands a safe distance from the blade.
13. **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.
14. **DO NOT CUT SMALL PIECES ON SAWS.** Always keep hands at least 6" away from saw blades. Use a push stick or block. Clamp small pieces or fashion a jig or hold-down. Otherwise, use hand tools to make cuts on small pieces.
15. **DO NOT CUT IRREGULARLY SHAPED, WARPED, OR SPLIT WOOD.** The wood must sit flat against the saw's table and fence.
16. **DO NOT CUT WOOD CONTAINING NAILS OR OTHER FOREIGN MATERIALS.** Metal will dull blades, instantly cause sparks, and can become dangerous projectiles.
17. **DO NOT START CUT WHILE CUTTER IS RESTING AGAINST MATERIAL.** Machine should be at full speed before entering cut.
18. **USE CAUTION WHEN CUTTING THROUGH KNOTS.** Knots will often fragment unpredictably, turning into dangerous projectiles.
19. **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.
20. **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.
21. **Be Patient!** Let machine come to a complete stop before removing scraps.
22. **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.
23. **DO NOT USE DULL OR DAMAGED BLADES.** Stop cutting and alert Creating/Making Lab personnel if cutting is difficult.
24. **DISCONNECT TOOLS THAT APPEAR TO BE DAMAGED OR MALFUNCTIONING.** Alert Creating/Making Lab personnel. Never reconnect tools found disconnected without the permission of Creating/Making Lab personnel.
25. **REDUCE THE RISK OF UNINTENTIONAL STARTING.** Make sure switch is in "OFF" position before plugging in power cord.
26. **NEVER LEAN ON TOOL.** Serious injury could occur if the tool is tipped or if the cutting tool is accidentally contacted.

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).

Rough lumber: wood that has not been machined or processed.

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 to 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.

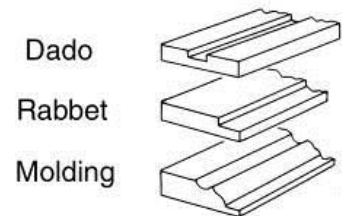
Blade Set: the alternating angled offset of the teeth of a blade.

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

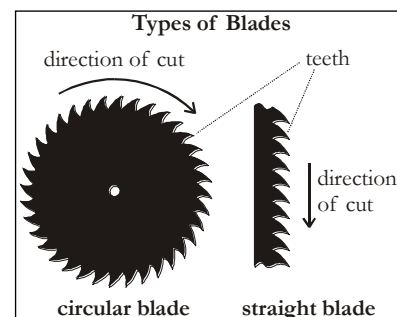
Obviously, the most dangerous parts of power tools are the moving parts. All of the machinery in the Creating/Making Lab is powered by electric motors, and the radial forces produced by spinning shafts, pulleys, blades and belts can be particularly dangerous. **This danger arises from two effects of 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.**

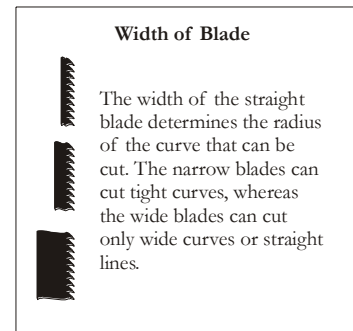
As one tooth cuts into the wood, it makes a path for the following tooth. As long as the cut is made properly, each individual tooth is required to remove only a small amount of wood. No significant friction should ever occur between the side of the blade and the wood. If the blade and/or the wood is 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



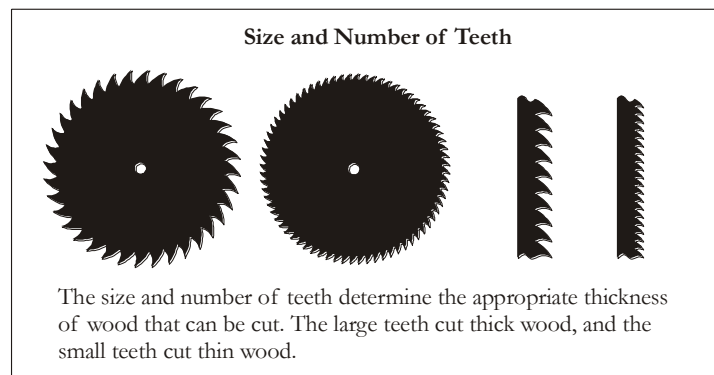
violent projectiles. When cutting, a slow steady feed should be used. If excessive force is required, the blade is dull or not appropriate for the material being cut. Forcing a cut will overheat the blade and create the potential for it to bind in the wood.

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.

LEVEL 1 Safety Training

Level 1 safety training will consist of the following tools and machines in this order. Media cutter, panel saw, miter saws, band saw, scroll saw, belt/disc sanders, spindle sander, edge sander, down draft table, hand drill, drill press, mortising machine, and nail guns.

Stationary Cutting Tools

Media Cutter

Configuration:

- Hand operated 90° media cutter mounted to the wall.
- The machine has a turret or blade holder that can be quickly and easily changed from one cutter to the next.

Cutting Action:

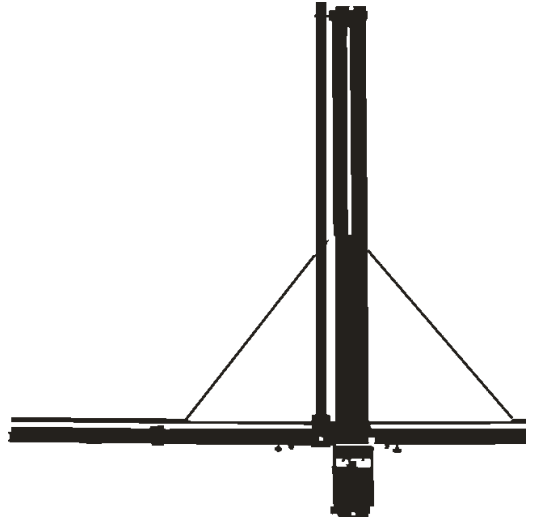
- Designed to cut mat board, cardboard and foam core.
- It will also score plastic and glass that then can be broken in a clean straight line.

Cuts:

- Blade cuts mat board, card board, chipboard, foam core, veneers.
- The plastic scorer and glass cutter can score up to 1/4" thick.

Safety:

- Keep hands away from the path of the turret.
- The turret must be rotated to the correct position. Different blades are used for mat board/cardboard, plastic, and glass.
- Use hold down clamp when cutting with matte blade and scorer. Never use hold down on glass.
- Score plastic, Plexiglas, acrylic 3 to 4 times before breaking. Do not score the glass more than once.
- Use stop blocks for cutting multiples of the same length.
- Always wear gloves when handling glass.
- Ask Creating/Making Lab personal to change or replace dull blades.



Circular Saw

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.

Panel Saw

Configuration: Hand held circular saw mounted on parallel bars.

Cutting Action:

- For 90° cross cuts, saw is pulled down across the stationary panel.
- For rip cuts, turn saw 90° counter clockwise and clamp to parallel bar. Roll panel from right to left through the saw.

Adjustments: Saw can rotate 90° clockwise and counter clockwise.

Cuts:

- 90° Cross- cuts on panels.
- Rip cuts on panels.

Safety:

- Firmly fix wood against back and rollers: never cut freehand.
- This tool is intended to cut large panels Small panels must be supported by a minimum of three rollers. 24" or bigger.
- Panels must be held down by the machines' hold downs or hands outside parallel bars.
- Slow steady feed: DO NOT TRY TO CUT TOO QUICKLY.
- Always return saw to its full start position after the cut.
- Avoid cutting more than one piece at a time.



- g. For rip cuts, lock saw in parallel position at desired height and feed panel through saw from right to left.
Look for the direction arrow on the saw rotary index.

Compound Miter Saw (Chop Saw)

Configuration: circular blade mounted on single action arm.

Cutting Action:

- Blade swings down in chopping motion.
- Wood is held in place while blade is moved.

Adjustments:

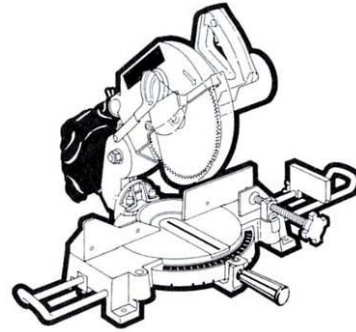
- Compound Miter Saw rotates and locks for miter cuts.
- Compound Miter Saw blade tilts for bevel cuts.

Cuts:

- Crosscut and miters in long narrow boards.
- Compound Miter Saw cuts compound miters in long narrow boards.

Safety:

- Firmly fix wood against table and fence with one hand or clamp: never cut freehand.
- Hand should never be closer than 6 inches to the blade.
- Do not cross arms while cutting.
- Slow steady feed: DO NOT TRY TO CUT TOO QUICKLY.
- Lumber must be flat and/or supported against table and fence to help prevent saw blade from binding or kickbacks.
- Always lock saw in desired miter position.
- Do not start the saw while the blade is resting against material. Saw should be at full speed before entering cut.
- When cutoffs are not supported by a fence they can be kicked by saw blade. To avoid this action, pull saw down to make cut, remain in down position, releases trigger switch and allow blade to stop before lifting saw.
- Tilted blade bevel cuts are most prone to binding and thus most dangerous.
- Always return saw to its full start position after the cut.
- Avoid cutting more than one piece at a time.



Sliding Compound Miter Saw

Configuration: circular blade mounted on a double action arm.

Cutting Action:

- Slides outward above wood, then pull down and push forward.
- Rail assembly can be locked so that saw can only chop like a standard miter saw.

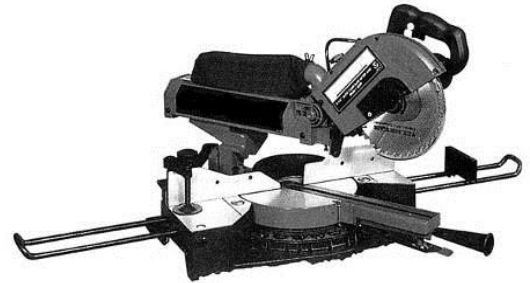
Adjustments:

- Rotates and locks for miter cuts from 45°/0°\60°.
- Blade assembly tilts for bevel cuts 0°\45°.

Cuts: crosscuts, miter cuts & compound miter cuts.

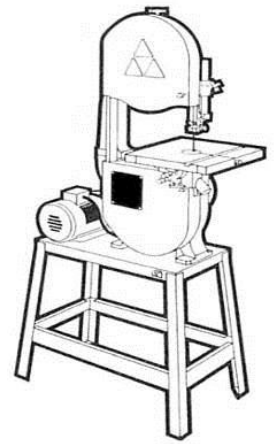
Safety: Also see above under miter saw.

- Slow steady feed: DO NOT TRY TO CUT TOO QUICKLY.
- Always pull saw outward above wood, then push down and push forward fence. You may have to saw in steps before cutting through.
- Use a hold down clamp for bevel cuts.



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.



Band Saw

Configuration: long, continuous band blade looped around large upper and lower wheels.

Cutting Action: Wood is moved on table into blade.

Adjustments:

- a. Table top tilts for beveled cuts 0\45°.

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 using the rip fence.
- e. Crosscuts and miters are cut with using the miter gauge.

Safety:

- a. **Wood must be 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.
- b. **Set blade guide ¼" above wood.**
- c. **Never force a curved cut tighter than allowed by the blade width. Do not twist blade.**
- d. **Watch your fingers, especially at the end of the cut.**
- e. **Never back out of long cuts with the machine running. Backward pressure can cause the blade to jump its guides, hang up, and break.**
- f. **Plan your cuts before you begin cutting. Make sure the wood will clear the throat throughout the cut.**
- g. **Make release cuts before cutting long curves.**
- h. **Use a jig such as a "V" block for cutting cylinders, logs and other non-flat objects.**
- i. **If blade breaks, simply turn off machine and notify shop personnel.**

Scroll Saw

Configuration: a short thin blade held through the table by a long arm.

Cutting Action: The blade reciprocates up and down, cutting on the down stroke.

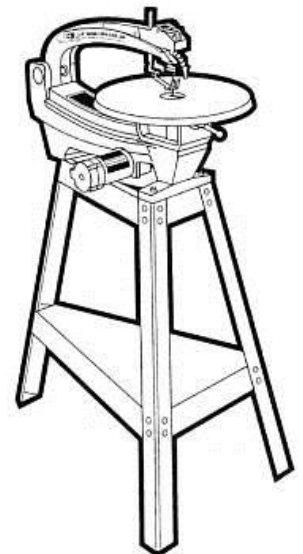
Adjustments:

- 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.

Cuts: intricate and delicate curves in flat, thin wood.

Safety:

- a. **Watch your fingers!**
- b. **Make sure blade has teeth pointing down.**
- c. **Make sure tension is adjusted properly on the blade.**
- d. **Hold material firmly down when cutting.**
- e. **Do not push too hard on wood. You want only enough pressure to maintain good contact on the down stroke, not the up stroke.**



Stationary 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.

General Stationary Sander Rules

1. Never leave sander running unattended.
2. Always maintain secure footing around the sander. Keep hands away from abrasive surfaces, especially near intake gaps.
3. Always sand with light pressure against abrasives holding the material securely. Excessive force against abrasives can cause material to be thrown leading to possible injury.
4. Hold wood firmly, always be able to hold against the direction of sander.
5. Keep moving. Do not over sand in one place. Wood and other material may heat up and burn.
6. **NEVER WEAR GLOVES, LOOSE CLOTHING, JEWELRY, NECKTIES, OR LONG LOOSE HAIR NEAR SANDERS.**
7. Never lean over or reach under running sanders.
8. Never power sand metal, including nails, screws or other fasteners. Sparks can ignite air borne sawdust. Countersink fasteners below wood surface before sanding.
9. Never power sand painted wood or other unknown materials.
10. Never sand pieces too small to hold safely.
11. Sand with the grain if possible.

Belt/Disk Sander

Configuration: combination belt and disk sander.

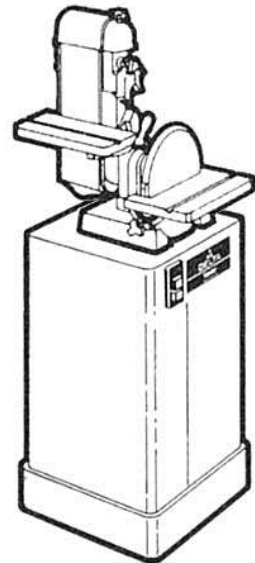
Action: rough sands and shapes.

Adjustments:

- a. Tables tilt 0\45°.
- b. Miter gauge can be used.

Safety: (also see above under stationary sander safety)

- a. **Be aware of belt tracking and tension. Shut off machine and alert Creating/Making Lab personnel if belt tracks wrong, especially if sparks are created.**
- b. **Do not use if belt or disk is loose or torn. Alert Creating/Making Lab personnel.**
- c. **Use tables to support material when sanding against a vertical belt or disk.**
- d. **Use sanding disk on down side, not upside.**



Edge Sander

Configuration: 9inch sanding belt rotating horizontally with a long table.

Action: sanding belt rotates and oscillates to a 90° table.

Adjustments: Table can lift and tilt up or down to 45°.

Safety: (also see above under stationary sander safety)

- a. **Hold wood firmly**
- b. **Never sand into or at an attacking angle.**
- c. **Drag against the belt.**
- d. **Never sand round objects.**
- e. **Never sand wood thinner than 3/4".**



Oscillating Spindle Sander

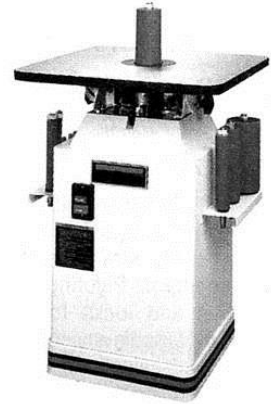
Configuration: A cylindrical sanding spindle mounted in a table

Action: The spindle spins (and on some models oscillate up and down) while the wood is moved against the tabletop.

Adjustments: some models have interchangeable various diameter spindles

Safety: (also see above under stationary sander safety)

- Keep material flat against the tabletop.
- Use light pressure. Do not burn sand paper.



Down Draft Table

Configuration: Self-contained dust collection unit.

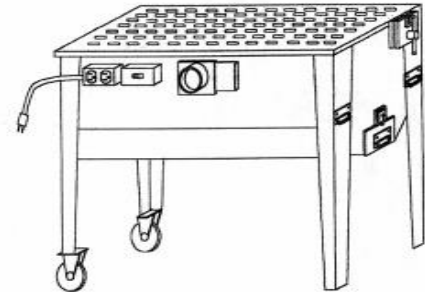
Action: Use down draft table for any power hand sanding, routing, or grinding.

Adjustments:

- Mobile wheels.
- On/off switch on side.

Safety:

- Wear dust mask when sanding on table.
- Do not use table as a workbench or glue up table.



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. Typically 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. Brad 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 4 ½ inches) through wood no thicker than twice its length (3-½ inches max).



Corded Hand Drill

Configuration: hand held drill.

Cutting Action:

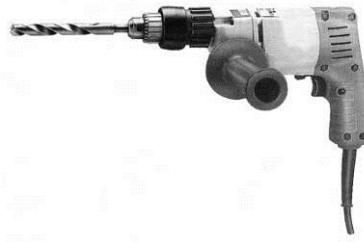
- Work is secured and drill moved by hand.
- Can be used to drive screw with special bits.

Adjustment: varies with model

- Trigger can be locked ON.
- Speed can be adjusted.
- Direction can be reversed.

Safety:

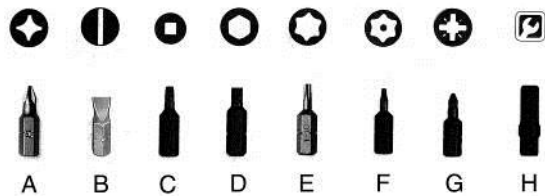
- Do not drill "blind". Do not drill without ascertaining backside of work is clear of obstructions.**
- Make sure that the bit is tight and straight in the chuck.**
- Remove chuck key before starting.**
- Clamp or secure material before drilling.**
- Do not drill into tabletop. Use scrap for backing.**
- Do not abuse electrical cord.**
- 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.**



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.

- Phillips Bit
- Slotted Bit
- Square Bit
- Socket Hex Head
- Torque / Star
- Torque / Star Insert Security
- POZIDRIV
- Hand Drive Adapter for socket wrenches



Floor Drill Press

Configuration: overhead drill mounted above adjustable table.

Cutting Action:

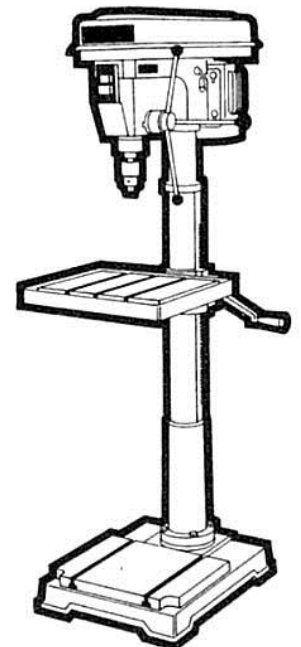
- Drill bit is mounted in a chuck, which travels up and down on the quill.
- Drills holes perpendicular to table.

Adjustments:

- Variable speed (change while drill press is running).
- Table lock and elevation located near the post.
- Quill can be locked.
- Depth stop for setting hole depth.
- Table can tilt 0° to 90°

Safety:

- Never wear gloves, neckties, jewelry, loose clothing, or long loose hair.**
- Use only bits appropriate for the material.**
- Make sure that the bit is tight and straight in the chuck.**
- Remove key from chuck before turning ON.**
- Secure material, clamping it whenever possible.**
- Do not drill into metal table.**
- Place a scrap of wood under work to avoid tear-out.**
- Material should be no further than a 1/2" below drill bit.**
- Check drill speed: faster for soft materials or small bits, slower for hard material or large bits. Adjust speed only with drill running. Check drill bit chart for your configuration.**
- Never use auger bits in the drill press.**
- Avoid awkward hand positions in which a sudden slip would cause hand to go into the cutting tool.**



- l. Hold work in left hand or clamp securely to table and operate drill with right hand. Clamping material is the safest and most accurate way of using the drill press.
- m. When drilling metal, use oil lubrication and clamp to table or vise.
- n. On deep cuts back out often to clean out the hole and clogged bits.

Hollow Chisel Mortiser

Configuration: Hollow square chisel with a drill bit in the center mounted in a press.

Cutting Action: Bores a squared hole.

Adjustments:

- a. Uses different sizes of chisels from 1/4" – 1".
- b. X & Y table crank adjustments.
- c. Table can tilt at an angle 35°.
- d. X, Y and Z stops.
- e. Leverage handle index.

Safety:

- a. Secure wood in table vise.
- b. Caution, chisel and bit tips are sharp!
- c. Ask for help for chisel changes and setups.
- d. Use the proper chisel/ bit combination.
- e. Tighten bit and remove chuck.
- f. Do not over work chisel and bit.
- g. Do not mortise your hand.
- h. Use a spoil board for through mortises.



Pneumatic Fasteners: Brad or Finish Nailer or Stapler

Configuration: pneumatic (compressed air) nailer.

Nailing Action: Used only to fasten wood together.

Adjustments: Nails vary from 1/2 inch to 2 1/2 inches.

Loading: Clips must be pulled back and proper nail size must be placed in with heads up.

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 check nailer clip and ensure proper nail length before using.
- f. Always have the nailer pressed against the wood when nailing.



Shop Clean Up

1. Put tools neatly back into their spot in the tool room.
2. Throw away any trash in trash cans. Put any unwanted but useful wood in scrap wood bend.
3. Brush off and clear workbenches and machines.
4. Sweep up dust and debris with brooms and make piles. Use broom and dust pan to sweep up piles. Dump into trashcans.

This Completes Level 1 Training.

LEVEL 2 Safety Training

In Level 2, you will learn use of the following tools in this order: Jointer, Planer, Table Saw, Wide Belt Sander, and Router and Router Table.

Jointer

Configuration: a series of short knives mounted on a horizontal spindle set into a long flat table equipped with a fence

Action:

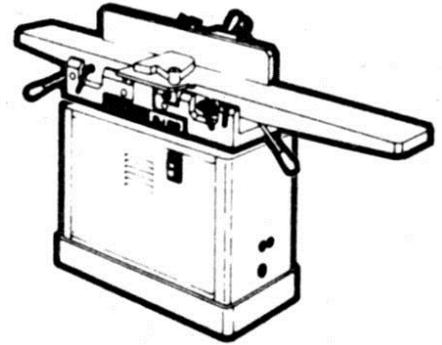
- a. The jointer is used to flatten boards face and straighten a boards edge.
- b. The wood is pushed on the table along the fence into the spinning cutter head.

Adjustments:

- a. In-feed table elevation.
- b. Fence can be tilted for beveled edge.

Safety:

- a. You must have had proper instructions on how to use the jointer.
- b. Creating/Making Lab personnel must supervise you when using jointer.
- c. Board length must be 10 inches or longer.
- d. Board thickness must be $\frac{1}{2}$ inch or greater.
- e. Always feed board with the wood grain. NEVER JOIN END OR CROSS GRAIN.
- f. Put the concave side down on the jointer. Like a rainbow.
- g. Use push blocks or paddles to feed wood through cutters.
- h. Be aware of where your fingers and hands are placed when using the jointer.
- i. Keep in feed and out feed table clean and clear of debris.
- j. Always keep cutter head guard (pork chop) in place when joining.
- k. Make sure that all stock is pushed clear past cutter head and guard has returned over cutter head before picking up stock.



Thickness Planer

Configuration: a 20 inch cutter head mounted on a horizontal axle set above a short table and equipped with self-feeding rollers

Action:

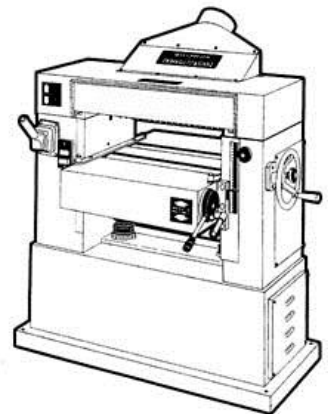
- a. Planer is used make the board faces parallel in thickness
- b. The wood is fed into the auto in feed roller, machined and fed out.

Adjustments:

- a. Table elevation for thickness $\frac{1}{4}$ - 8 $\frac{3}{4}$ inches.

Safety:

- a. Must have had proper instructions on how to use the thickness planer.
- b. Never put hand into planer.
- c. Never look or stick head near planer in feed.
- d. Stand to the side of stock in feed.
- e. Wood must be free of all dirt or any metal and paint.
- f. Wood must be longer than 12 inches.
- g. Lumber must have one flat surface before planing.
- h. Never place fingers under board on planer table.
- i. Feed wood through with the grain. NEVER PLANE END OR CROSS GRAIN.
- j. Remove only a maximum $\frac{1}{16}$ of an inch at a time.
- k. If board gets stuck, turn off machine and lower table.



SawStop Table Saw (OFF LIMITS WITHOUT SPECIFIC PERMISSION, TRAINING, AND SUPERVISION)

Configuration: circular blade mounted into table.

Cutting Action:

- Wood is moved across tabletop either against fence.
- Pushed with miter gauge or sled into blade.

Adjustments:

- Blade elevation.
- Blade tilted to the left 0/45° for bevel cuts.

Cuts:

- Rip cuts (along board's length) with fence.
- Cross- cuts on panels with fence or sled.
- Cross-cuts and miter cuts on short boards with miter or sled.
- Miters, dados and rabbets.



Safety:

- NEVER CUT FREEHAND ON A TABLE SAW. Always use a fence, miter gauge or sled.**
- Blade should never be exposed more than 1/4" above the material being cut.**
- Saw blade guard must always be in place over blade except when shop personnel has authorized its removal for special setup.**
- Away use riving knife when cutting. Riving knife helps prevent wood from pinching, binding and kicking back.**
- Always push material clear past the riving knife and or blade! Material left unsupported between blade and fence could kickback.**
- Wood should be flat and straight.**
- Use 24 tooth or 40tooth blade for ripping.**
- Use 40tooth or fine tooth blade for crosscuts or plywood cutting.**
- Use a 60tooth or 80tooth for cabinet plywood to reduce tear out.**
- Use a push block or stick for cuts less than 6 inches.**
- Always feed material with control in a smooth steady rate. Material should always be flat on table and tight to fence, miter gauge or sled.**
- Conductive material such as: you, metal, wet, moist or treated lumber, mirror acrylic, metallic finishes, laser burned materials and black matte board will trigger Saw Stop brake. If you must table saw any of these material, contact Creating/Making Lab staff for assistance.**
- When ripping wood, the scrap wood must be to the outside of the blade to reduce kickback.**
- When cutting, if the wood begins to bind, TURN OFF SAW.**
- Use of any jig such as tenoning, tapering, vertical panel, V block, must have approval from Creating/Making Lab staff.**
- Plunge cuts or the raising of the blade into the middle of the material must be done by Creating/Making Lab staff.**

Wide Belt Sander (OFF LIMITS WITHOUT SPECIFIC PERMISSION, TRAINING, AND SUPERVISION)

Configuration: 37" wide belt surface sander

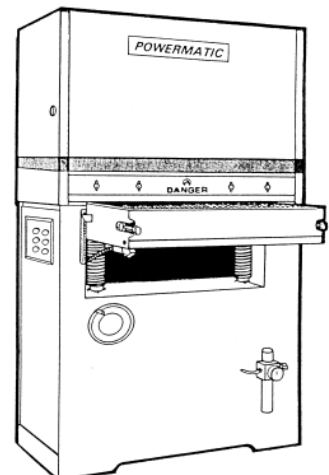
Action:

- Power belt sands parallel surfaces.
- The wood is fed on conveyor belt into sander.

Adjustments: Table can adjust from 0.10-4.85".

Safety:

- You must have had proper instructions on how to use the Wide belt sander.**
- Creating/Making Lab personnel must supervise you when using it.**
- Wood must be free of all dirt or any metal and paint.**
- Before turning sander on, check sanding belt for defects and grit before sanding.**
- Always measure material thickness and set table lower than its measurement. Gradually raise table until material surface begins to be sanded.**
- Remove only a maximum .020 of an inch at a time.**



Router (OFF LIMITS WITHOUT SPECIFIC PERMISSION, TRAINING, AND SUPERVISION)

Configuration: Hand held motor that holds bits

Action:

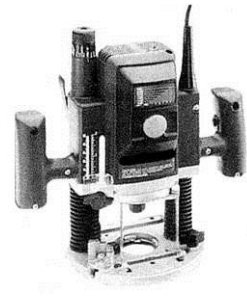
- The router is used to cut and mold material.
- The wood is secured and the router is moved by hand.

Adjustments:

- Interchangeable cutters (bits) for different cuts and profiles.
- Bit depth.
- Various guides, jigs, templates, straight edges, and accessories for specific procedures.

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

- Be sure switch is OFF before plugging in.
- Always unplug router when changing bits.
- Ensure collet nut is securely tight on bit.
- Ensure material is secure or clamped down before routing.
- Never start router while bit is resting on material.
- Use plunge jig handle for plunging into material from above.
- Allow bit to stop before rising from cut.
- Maintain a firm grip on router when starting motor to resist starting torque. Allow motor to come to full speed before contacting material.
- Always hold router securely and firmly when cutting. Two hands on router.
- Cuts deeper than $\frac{1}{4}$ inch should be stepped in $\frac{1}{4}$ inch increments.

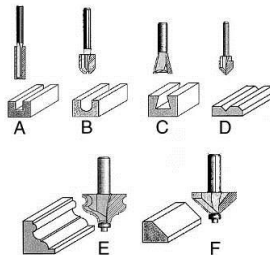


Router Bits

Router bits come in a variety of shapes and profiles, each 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:

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



Bearing bits:

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

Router Table

Configuration: Router mounted upside-down in a table with a fence.

Action:

- The router is used to "mold" the edges of boards - that is shape them into specific molding profiles.
- The wood is pushed on the table along the fence or with the miter gauge and into the bit.

Adjustments:

- Interchangeable bits for different profiles.
- Router elevation.
- Fence settings.

Safety: (also see Router safety section)

- Creating/Making Lab staff is required to check router table setup before use.
- Always feed stock against the rotation of the bit.
- Never freehand cut on a router table. Use a fence, miter gauge or router table guide pin.
- The use of feather boards will assist holding the material against table and/or fence and prevent kickback.
- Material should be 6 inches or longer.
- Use a push block or sticks for material smaller than 6 inches.



This Completes Level 2 Training.

Wood Lathe

(OFF LIMITS WITHOUT SPECIFIC PERMISSION, TRAINING, AND SUPERVISION)

Configuration: two spindles equipped with a parallel tool rest

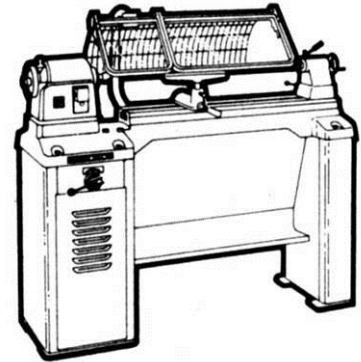
Action:

- a. Wood is “turned” or shape wood into cylindrical forms.
- b. The wood is mounted between the spindles and spun, while turning gouges and tools are used to cut the cylindrical profiles.

Adjustments:

- a. Spindles accommodate various lengths.
- b. Variable speed.
- c. Adjustable tool rest.
- d. Variety of chisels.

Safety: Do not use without specific permission, training, and direct supervision. Contact Creating/Making Lab staff for use request regarding the wood lathe.



HAND-HELD TOOLS

These are additional tool available in the Creating/Making Lab tool room but not covered during Level 1 & 2 Training. These tools are still dangerous and users should seek help if unfamiliar with the safe operations of them. Like always, when in doubt, ask Creating/Making Lab staff for assistance.

Hand-held Power Tools General Rules

1. Do not cut into tabletop or support.
2. Do not cut electrical cord.
3. Keep electrical cord free of snags.
4. Never cut “blind.” Always ascertain that underside of cut is clear of obstructions.
5. Allow blade to stop moving before placing saw down after cut is finished.
6. Secure small and/or thin work with clamps. The material must not be allowed to move, flex or vibrate.
7. Hold foot/base of saw firmly to material being cut.
8. Use proper blade for material being cut.
9. Always have saw pointed away from your body.

Circular Hand Saw (USE ONLY UNDER DIRECT SUPERVISION)

Configuration: hand held circular blade

Cutting Action:

- a. Wood is held in place while blade is moved.

Adjustments:

- a. Blade can be raised or lowered for cut depth.
- b. Blade tilts for bevel cuts 0/45°.

Cuts: straight cuts

- a. Rips-cuts and crosscuts on stock too large to fit on table saw, radial arm saw, or miter saw.

Safety:

- a. **USE ONLY UNDER DIRECT SUPERVISION OF Creating/Making Lab STAFF**
- 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. **Make sure both sides of the cut are supported even after the cut is made.**
- e. **Take extreme care when making bevel cuts, as the angle between the blade and foot can bind the blade easily.**
- f. **Allow saw to gain maximum speed before starting the cut.**
- g. **Never back up the saw while cutting.**



Jig Saw

Configuration: hand held, with a straight blade extending from bottom (foot)

Cutting Action: the blade reciprocates up and down.

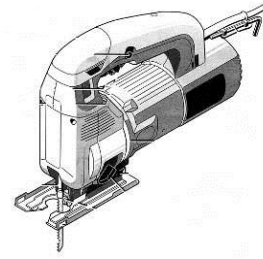
Adjustment: varies with model

- Trigger can be locked ON.
- Speed can be adjusted.
- Single action or orbiting blade.
- The foot tilts on some models.

Cuts: straight or curved cuts in moderately thin wood (up to length of blade)

Safety: also see above under general hand held power tool safety.

- Make sure blade extends completely through material throughout stroke.**



Reciprocating Saw

Configuration: hand held, with a straight blade extending from end.

Cutting Action: the blade reciprocates in and out, cutting on the in stroke

Adjustment:

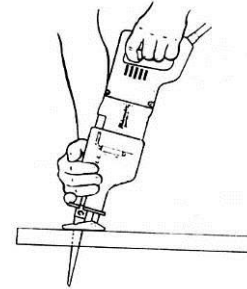
- The shoe is both hinged and removable.
- The blade can be reversed.
- Variable speed.

Cuts:

- Freehand rough cuts (up to length of blade).
- Demolition.

Safety: also see above under general hand held power tool safety.

- Make sure blade extends completely through material and beyond shoe throughout stroke**
- Use both hands to hold the saw.**



Dremel

A small all-purpose shaping device used 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:

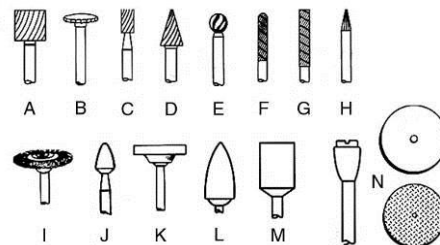
A – E. High speed rotary cutters: for general purpose shaping of wood, metal, or plastics.

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.



Power 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 produce far less force and are generally safer.

General Power Hand Sanders

1. Always wear a dust mask when sanding, especially when there is not a dust collector on the machine.
2. Power sand over down draft whenever available.
3. Never sand lead-based paint. 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.
4. 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.
5. Some hand sanders are equipped with dust collecting bags. Always check these bags before and after use, and empty any dust inside.
6. Use shop vacuum with power sander if at all possible.
7. Do not sand electrical cord, loose clothing and/ or cloth in the sanding area.

Hand Belt Sander

Configuration: small, hand held belt

Action: belt rotates around two pulleys; sander is moved while wood is held stationary

Safety:

- Use both hands to hold the sander firmly. Always be able to hold against the direction of belt rotation.
- Secure the wood. The sander will try to throw loose wood.
- Never approach from attacking angle. Do not tear the belt on sharp corners.
- Be aware of belt tracking and tension. Shut off machine and alert Creating/Making Lab personnel if belt tracks wrong, especially if sparks are created.
- Do not use if belt is loose or torn. Alert Creating/Making Lab personnel.
- Keep hands away from abrasive surfaces, especially near intake gaps.
- Keep electrical cord free of snags.



Finishing Sanders

Configuration: small, hand held vibrating pad sander.

- Half Sheet Finish Sander: uses a half sheet of sandpaper.
- Quarter Sheet Palm Sander: uses a quarter sheet of sandpaper.
- Palm Sander: round pad hook and loop.

Action: sanding pad vibrates in a randomly changing circular motion.



Half Sheet



Quarter Sheet



Palm Sander

Pneumatic Tools

Pneumatic tools are powered using compressed air and must be connected to the Creating/Making Lab's air supply. Compressed air lines are throughout the Creating/Making Lab 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.

Die Grinder

Configuration: Hand held rotary grinder.

Action: Uses different bits for many different grinding purposes.

Bit Requirements: Use the proper bit for the proper material.

Safety:

- Safety glasses, dust mask, and ear protection are required for use of the tool.**
- Be aware of body parts near grinding bits.**
- Be aware of loose clothing and material.**
- Item in which you are grinding must be properly clamped or held down.**



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.

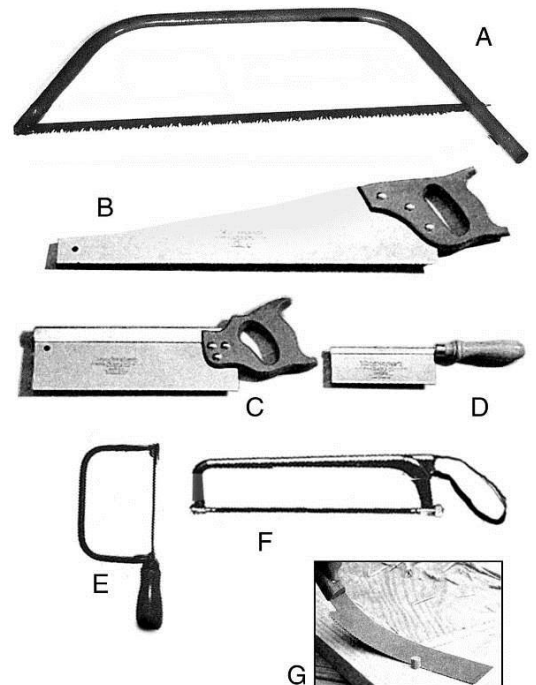
Correct Use of a Handsaw

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 Creating/Making Lab 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. With your elbow bent, the saw should be held at a 45-60° angle to the wood for general cutting. With your elbow bent, the saw should be held level for precise cutting. 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 see-sawing 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. Twisting the saw to knock the waste piece away will damage the saw's teeth.

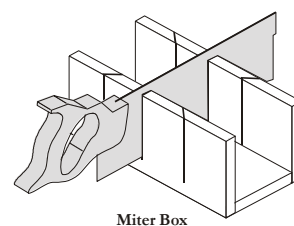
Types of Saws

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), tenons, 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.).

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.



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.

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.



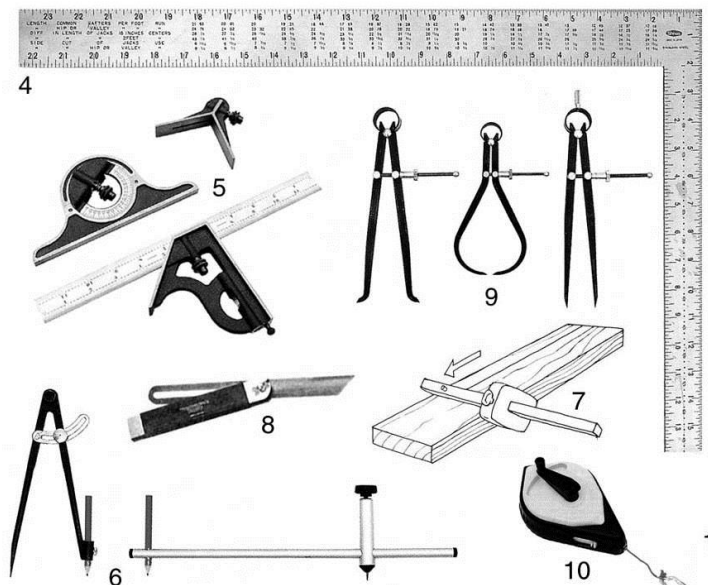
How to use a Block Plane

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 the 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.



**This concludes Hand-Held Tools and the University of Oklahoma,
College of Architecture, Creating/Making Lab Safety Manual.**