

SAFETY SESSION 2 – PART 1

HAND-HELD PORTABLE POWER TOOLS.

General stuff.

- Materials are all the stocks of goods we consume in the shops to build scenery, props, etc., such as fabric, buttons, wood, screws, steel, foam, and paint.
- A tool is something that manipulates the materials in a certain way, usually by either cutting it or by fastening it, and sometimes by measuring it.
- All general and workspace guidelines apply to the use of each power tool. An important example is operating these tools creates flying chips and dusts, so safety goggles are required for the use of every tool on this list and in the shop.
- The work, or piece being worked on, should be clamped or otherwise secured so that it cannot move (but do not hold it with your hand!), unless it is freestanding (i.e. molding on a wall). Safe and successful cutting and fastening processes depend on the work being stationary and stable.
- Never put your hand in the path of the blade, sanding belt or fastener. Find another way to accomplish the task. Note that this also means under the work (where you can't see your hand).
- Do not disable any of the safety guards on any tool--they are there to protect you.

Safety Guidelines for Power Tools

- Remove jewelry including watches, rings, and necklaces; don't wear loose clothing; roll up long sleeves; and tie up long hair.
- Make sure all guards are in place and operating correctly.
- Always use eye protection.
- Do not leave the machine until it has stopped completely.
- Always unplug and lock out the machine before changing a blade or bit, installing a guard, or otherwise servicing the machine.
- Never use a machine that is missing its guard/s.
- Use ear protection and dust masks when necessary (e.g. when using circular saws, routers, etc.)
- Always know the position of the power cord in portable tools to avoid running over it.
- Don't use light duty extension cords with power tools.
- Make sure that power switch is in the off position before plugging in.

Guidelines for Specific Tools.

- JIGSAW. The jigsaw is a reciprocating saw; the saw blade cuts by moving out of the case and back, usually sliding on the down stroke and cutting on the return stroke.
 - ➔ Select the blade according to the type and thickness of the material, and according to the required fineness of cut (more teeth per inch means a cleaner, slower cut) and tightness of curve of the blade path (a scroll blade is required for small circles).
 - ➔ To cut safely, you must hold the foot of the saw firmly to the work--press down.
 - ➔ Never pull the blade out of the work until the blade has stopped moving, as the saw will buck, or jump.
 - ➔ Using both hands will help decrease vibration.
 - ➔ Try adjusting to a higher speed if still vibrating.
 - ➔ Use ear protection.

- SAWZALL. The sawzall, or tiger saw, is also a reciprocating saw. There are many different types of blades available, and choosing the right blade is important.
 - You must wear leather gloves and be wearing denim or leather pants when using this saw, as the blade has much more travel than the jigsaw's blade.
 - The same rules apply to this saw as the jigsaw: you must hold the sawzall foot firmly to the work, and never remove the blade from the work until it has fully stopped.

- CIRCULAR SAW. The circular saw operates by spinning a circular blade. You should wear eye and ear protection when using this machine.
 - When cutting long cuts on sheet goods (like plywood), you must use a fence, such as a piece of 1x3 wood fastened to the work, or a saw guide, to achieve a straight cut.
 - Make sure the material being cut is adequately supported.
 - Be sure the safety guard returns. Always adjust the depth ($\frac{1}{4}$ inch below material) and angle of the base of the saw with the saw blade stopped and your finger away from the trigger.
 - Let the blade get fully going before starting the cut and do not set down until blade stops.
 - Make sure the power cord is clear of the blade.
 - Do not twist the saw while cutting, as it will bind, and the saw will buck. Cut straight!

- ROUTERS (2). The routers cut by spinning a shaped bit at up to 30,000 RPM.
 - To use the router, make sure the bit is tightened in the collet, and the router base is set at the proper height for the rout.
 - The router only cuts one way. The router must travel so that the blade digs into the work as it spins, and does not roll over it.
 - If you use a router bit with a bearing, such as a flush trim bit, you must hold the router firmly to the edge of the work as the router travels.
 - If you use a bit without a bearing, such as any plunge bit, you must use a fence so that the router does not wander, and hold the router firmly to the fence as you travel. You must also set the plunge (depth of cut) before beginning. Don't make cuts that are too deep --start small.
 - Make sure material is free from nails and other defects.
 - Use two hands and feed at a slow and steady rate.
 - Turn power on before cutting in and release before turning off.

HAND DRILL. The corded drill cuts holes by spinning a twist drill bit at 300-1200 rpm.

- Make sure the bit is secure before drilling.
- For all holes, you must use the extra drill handle, and use two hands to control the drill.
- For holes in metal, use only high-speed steel or carbide-tipped twist bits. Do not change the angle of the drill while drilling; the bit may snap. Use cutting oil to cut faster and make the bits last longer. And for larger holes, start with smaller pilot holes, and step up from smaller to larger gradually.
- For holes in wood use paddle bits, the paddle bit provides much more leverage for the drill to resist you; to stop the bit from binding, keep the drill as straight as possible while drilling. Do not use pilot holes, or small starter holes, with paddle bits. Do not cut metals with paddle bits.
- For holes in wood, sheet metal and plastics with hole saws, the drill requires great control. Some hole saws require pilot holes. You should oil sheet metal to cut faster and save the saw. Cut slowly, and keep the drill perpendicular to the work. Use the drill press if possible.
- Do not use the adjustable-arm cutter with this, or any, hand drill; use adjustable-arm cutter with the drill press only.
- Avoid touching drill bit after use –can burn skin.

- **CORDLESS DRIVER-DRILLS.** This is a battery-powered (cordless) hand drill. To recharge a dead battery, place it in a charger and press the charge (red) button. The charging light should come on. Use the batteries until they are mostly drained; this will prolong battery life.
 - ➔ The drill has high and low speeds, a forward/reverse control, and a clutch. Learn the controls and settings.
 - ➔ While using the drill as a screw gun (with screw bits) hold the drill perpendicular to the screw so it doesn't slip off the screw head. To start the screw, do not hold the screw with your fingers while applying pressure with the drill. It may slip and the Phillips screw bit will “star,” or bruise, your finger. This also applies to Yankee, or flat-blade, screws and screw bits.
 - ➔ Only drill small holes in metal and wood with the cordless drills, so as not to overwork the drill.

- **ANGLE GRINDER/SANDER.** The 4 1/2” angle grinder can be used to rotary-sand most materials and to grind metals. Its consumable sanding disks and grinding stones spin at 11,000 RPM; although the tool doesn’t develop a lot of torque, or circular force, the high speed of the wheel can be difficult to control.
 - ➔ You must wear leather gloves and a facemask when grinding metal. Ear protection is recommended.
 - ➔ Be aware of where the sparks and sawdust fly; sparks must not land on combustibles or people, and dusts must be aimed away from people.
 - ➔ Use the guard at all times. It is removable to facilitate changing disks and stones. If it is absolutely necessary to remove it for a process, wear heavy-duty leather gauntlets, such as old welding gloves.
 - ➔ Use the screw-in accessory handle. It provides a great deal of control over the tool; and adjusts to accommodate left and right-handed operations.
 - ➔ Always set the grinder down on its back when setting down the grinder while still spinning. If the wheel touches the table, the tool will jump.

- **HEAT GUN.** The heat gun is specifically used for drying paint, heating shrink-wrap, etc.
 - ➔ It is not a hair dryer--it gets much hotter than a hair dryer does.
 - ➔ Do not set a hot gun down on any combustible.

- **SOLDERING IRON.**
 - ➔ When soldering, keep head out of the smoke plume. We only use lead-free solder, but it is good practice as the smoke can irritate your lungs.
 - ➔ Soldering irons get hot enough to easily burn. Do not touch a hot iron, and assume that all irons are hot.
 - ➔ Do not set a hot soldering iron down on any combustible.
 - ➔ Unplug when not in use.

- **BELT SANDER.** The portable belt sander uses a continuous loop belt to sand wood, some metals, and many soft materials such as plaster and plastic. The belt turns one way, and you must resist the movement of the sander to hold it in place.
 - ➔ Gloves are recommended; touching the moving sanding belt will remove exposed skin quickly.
 - ➔ Eye protection is required. A dust mask is recommended for any large jobs.
 - ➔ Use two hands to operate the sander.
 - ➔ Do not set the sander down until the belt has come to a complete stop; the sander may jump.
 - ➔ Clamp the sander securely in a vise when using it as a stationary sander.

- ➔ See the supervisor for the proper way to change a belt.
- **PAD SANDER.** The pad sander is a small, low-RPM random orbital sander. Its random circular motion minimizes scratch marks.
 - ➔ Eye protection is required; ear protection is recommended.
 - ➔ The sander vibrates when using it; take breaks on long jobs.
 - ➔ To minimize dust, use the “hole provider” with each change of sandpaper.

Pneumatic tools operate by using air under high pressure from the compressor.

- **GENERAL SAFETY.**
 - ➔ Learn how to attach and remove a pneumatic quick-disconnect fitting. Watch the class demonstration and see the supervisor with any questions.
 - ➔ Hold the hose firmly when disconnecting; it can whip around when released.
 - ➔ Avoid cutting or crushing air hoses.
 - ➔ Do not use a hose with a leaky fitting, or cut or bulging rubber. Do not repair with duct tape; see the supervisor for repairs.
 - ➔ All tools should have a drop of airtool oil dripped into their air intake at the start of the work period, every day.
- **PNEUMATIC STAPLER.** The family of pneumatic staplers shoot nails and staples under high pressure.
 - ➔ Eye protection is required; ear and hand protection is recommended depending on the nature of the task.
 - ➔ Thin-wire guns, such as light-duty tacker, **DO NOT** have safeties. These must be used with extreme caution, and must never, ever be pointed at another person. Any deliberate shooting of staples towards anywhere but the work piece is very dangerous and is grounds for removal from the class.
 - ➔ Larger guns have safeties that prevent you from firing until the gun is pressed into the work piece. Never press the working end of a pneumatic gun into anything except the material--this means your arm, your shoe, etc. And keep in mind--they can fire accidentally, despite the safety mechanism.
 - ➔ Never hold your hand or any body part in the path or direction of the gun. While holding the work piece make sure your hand is not in the range of the fastener; it may shoot through the wood, curve out of the wood unexpectedly, or fire twice.
 - ➔ If a gun jams, remove the hose from the gun before servicing. Do not turn down the air or remove the hose from the air station.
- **Other Pneumatic Tools.** This includes the blower, screw gun, drill, disk and orbital sanders, ratchet, and cut-off tool.
 - ➔ Never operate a blower with the regulator set above 30 PSI, and do not blow compressed air at any person especially at their (or your) face.
 - ➔ All the pneumatic tools can be just as dangerous as their electric counterparts. Treat them with the same caution and respect.

SAFETY SESSION 2 – PART 2

HAND TOOLS.

Hand tools, like power tools, generally either:

Cut or shape materials. Examples include the handsaw, wire cutters, and file

Manipulate fasteners. Examples include the screwdriver, hammer, wrench

Measure, examples being the tape measure, level, compass, bevel gauge

While hand tools are not power-driven and seem easier to control than power tools, they can be just as dangerous when used improperly.

Cutting Tools. If any tool is dull, tell the Technical Director. Sharp tools are essential for safety and for clean, precise work.

- **MAT KNIVES.** The mat knife is the most frequently used cutting tool in the shop; use to cut fabric, paper, plastic, shave wood, etc. Also called a utility knife.
 - ➔ The mat knife has two-ended, disposable blades; turn blade around or replace whenever they are dull or are chipped.
 - ➔ Be sure you will not cut yourself if the blade should slip; always cut with the blade pointing away from you. Also, make sure you will not cut anyone else if the blade should slip; cut with the blade pointing away from others.
 - ➔ On mat knives with retractable blades, make sure the blade is locked in position before cutting with it. And, retract it before putting it away.
- **CHISELS.** Used for gouging and smoothing wood.
 - ➔ Don't use for anything else. They will be ruined if used to pry, take out staples, etc.
 - ➔ Do not chisel with the blade pointed towards anyone else.
- **COLD CHISEL.** These chisels are designed for chiseling metal, and can be applied to masonry.
- **HAND SAWS**
 - ➔ It is especially important to protect the face, hands and body when using these; they produce flying chips of metal and masonry.
 - ➔ Be sure the work is well braced before beginning to cut.
 - ➔ Cut smoothly, with even strokes.
- **WIRE CUTTERS-** Diagonal and End Nip. These tools are designed to cut copper wire, but they also do a fine job of cutting other small stranded wire (not to be confused with wire rope-see cable cutters below), plastic wire ties, and light-gauge baling wire, as well as removing staples, and doing many other jobs. They don't cut nails, chain, sheet metal, etc.
 - ➔ While they look dull, both tools have nip points that can pinch and cut the skin; keep fingers clear.
- **CABLE CUTTERS.** Also known as Felcos, C-7s or wire rope cutters. The special cutters are not to be used for any other type of cutting; and no other tool is to be used for cutting wire rope. Do not cut wire rope over 1/4."
 - ➔ This cutting tool is very sharp, has nip points, and can cut through bone. Use caution.
- **BOLT CUTTERS.** We have two sizes of bolt cutter: the smaller for shearing small bolts and steel rod, to 3/16", the larger for shearing up to 7/16" mild steel rod and 3/8" chain.

- Use eye protection every time you use these tools; they can create flying steel chips.
 - These tools have several nip points which can pinch and crush the skin. Keep fingers clear.
 - Cut steel ends are sharp.
- TAP AND DIE. This tool kit threads holes in steel to receive bolts ('taps'), or cuts threads on steel rod to accept nuts ('die cuts').
 - Use cutting oil when tapping or die cutting; thoroughly wash this oil off your hands afterwards with soap and water.
 - PIPE THREADER. This tool threads pipe to accept threaded fittings such as flanges, pipe unions, elbows, etc.
 - Use cutting oil when threading pipe; thoroughly wash off afterward with soap and water.
 - SCISSORS. We have standard household shears for cutting paper, fabric, etc. Don't overtax them; use a larger, more appropriate tool if necessary.
 - The blades are sharp, and have nip points. Keep fingers clear.
 - PAPER CUTTERS. We have two: in the drafting classroom, and in lighting storage for cutting gel.
 - These tools are very sharp. Never touch the blade.
 - Never put any body part in the path of the blade; the blade only stays in the up position by friction, and could drop and cut you.

Hammering Tools.

- HAMMER. We have hammers ranging from 16 to 22-ounces, and a 4-pound beater.
 - The most common injury associated with hammers is the pounded, swollen finger. To prevent this, start the nail by tapping, then remove your hand for the power strokes.
 - Take care when swinging; bystanders have been hurt on the upswing of the hammer.
 - When using, choke up on the hammer for more control and less power; holding the hammer at the end of the handle will provide power.
 - If any hammer has rough edges on the face of the hammer, it must be peened. Tell the Technical Director.
- MALLET. We have two kinds of soft mallets.
 - Polyurethane shot mallet. These are wooden-handled, green plastic-headed mallets. The soft plastic head won't mar (scuff) many surfaces; the metal shot inside the head adds extra hitting power. We have two- and five-pound sizes.
 - Black rubber mallet. This lightweight mallet is good for light tapping where minimum denting is desired, such as on hubcaps.
- NAIL SETS. Nail sets countersink nails; that is, they sink the head below the surface of the wood.
 - Hold the nail set straight up and down, and firmly to the nail before swinging the hammer.

Other Fastener Tools.

- SCREWDRIVERS- Flat and Phillips. These insert and remove screws manually (by hand-ugh!).
 - Flat-blade (also known as 'Yankee') screwdrivers are not pry bars. If the job requires prying, use a pry bar. Screwdrivers are not hardened steel and can bend or snap.

- ALLEN WRENCHES. These special tools are designed to insert and remove Allen screws, and any fastener with an inverted hexagonal head. They are usually small and easy to bend or break.
- HAND STAPLER. Hand staplers are used for stapling fabric, paper, cardboard, etc.; they don't do a very good job on lauan (wood), Upson board, etc. Use only T-50 staples (.050" heavy-duty staples); if you put any other type of staple in the gun, including office staples and pneumatic staples (which look a lot like .050" heavy-duty staples), you will have to take apart the stapler and fix it.
 - ➔ Do not, under any circumstances, point the stapler at yourself or anyone else. Staples easily pierce the skin and could blind. If you shoot staples at someone else, this is grounds for removal from class.
- STAPLE PULLERS. These are designed for the removal of the staples you just put in with the hand stapler.
 - ➔ The pullers are curved to get under the staple and have sharp, pointed ends, but they will slip easily. Do not use these tools while they are pointed at any of your own, or anyone else's body parts.
- WRENCHES. These tools install and remove bolts and nuts.
 - ➔ Use the correct size wrench for the nut or bolt. Oversized wrenches will slip.
 - ➔ Use the adjustable wrenches, AKA crescent wrench, AKA C-wrench, only when it is impractical to use the correct size wrench. Adjustables tend to loosen and slip off the bolt head; tighten the knurled adjusting knob to the correct size each time you use it.
- RATCHETS. Ratchets are a quicker way to install or remove nuts or bolts than wrenches; they tighten or loosen on the fore stroke; and ratchet on the backstroke.
 - ➔ Ratchets may slip off the bolt head. If possible, hold the head of the ratchet to the bolt with one hand and tighten or loosen with the other.
- POP RIVETER. This tool is used for blind riveting, or installing light-duty rivets where you cannot access the underside. Rivets must be drilled out to be removed, preferably on the drill press. See supervisor before using the pop riveter.

Other Tools.

- PRYBAR. The large steel pry bar is used to separate anything tightly held together; as a lever; and for a variety of jobs. Also known as a crowbar.
 - ➔ When using the pry bar lifting, have as many people as necessary steady the load; don't place feet or hands under the load, as it may shift or slip; and use your legs, keeping your back straight, for heavy loads.
 - ➔ When prying anything, remember that the material or the bar may splinter, shatter or chip, and use appropriate PPE; at minimum, eye protection.
- FLAT BAR. The smaller version of a pry bar, also known as a flat bar or wonder bar. Use it to remove nails, pry, etc.
 - ➔ Use caution: as above, the material or the bar may snap or chip, so wear appropriate eye protection.
- HAND CART. Use this to your advantage, to port heavy loads. Do not attempt to move more than the cart can handle approx. 100 lb.
 - ➔ Load the cart with the heaviest pieces at the bottom.
 - ➔ When moving up and down stairs, use your legs for lifting and lowering.

- If necessary, have someone steady the load while moving it.
- DOLLY. Dollies are useful for moving heavy loads.
 - When loading, balance the weight. Do not build a tipsy, or unstable, load. If necessary, use two dollies.
 - Always have enough help to steady, push and stop the load, especially on ramped surfaces.
 - Keep hands and feet out from under the load.

SAFETY SESSION 2 – PART 3

STATIONARY POWER TOOLS.

This group of tools includes all of the power tools in the shop that are permanently mounted. These tools tend to present the largest potential hazards.

Here are general rules for using stationary power tools:

- Be trained on and familiar with the operation and potential hazards of the tool.
- Use appropriate Personal Protective Equipment; i.e. goggles and ear protection.
- Make sure all the guards are in place and working before turning on the tool.
- Check to see that the tool is functioning properly; i.e. the blade is tight.
- Make sure cut area, blade path and area where you'll stand is clear of sawdust, chips and other debris.
- Don't use the tool for more than it was meant for; i.e. don't overwork, overextend or rush the tool.
- Make sure that you are using the tool correctly. Feed direction, speed of cut and fence placement are examples of things to consider when starting a cut.
- If you perform any repairs, such as clearing debris or changing the blade, you must unplug the saw and tag-out (mark with a label) the plug.
- Never let saws run unattended.
- When using power tools, using strength to perform a woodworking operation is a sign of something wrong, such as the fence or blade being out of line, a dull blade, or lack of the necessary support tables. Using strength is dangerous since you could push yourself into the blade with the work piece.
- Be sure to control where your hands are: hooking fingers over the fence, resting palms on the table and using a push stick are all good ways to make sure your hands are kept out of danger.

Guidelines for Specific Tools

- TABLESAW. The tablesaw is designed to crosscut (cut across the grain) and rip (cut with the grain) sheet goods, like plywood, and to rip dimensional lumber, such as 1"x3" pine. The blade is stationary, the fence is adjustable, and the material is pushed across the spinning blade.
 - ➔ Before cutting, the fence must be secured by firmly pressing the lock handle down. Make sure the fence is parallel to the blade.
 - ➔ Use the rip fence for ripping and miter gauge for cross cutting.
 - ➔ Select proper blade and set at correct height (1/8 inch above wood)
 - ➔ The material must be clean, that is, free of staples, screws, etc.
 - ➔ Make sure the path of the material is clear. If you cut an 8' board, there must be at least 8' of room beyond the saw free of debris and people.
 - ➔ If the piece is too large for the table, add supports--such as helping hands, the individual roller stands.
 - ➔ If the material is too large for a single person to cut easily, get a helper.
 - ➔ For any cut smaller than 6", you must use a push stick.
 - ➔ Nobody should stand around or behind the saw during the cut.
 - ➔ If the edge of the material is warped, cupped, twisted or otherwise not straight, it may bind when cut. Special care must be taken.
 - ➔ Never cut anything freehand!! Always use a fence.
 - ➔ Do not attempt any process requiring guard removal, including any blind cut, without supervision. Replace the guard immediately afterward.
 - ➔ Make all adjustments and remove scraps with the machine completely stopped
 - ➔ When cutting:
 - Watch the blade area as you cut.
 - Keep an eye on leading edge of the board as it travels across the cut table. Watch the work piece against the fence to make sure you're feeding it straight
 - Never let go of the material in mid-cut. Holding the work piece is the only way to control it.
 - If the saw jams or you must turn it off mid-cut, hold the material until the blade comes to a full stop. Do not move away from it.

- Do not twist or turn the material. It may bind.
 - Do not lift the work piece in mid-cut. It may slam down with considerable force.
 - Push smoothly and evenly.
 - Hold the material firmly to the fence as it travels.
 - Follow through. Push the material clear of the blade at the end of the cut. Don't let go of the piece between the blade and the fence until it's completely free of the blade.

- BANDSAW. The bandsaw is designed to scroll cut most any material, except metals.
 - ➔ Make sure table (and underneath insert table) are clear of debris.
 - ➔ Keep hands and fingers in such a position that there is not danger of their slipping into the blade. Hold work piece on the right side of the cutting line. Do not cut materials too small to be held in the hand. Use a push stick where necessary.
 - ➔ This saw comes out of adjustment easily, so make sure this saw is properly adjusted; and after each blade change, the blade guides must be reset. See supervisor.
 - ➔ Very Important: the upper blade guard is adjustable, and must be no more than 1/4" above the height of the material.
 - ➔ Support any materials too large to be easily cut on the table.
 - ➔ Unstable work is the largest danger. The material must be pressed firmly against the table before beginning cut.
 - ➔ Circular materials may roll when cut along a side: use extra caution, or a jig.
 - ➔ If you must turn off the saw mid-cut, hold the material until the blade stops.
 - ➔ Remove scrap only when machine is stopped.
 - ➔ Choose a thickness of blade appropriate for the radius of the cut.
 - ➔ Before using circle-cutting jig, be trained to do it; see supervisor.

- HORIZONTAL-VERTICAL BAND SAW. This is a band saw (with a looped blade) which is designed for cutting metal.
 - ➔ Keep hands and fingers in such a position that there is not danger of their slipping into the blade. Hold work piece on the right side of the cutting line. Do not cut materials too small to be held in the hand. Use a push stick where necessary.
 - ➔ You must clean any debris from around the blade before turning it on.
 - ➔ Do not overload the saw, or cut in a way it is not designed for.
 - ➔ Do not load the saw so that the blade slows. This will force the blade off of the guide wheels.
 - ➔ Very Important: the upper blade guard is adjustable, and must be no more than 1/4" above the height of the material.
 - ➔ Support any materials too large to be easily cut on the table.
 - ➔ Unstable work is the largest danger. The material must be pressed firmly against the table before beginning cut.
 - ➔ Remove scrap only when machine is stopped.

- DRUM/DISK SANDER. The stand-up sander sands large pieces, high-volume, and in a wide variety of ways. Wear a dust mask if sanding for a sustained period.
 - ➔ Do not leave anything on the belt sander when it is off. It is not a table.
 - ➔ Clear the sander of any debris--or anything sitting atop it--before turning on.
 - ➔ Make sure the belt tracks correctly so that it doesn't come off or eat into the guard. See your supervisor if there are any problems with the machine.
 - ➔ If sanding small pieces, use a clamp to hold the piece, and wear gloves.
 - ➔ Before sanding steel or aluminum, or any other metal, remove the shop vac; sparks may ignite the sawdust.
 - ➔ Make sure there is 1/16" clearance between the sanding disc and the table.
 - ➔ Hold the material firmly when belt sanding (do not let go!), and firmly against the table when disc sanding.
 - ➔ When disc sanding, only use the downward side of the disc rotation!

- DRILL PRESS. The drill press allows you to drill at precise angles and to apply controlled amounts of pressure to the drill bit cutting a material.

- ➔ When setting the drill speed according to the chart on the side, subtract two drill speeds. You cannot drill too slowly. Make sure the belts are tight.
 - ➔ Never leave the key in the chuck -- it can be thrown and injure someone.
 - ➔ Always wear eye protection -- steel drill bits can fracture.
 - ➔ Never put any body part in the path of the drill.
 - ➔ Never operate the drill with the belt guard up. It grabs hair.
 - ➔ Make sure the table is centered beneath the drill, so you do not cut into the table. Hole saws, circle cutters, large paddle bits, and off-center drilling require a pad of wood on top of the table.
 - ➔ Secure the work piece!! Clamp it or brace it against the drill column; but do not hold in place by hand.
 - ➔ Support any piece that is too large for the table.
 - ➔ Drill slowly and smoothly.
 - ➔ Use cutting oil for any drilling into ferrous metal.
 - ➔ If the drill jams, turn it off immediately and remove the plastic yellow key before clearing the jam; do not try to stop by hand.
- METAL CUTOFF SAW (also “Chop Saw”). This saw cuts ferrous metals with an abrasive blade.
 - ➔ This saw is very loud, produces hot sparks, and can cut through just about anything. Eye, ear, face and hand protection is required for this saw.
 - ➔ If you are making several cuts, use the ventilation system; position the hood so that it picks up the dust cast off by the blade.
 - ➔ Clamp the work securely in place before beginning the cut.
 - ➔ Cut the least amount of material at one time that is practical: flat bar on edge, angle iron point-up.
 - ➔ Do not move the work while cutting; the blade may snap or shatter if twisted while moving.
 - ➔ Do not use a blade that has a broken or ragged edge.
 - ➔ Cut slowly and smoothly, and do not rush the saw; it will not cut any faster.
 - RADIAL ARM SAW. This saw cuts wood and soft plastics radially, or across the short length of the work. We will only use the radial-arm saw for crosscut and dadoing.
 - ➔ Don’t cross arms! Avoid awkward arm positions, where your limb could slip into the path of the blade and don’t intentionally put your arm in the path of the blade. You can lose control of the material.
 - ➔ The work piece must be pressed firmly to the fence; if necessary, clamp it.
 - ➔ This saw is unlike others in the shop. It will draw itself across the work, so that controlling it means holding it back. Cut smoothly and slowly.
 - ➔ Make sure the saw returns to the start position on its own when blade is not cutting. If it doesn’t, loosen the stop nut or tell the supervisor.
 - ➔ Make sure all other adjustments are set: carriage height, bevel, and miter; generally, you’ll want the miter to be at 90 degrees. This comes out of adjustment frequently.
 - ➔ Clear debris and excessive dust from blade path before turning on.
 - ➔ To dado, unplug and tag-out tool, and change blades. You must use a molding-head cutter safety guard, as the standard guard will not fit with a dado blade. Wear a face shield.
 - ➔ When changing blades, setting up the dado blade, or tightening the blade nut, unplug and tag-out the tool. See supervisor--the nut has a left-hand thread, and you mustn’t over tighten.
 - ➔ If the blade jams, turn it off immediately! Unplug and tag-out the saw before clearing jams or effecting repairs.

POWER MITER SAW (“Chop Saw”). This saw is designed to easily adjust to different miter angles. Many of the safety rules for the radial arm saw apply to this saw also.

- ➔ Make sure guard is working properly.
- ➔ Clear all debris before beginning cut.
- ➔ Never place hands in the path of the blade, or on the metal carriage of the saw. Do not cross arms to cut!
- ➔ Do not cut more than the saw’s capacity. Use another tool.
- ➔ Hold the work piece firmly to the fence while cutting; clamp if necessary.
- ➔ Don’t reach in while blade is moving. Keep little pieces away from where they can get caught by the blade.

- ➔ Before changing blade or performing any other operation on the tool, unplug and tag-out the plug.
- BENCH GRINDER. This tool grinds, buffs and wire brushes materials with wheels that spin at high speed.
 - ➔ Eye, face and hand protection is required when using this tool, and ear protection is recommended.
 - ➔ Stand to one side when starting the machine.
 - ➔ If you will be working for any length of time, use the ventilation system.
 - ➔ Always brace the material against the tool rest; never work the material freehand.
 - ➔ Small pieces should be held with vise-grip type pliers.
 - ➔ The glass safety shield should be clean.
 - ➔ The tool rest is adjustable and must always be 1/8" or less from the wheel and at the same angle you are working at so that it supports the work piece.
 - ➔ Spark arrest or top guard must be within 1/8 inch of wheel.
 - ➔ Do not use if the wheel is cracked, excessively worn, or has an irregular face, or if the wheels vibrate a lot. See supervisor.
 - ➔ Clean out any debris or shavings from the wheels before using.
 - ➔ Before changing wheel performing any other operation on the tool, unplug and tag-out the plug.
- ROUTER TABLE. This is essentially a hand-held router mounted upside-down, with an adjustable fence. It is very useful for making molding.
 - ➔ You must clean out any debris from the motor before turning on; and blow out any dust with compressed air.
 - ➔ You should install a featherboard, or other jig, to hold the work to the router bit.
 - ➔ Keep fingers clear of the router bit by pushing at the start of a cut, and pulling at the end, keeping fingers a safe distance from the bit at all times.
 - ➔ You may remove the work mid-cut provided the bit has no fingers, such as a rabbeting bit.
 - ➔ Do not plunge rout, that is begin routing in the middle of a board, without direct supervision.
 - ➔ Cover the hole in the runoff table with tape when finished to keep the router motor clean.
- PANEL SAW. This saw crosscuts sheet goods.
 - ➔ You must clean out any debris from the bed before setting lumber on it.
 - ➔ You must hold the lumber firmly to the saw.
 - ➔ Keep fingers clear of the path of the blade.
 - ➔ Saw must be manually retracted. Raise it once the blade has stopped, and with a smooth motion.
 - ➔ Do not use this saw for rip cuts. Use the table saw.
 - ➔ Saw only cuts in the downward direction. Do not attempt to cut when moving saw upwards.