

Art Department Woodshop

Kansas State University

Fall 2016 – Spring 2017

Standard Operating Procedures

(S.O.P.'s)

Contents

Drills.....	pg 1
Drill Press.....	pg 2
Jointer.....	pg 3, 4
Planer.....	pg 5, 6
Routers.....	pg 7, 8
Router Table.....	pg 9
Random Orbit Sander.....	pg 10
Disc Sander.....	pg 11
Belt Sander.....	pg 12
Oscillating Spindle Sander.....	pg 13
Standing Combination Sander.....	pg 14, 15
Jigsaw or Sabre Saw.....	pg 16
Circular Saw.....	pg 17
Sliding Compound Miter Saw.....	pg 18
Scroll Saw.....	pg 19, 20
Band Saw.....	pg 21, 22
Table Saw.....	pg 23-31

Do not operate tools/machines without proper demo

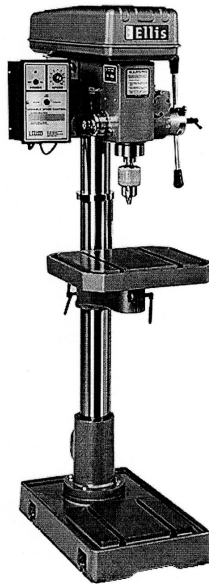


Drills

Drills have a variety of uses; drilling holes, driving screws and fasteners, sanding with abrasive accessories, etc. They are very versatile because of the large number of accessories available.

Safety and Use

- ***Eye protection is required when using these tools.***
- ***Do not talk with observers while operating these tools.***
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Use appropriate drill bit or accessory for work to be performed. Ask attendant for assistance if you are not sure which bit or accessory to use.
- Check forward/reverse switch before drilling or driving screws. Switch should be in forward position for drilling or driving screws and reverse for removing screws.
- Adjust clutch to appropriate setting for work being performed. Ask for assistance if you are not sure which setting to use.
- Always keep fingers or exposed flesh away from drill bit or accessory.
- Avoid dropping or bumping drill off tables and ledges. Be mindful and keep drill away from the edge of work benches or elevated surfaces.
- When drilling holes use a piece of scrap under material being drilled to protect workbenches and to minimize tear out on material.



Drill Press

The Drill press can cut holes in wood, metal and plastics depending on the type of drill bit installed. The shop has a variety of basic drill bits and a small collection of specialty bits. Please follow the operating directions carefully for this machine.

Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Do not talk with observers while operating this machine.**
- General Rule: The Larger the bit the slower the speed. Ask shop attendant for help changing speed.
- Always remove chuck key before starting drill press.
- Make adjustments with power off.
- Securely lock bits into chuck by tightening all three holes.
- Be sure to use scrap beneath material to be drilled.
- Avoid drilling into drill press table top.
- Drill only wood, plastics, mild steel, aluminum, brass with the drill press.
- **Always clamp down metal or plastic material.**
- Hold material to be drilled securely. For small pieces use a drill press vise or clamp.
- Do not drill length of hole in one plunge. Take several small plunges.
- Shut off power, remove bit and clean drill press and surrounding area when done.



Jointer

The Jointer is a primary piece of woodworking equipment. It is used to make wood material flat and square in preparation for other machining procedures.

Safe and proper use and good technique are essential for accurate and consistent performance.

Safety

- *Protective eyewear should always be worn when operating these machines.*
- *Do not talk with observers while operating these machines.*
- *For safety reasons material should be at least 12" long and 3" wide and at least 1/2" thick.*
- *Never attempt to joint end grain on this machine.*
- *Never reach down to pick up a board that jams on the out-feed bed.*
- For best performance cuts should be limited to 1/16" maximum in hardwoods and 1/8" maximum in softwoods.
- Ask for shop attendant's assistance for help changing depth of cut settings.
- It is easier to flatten shorter lengths of material. Cut longer boards to rough length before flattening.
- *When flattening material less than 1" thick use a push board to hold material down.*

Procedure for flattening a board:

Seldom does a board come from a lumberyard or sawmill truly flat or square. More often than not boards will have a warp, twist or bow or a combination of all of these things.

A jointer can remove these undesirable qualities and leave the material in a more workable condition.

1. Inspect material. It should be clean and free of debris; dirt, nails, screws and loose knots.
2. Check settings on machine. Depth of cut should be 1/16" or less for hardwoods or 1/8" or

less for softwoods.

3. Turn the machine on.

4. If material is bowed or cupped place it on the in-feed table with the cup or bowed side down. ***If material gets caught on out-feed bed do not reach down to free material. Hold material in place and turn off machine. Remove material after machine has stopped completely.***

5. Apply downward pressure to the leading end of the board and a combination of downward and forward pressure on back end of board.

BE SURE FINGER TIPS ARE ABOVE SURFACE OF MATERIAL AND ARE AT LEAST 2" ABOVE CUTTER KNIVES.

6. Begin feeding material through cutter knives. As material passes over cutter knives gradually shift more downward pressure to back end of board. Material should pass over knives with relatively little vibration and with a moderate noise level. Noisy cuts or cuts that generate a lot of vibration indicate dull knives. Report this to shop attendant.

7. Repeat steps 5 and 6 until material is flat on one side.

Procedure for jointing the edge of a board

Once the face of a board has been flattened an edge that is straight and 90 degrees to the face can be obtained.

1. Inspect material. It should be clean and free of debris; dirt, nails, screws and loose knots.

2. Check settings on machine. Depth of cut should be 1/16" or less for hardwoods or 1/8" or less for softwoods.

3. Make sure dust collector is on.

4. Turn the machine on.

5. Place the flat face of the board against the fence. Apply pressure at the leading end of the board and press it flat against the fence. At the back end of the board use your other hand to begin pushing the board.

6. As the material passes over the cutter head use one hand to keep the board against the fence and tight to the bed. Allow the board to slide past as the other hand pushes the material. Ask for help if you don't understand this procedure.

7. Repeat steps 6 and 7 until the edge is square to the face and straight along the length. Use a square to check for square.

Additional Jointer Safety

Proper stance and posture are important when operating any of the shops Jointers.

Feet should be firmly placed and body weight should be evenly distributed. Fingers should never touch the table surfaces when processing material.

Never reach down to free material that gets stuck on out-feed bed while machine is on and Running.



Planer

24" Planer

The 24" Planer is ideally suited for planing large boards of solid wood. It can be used to plane rough sawn wood or wood that has been previously flattened.

PLANERS DO NOT FLATTEN BOARDS. If there is a bow, cup or twist in a board the planer will not remedy these characteristics. A planer will merely smooth the face of a board and plane it to a consistent thickness. The planers in the woodshop are vital pieces of equipment and crucial to the completion of many projects. Be gentle with these machines and read the operating procedures carefully.

Safety

- ***Do not stand directly behind machine when operating.***
- ***Do not look into machine while it is on and operating.***
- ***Protective eyewear should always be worn when operating this machine.***
- ***Use Hearing protection when operating this machine.***
- ***Do not talk with observers while operating this machine.***
- Do not stand directly behind machine when operating.
- Do not attempt to remove too much material per pass (more than 1/16" / pass).
- Always measure thickness of board at several points along the length.
- For the first pass set the machine according to the thickest part of the board.
- Do not adjust feed rate crank unless machine is running.
- Material to be surfaced should be at least 16" long.
- If needed see attendant for assistance with this machine.

Procedure for planing boards

1. Check board for maximum thickness.
2. Turn on machine (Green button).
3. Make sure dust collector is on.
4. Use hand crank on side of machine to raise or lower bed in small increments.
5. Feed board into machine.
6. Raise bed for next pass.
 - a) For boards 6" and under turn crank handle clockwise maximum $\frac{1}{2}$ crank / pass.
 - b) For boards 6" and over turn crank handle clockwise maximum $\frac{1}{4}$ crank / pass.



Routers

The routers, shown above, are some of the most useful tools in the woodworking field. Different cutters may be used to provide a variety of cutting and shaping operations such as slotting, mortising, dadoing, grooving, rabbeting, corner-rounding, beading, dovetailing, veining, inlay work, etc.

Safety

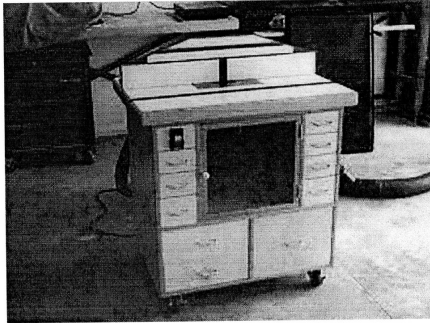
- *Eye protection is required when using these tools.*
- *Do not talk with observers while operating these tools.*
- *Be sure switch is "OFF" before plugging in.*
- The use of hearing protection is encouraged when using this tool.
- The use of a dust mask is encouraged when using this tool.
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Select proper bit for work to be done.
- Always be sure the collet nut is securely tightened to prevent the router bit from slipping during use.
- Make certain that the work piece is rigidly held in desired position and free of obstructions and always hold the router firmly and against the work, using both hands.
- Remove material in increments (successive passes) if cut will exceed 1/8" in width or depth of cut. Keep cutting pressure constant. Do not force tool into cut.
- Never adjust depth of cut while motor is running.
- Be sure cord is free and will not "hang up" during routing operations.
- Keep hands clear of cutter when motor is running to prevent personal injury.
- Maintain firm grip on router when starting motor to resist starting torque. Allow motor to come to full speed before contacting work piece.
- Be sure motor has completely stopped before setting machine down.

Typical procedure for using router

Before using your router, consider the kind and total amount of material to be removed. Depending on the material, it may be necessary to make more than one cut to avoid overloading the motor.

- Before beginning the cut on the actual work piece, it is advisable to make a sample cut on a piece of scrap lumber. This will show exactly how the cut will look as well as enable you to check dimensions.
- Always be sure the work is rigidly clamped or otherwise secured before making a cut. Generally speaking, when working on a bench, the work piece should be held on the bench by wood clamps.
- When routing edges, the router should be held firmly down and against the work by both guiding knobs. Since the cutter rotates clockwise (when viewing router from top), more efficient cutting will be obtained if the router is moved from left to right as you stand facing the work.
- When working on the inside of a template, move router in a clockwise direction. When working on the outside of a template, move the router in a counter clockwise direction. The speed and depth of cut will depend largely on the type of material being worked upon. Keep the cutting pressure constant, but do not crowd the router so the motor speed slows excessively.
- It may be necessary on exceptionally hard woods or problem materials to make more than one pass at various settings to get the desired depth of cut. When making cuts on all four edges of the work piece, it is advisable to have the first cut on the end of the piece across the grain.

Thus, if chipping occurs at the end of a cut, it will be removed when making the next cut parallel with the grain.



Router Table

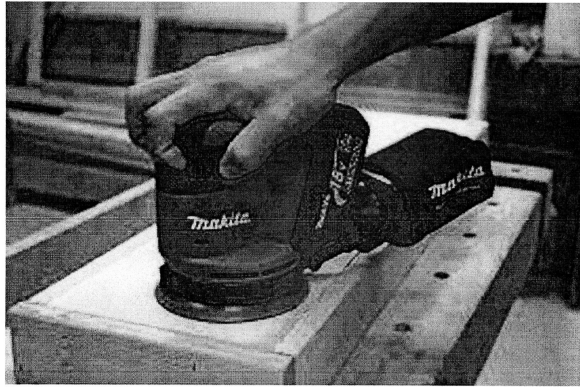
The Router Table is simply a handheld router mounted on a fixed plate, inverted and mounted in a cabinet or stand. The shop has a variety of router bits that can be used to shape and groove material. As with any machine in the shop certain precautions and procedures should be followed when operating this machine.

Safety

- Eye protection is required when using this machine.
- Do not talk with observers while operating this machine.
- Be sure switch is "OFF" before plugging in. The router is hooked up to a switch on the front of the table. Always be sure to unplug the router when changing bits.
- Do not attempt to remove too much material in a single pass. Raise bit in 1/8th inch increments or adjust fence in 1/8" increments.
- Always feed material from the right side of the bit to the left side of the bit.
- Never position material between bit and fence or use the back side of bit.
- Fingers should always be at a safe comfortable distance from bit, and never closer than 2" from bit. Seek attendant assistance when working on small pieces.
- Material to be routed should be flat and free of and free of any debris (nails, screws, knots, bark).
- Always hold material firmly but not forcefully against fence or bearing if using bearing bits.

Procedure for operating router table

1. Select desired router bit (Seek attendant assistance).
2. Unplug router from power strip.
3. Seek attendant assistance for help installing bits.
4. Adjust height of bit or depth of fence so no more than 1/8" in depth or width will be removed per pass.
5. Turn on router.
6. Hold material steady against fence or bearing and begin feeding material from right to left.
7. Repeat step 4-6 as many times as needed until desired width or depth of cut is obtained.

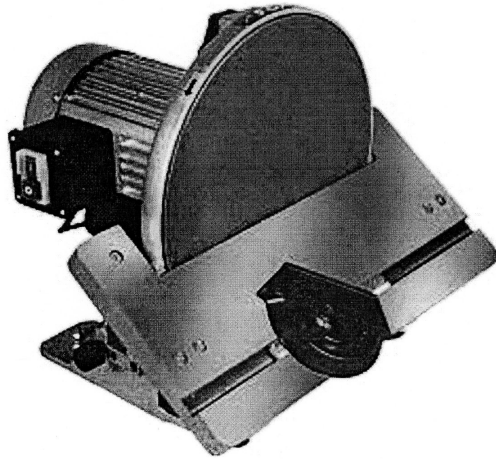


Random Orbit Sanders

Electric Random Orbit Sanders are used for final finish sanding and may be used on wood or wood composite material and some plastic materials.

Safety and Use

- *Eye protection is required when using these tools.*
- *Sandpaper disc must be attached to bottom of sander before using.*
- *Be sure switch is "OFF" before plugging in.*
- Do not talk with observers while operating these tools.
- Use appropriate sandpaper disc for sander and for work to be performed. Ask attendant for assistance if needed.
- Start sander on material to be sanded. Hold sander firmly.
- When pausing or stopping sanding operation lift sander off material and hold away from any surfaces until disc coasts to a complete stop.
- Sander should "float" on top of material. Do not bear down on sander or push sander into material.
- The use of a dust mask is encouraged when using this tool.



Disc Sander

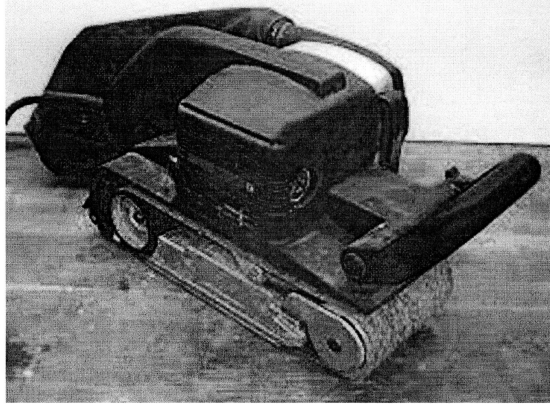
The 12 and 20" Disc Sander can be used to do rough sanding work on straight edges and on convex curved surfaces. As with all power sanders care must be taken not to remove too much material at once.

Safety

- ***Protective eyewear should always be worn when operating this machine***
- ***Do not talk with observers while operating this machine.***
- ***Use of a dust mask is recommended while using this machine.***
- Long hair should be tied back and restrained.
- Loose clothing should be restrained or removed. Roll up sleeves.
- Be sure to wear eye protection.
- To keep material from "jumping" sand only to the right of center.
- Do not force material into disc.
- Stock that is smaller than 1" in width should not be sanded.
- Material to be sanded should be flat on at least one face.
- Disc Sander is for use on wood only. Do not attempt to sand plastic, metal, plaster or rubber.
- If disc appears to be clogged or dirty ask shop attendant for assistance.

Procedures for Sanding:

- Turn on Sander.
- Place flattened surface of material on table to the left of center of disc (all disc sanders rotate counter-clockwise).
- Hold material firmly and gently move it into spinning disc.
- Turn off machine when finished and allow disc to coast to a stop.
- ***Do not sand items with wet or soft glue.***



Belt Sander

Belt sanders are used for flattening and smoothing material in preparation of final sanding. With the appropriate belts they will quickly remove large amounts of material or smooth a surface for further sanding with other sanders.

Safety and use

- *Eye protection is required when using this tool.*
- *Do not talk with observers while operating this tool.*
- *Be sure switch is "OFF" before plugging in.*
- The use of a dust mask is encouraged when using this tool.
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Use appropriate sandpaper belt for sander and for work to be performed ask attendant for assistance if you are not sure which belt to use. (Some belts have an arrow indicating directions of installation).
- Sandpaper belt must be attached to sander before using.
- Always keep fingers or exposed flesh away from sanding belt.
- Start sander on material to be sanded.
- When pausing or stopping sanding operation allow sander to decelerate by slowly releasing trigger switch, wait for sander to come to a complete stop.
- Sander should "float" on top of material. Do not bear down on sander or push sander into material.



Oscillating Spindle Sander

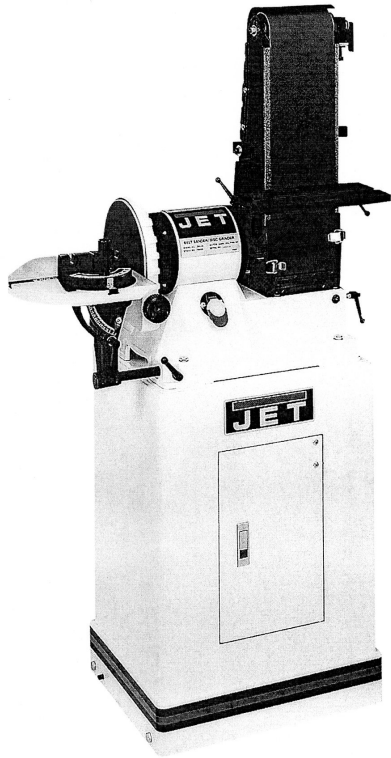
The Oscillating Spindle Sander is most useful for sanding concave surfaces. The spindle rotates and oscillates simultaneously leaving a smooth surface on the material being sanded.

Safety

- ***Protective eyewear should always be worn when operating this machine.***
- ***Do not talk with observers while operating this machine.***
- Long hair should be tied back and restrained.
- Loose clothing should be restrained or removed. Roll up sleeves.
- Do not force material into spindle.
- Material to be sanded should be flat on at least one face.
- This sander is for use on wood only. Do not attempt to sand plastic, metal, plaster or rubber.
- If spindle appears to be clogged or dirty ask shop attendant for assistance.

Procedure for sanding

- Hold the material flatly and firmly on the table away from the spindle.
- Ease the material into the spindle, move the material from side to side around the spindle to obtain a smooth even surface.
- ***Do not sand material with wet or soft glue.***



Belt and Disc Sander

The disc sander consists of a reference table and a circular plate mounted to a motor shaft. A cloth or paper-backed abrasive disc is cemented to the plate. The diameter of the disc indicates the size of the machine, commonly 8". The combination sander includes a vertical belt sander as part of the machine.

Safety

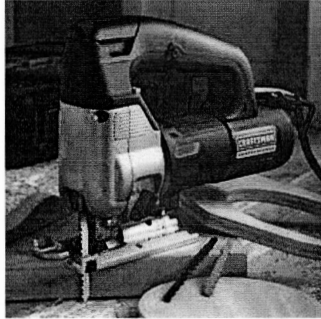
- *Always sand on the downward motion side of the disc/belt. Never the upward motion side as this can throw your part upwards with tremendous force.*
- *Always attempt to place your work against the rest on the*

disc and belt sanders and hold the work securely.

• ***When using the horizontal belt sander, always sand so that the belt motion is away from you.***

- Do not operate machines with torn or ripped belts or disks.
- Always sand on the down travel side of the disc / belt (left side of disc).
- The rest should be adjusted so that it is no more than 1/8" from the disc.
- Make adjustments only when the sander is at a complete stop.
- Keep fingers away from the abrasive surface on the sander.
- Avoid pressure against the disc. Feed stock into the abrasive material at a moderate rate of feed and pressure.
- Stock that is smaller than 1" in width should not be sanded.
- Use the disc sander for sanding outside curves or angles only.
- The disc sander is NOT to be used for joinery, squaring stock, etc.
- Any disc that is dull or loose should be repaired or replaced immediately. Notify the instructor when the disc is loose.

Do not use tools/machines without proper demo first

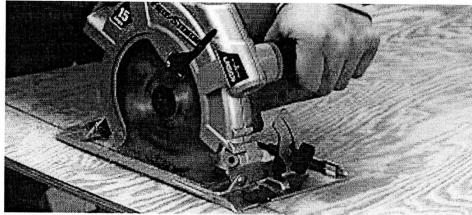


Jigsaw or Sabre Saw

This tool is generally used for pattern cutting into materials with the maximum thickness of 2".

Safety and Use

- ***Eye protection is required at all times when using this tool.***
- ***Do not talk with observers while operating this tool.***
- Restrain loose clothing, tie back long hair, remove or restrain loose jewelry.
- Keep fingers away from line of cut
- Always securely clamp or hold material in position.
- Use appropriate blade for material to be cut. Ask for help from shop staff.
- Find a clear area to work with this tool and secure the material
- When cutting on material on bench-tops be aware of where bench surface is. Avoid cutting bench-top.
- Area underneath line of cut should be free of any obstructions.
- Line up front edge of blade with line of cut.
- Never start Jigsaw with front edge of blade pressed up against material.
- Keep jigsaw base flat on material when in use.
- Never use a bent blade.



Circular Saw

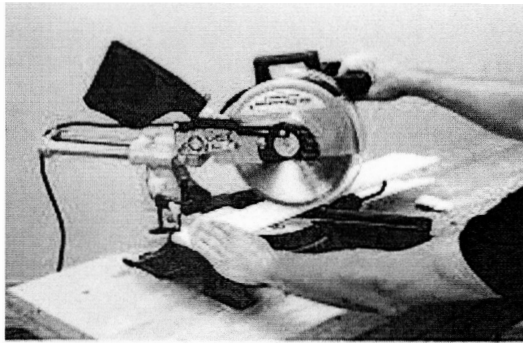
The Circular Saw is used for making straight cuts. With the appropriate blade various materials may be cut such as: wood and wood composites, Paper or fiber based materials, plastics and masonry type materials. Like all tools that utilize a moving blade care and caution should be used when operating this tool.

Safety

- ***Eye protection is required at all times when using this tool.***
- ***Do not talk with observers while operating this tool.***
- The use of a dust mask is encouraged when using this tool.
- The use of hearing protection is encouraged when using this tool.
- **Keep fingers away from line of cut when operating this tool.**
- **Keep fingers away from line of cut in front of and in back of saw.**

Procedure for using Circular Saw

- Use appropriate blade for material to be cut. Ask for help from shop staff.
- Do not attempt to change blade or blade settings. Ask for assistance if needed.
- Find a clear area to work with this tool and secure the material with clamps if needed
- Avoid binding the blade in line of cut by supporting work properly using either method:
 - a. Material should be fully supported on both sides of cut line (large pieces).
 - b. Material may be supported on only one side of cut with waste falling away (shorter pieces)
- When cutting on material on bench-tops be aware of where bench surface is. Avoid cutting into bench-top.
- Area underneath line of cut should be free of any obstructions.
- Line up front edge of blade with line of cut.
- Never start saw with front edge of blade pressed up against material.
- Keep saw base flat on material when in use.



Sliding Compound Miter Saw

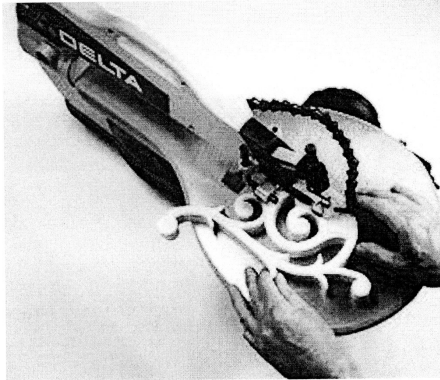
The Sliding Compound miter saw can 90-degree crosscuts as well as compound angles in wood material. It cuts quickly with a fair degree of accuracy. For greater accuracy the table saw equipped with the crosscut box is suggested.

Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Do not talk with observers while operating this machine.**
- Cut only wood and wood based material with this saw.
- **Material should be flat and straight. Do not attempt to cut bowed or twisted boards with this machine. This could cause a kickback.**
- Hands and finger should be kept a minimum of 8" from blade.
- **Do not cut pieces less than 12" with this saw.**
- Do not operate saw with hands crossed. I.E., Left hand should always stay to the left of saw and used for holding material and right hand should always be used to operate saw switch.

Procedure for crosscutting

1. Adjust bevel angle and miter angle to desired settings (seek attendant assistance).
2. Adjust adjustable fence to clear blade guard travel (seek attendant assistance).
3. Hold material firmly and flatly against fence and table.
4. Pull saw carriage out past material.
5. Squeeze trigger handle to start saw.
6. Allow blade to reach full speed before lowering saw into material.
7. Lower saw blade into material with a slow steady rate of feed.
8. Push saw carriage through material and back towards fence.
9. If material starts to bind against blade, lift saw from material and take several shallow passes until cut is complete.
10. Allow blade to come to a complete stop before raising blade.



Scroll Saw

The Scroll Saw can be used to cut all kinds of wood and some types of plastics. Before using these pieces of equipment please read and make sure you understand the following safety rules.

Safety

- Eye protection is required when using these machines.
- Do not talk with observers while operating these machines.
- Always maintain a 3" margin of safety (Keep hands and body parts away from line of cut).
- Make all adjustments with the power off.
- Do not expose more than 1/2" of blade between material and bottom of upper guide.
- Allow saw to reach full speed before beginning cut.
- Hold stock flat on table top.
- Do not cut stock that does not have a flat surface. (i.e. do not attempt to cut spherical objects).
- Feed stock only as fast as teeth will remove material.
- Avoid backing out of cuts when possible.
- Plan relief cuts in advance – think first.
- Do not make turns too tight – listen for blade twisting.
- If "clicking" noise is heard, SHUT OFF POWER – BLADE MAY BE DAMAGED.
- Stop machine and blade before removing scrap pieces.
- Operate the machine from front side (side with doors). Avoid standing to side of machine.
- Ask for help when cutting long or wide or difficult to handle pieces.
- Saw is for use in cutting wood and some other soft materials (ask shop attendant).
- Keep hands and body parts away from line of cut.

Absolutely no metal cutting is allowed on these Scroll Saws.

Adjusting the blade:

- a. Loosen tension by pulling front knob forward
- b. Loosen blade by pulling release.
- c. Lift head & place material over blade.
- d. Lower head and place blade into the upper arm and tighten.
- e. Create tension.
- f. Saw is ready to use.

Make sure blade teeth are pointing down.

Keep “hold down” foot tight to work.

Note, “hold down” foot is also a blade guard.

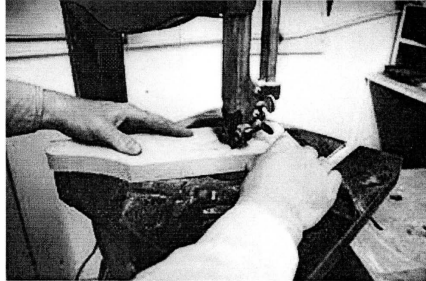
Keep finger out of line of cut.

Feed stock slowly and hold firmly to table.

Turn off machine and clean area.

Use ½” stock wood or smaller only

Do not use tools/machines without proper demo first 20



Band Saw

The Band Saw can be used to cut all kinds of wood and some types of plastics. Before using these pieces of equipment please read and make sure you understand the following safety rules.

Safety

- Eye protection is required when using these machines.
 - Do not talk with observers while operating these machines.
 - Always maintain a 3" margin of safety (Keep hands and body parts away from line of cut).
 - Make all adjustments with the power off.
 - Do not expose more than 1/2" of blade between material and bottom of upper guide.
 - Allow saw to reach full speed before beginning cut.
 - Hold stock flat on table top.
 - Do not cut stock that does not have a flat surface. (i.e. do not attempt to cut spherical objects.
 - Feed stock only as fast as teeth will remove material.
 - Avoid backing out of cuts when possible.
 - Plan relief cuts in advance – think first.
 - Do not make turns too tight – listen for blade twisting.
 - If "clicking" noise is heard, SHUT OFF POWER – BLADE MAY BE DAMAGED.
 - Stop machine and blade before removing scrap pieces.
 - Operate the machine from front side (side with doors). Avoid standing to side of machine.
 - Ask for help when cutting long or wide or difficult to handle pieces.
 - Saw is for use in cutting wood and some other soft materials (ask shop attendant).
 - Keep hands and body parts away from line of cut.
- Absolutely no metal cutting is allowed on these Band Saws.

Procedure for using Band Saw

1. Inspect material. It should be flat and free of debris (dirt, nails, screws, etc.)
2. Check blade pitch. Use proper blade for various cuts (ask shop attendant).
3. Adjust upper guide to within 1/2" above surface of material.
4. For straight cuts set up fence (see attendant for assistance).
5. Turn on saw. Machine should run smoothly with a consistent buzz, report strange noises to shop attendant.
6. Feed material while standing directly in front of blade. Avoid standing to side of blade.
7. Keep hands and body parts away from line of cut. Sometimes the blade may "jump" through the material. This happens sometimes when the blade cuts through a portion of the material that may have a lesser density, thus offering less resistance to cutting. The blade will actually speed up and cut at a greater velocity. If you are near the end of a cut and your fingers are in the line of cut injury could occur.
8. Begin feeding material into blade. Use enough pressure to feed material through blade at a slow consistent speed. If material smokes or burns report it to shop attendant.
9. If you need to pull material out of blade do so with caution. If blade gets stuck in saw kerf and pulls out of guides, turn off machine and seek help from shop attendant.
10. For angled cuts check with shop attendant for help.

Table Saw

The 10" Table saw is a frequently used piece of equipment. It can be used to cut solid wood, composite wood products such as plywood and particleboard and some types of plastics. Two table saws in the woodshop are configured primarily for ripping wood (cutting with the grain of the wood) and a third is setup exclusively for 90 degree crosscuts (cutting perpendicular to the grain of the wood). The table saws in the shop have powerful motors and special care should be taken whenever operating any of the table saws.

Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Hearing Protection is recommended while using these machines.**
- **Do not talk with observers while operating these machines.**
- **Seek shop attendant approval before using these machines.**
- Material to be cut on table saws should be flat and straight on at least two adjacent surfaces. Free of dirt, loose knots and splits.
- Be sure to check for any metal objects embedded in the wood (nails, screws, staples, etc.)
- Use a push stick whenever cutting pieces less than 6" wide.
- Do not rip material greater than 2" thick on this machine.
- If guards need to be removed please ask shop attendant for help.
- **DO NOT LET GO OF MATERIAL UNTIL COMPLETELY PAST BLADE.**
- Avoid standing directly in-line with blade. If possible stand off to the side of blade.

Procedure for ripping material on table saw

1. Inspect material. It should be flat and straight, free of loose knots, dirt, or metal objects.
2. Use appropriate blade for material being cut. Seek attendant's help if needed.
3. Adjust blade tilt if needed, use appropriate throat plate for beveled cuts. Seek attendant's assistance if needed.
4. To adjust fence to desired width, lift large handled knob upwards and slide fence bar towards or away from saw blade.
5. Guards should be kept in place. But can be removed if they interfere with passage of material through blade (By shop attendant only).
6. Lock down fence by pushing large handled knob downwards.
7. Have push stick ready for use if there is less than six inches between fences and saw blade.
8. Remove dust shield if it interferes with passage of push stick (Usually about 3" width).
9. Remove Splitter if it interferes with passage of push stick (Usually about 1 3/4").
10. Turn on saw.
9. Place material flat on table saw surface and tight against fence.
10. With steady even pressure and moderate speed push material into blade.
11. As material moves through blade continue holding material tight against fence and flat against table.
12. Minimize saw marks and burning by not pausing during the sawing process.
13. When end of board approaches reach for push stick if needed (Material less than 6" wide).

14. When reaching for push stick, do not let go of material at any time. Switch hands as necessary to reach for push stick.

Procedure for cross cutting on the table saw with miter gauge

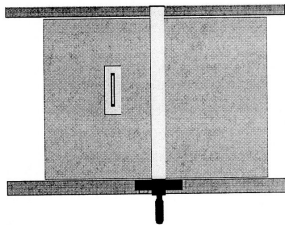
NEVER USE TABLESAW FENCE IN CONJUNCTION WITH MITER GAUGE.

(I.E. DO NOT USE FENCE AS A STOP).

1. Material should have at least one flat and straight face and at least one flat and straight edge.
2. Place miter gauge into the slot in the table saw (bar on the miter gauge should be pointing away from front of saw).
3. Line up the mark on the material with the edge of the blade. (Blade should be to the waste side of the cut).
4. Make sure material is away from blade. Start saw.
5. Hold material tight to miter gauge and with steady speed push it and material through blade.
6. While still holding material and miter gauge pull back to starting position. Remove scrap after blade has completely stopped.

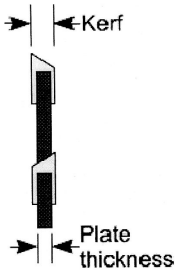
Tablesaw Kickback

Most tablesaw owners dread kickback without necessarily understanding what it is and more importantly, what causes it. Knowing that it involves a piece of stock coming back towards you is fine, but as with most technical matters, once you understand how and why it happens, you've got much more chance of preventing it. These words and pictures are an attempt to get back to basics and demystify the subject.



Here's a simplified view of the BT3 saw from above, showing the throat plate surrounding the blade, the fence assembly and the fence rails. While most will recognize the importance of having the fence parallel to the blade, the reason for this might not be obvious and bears further (later) explanation.

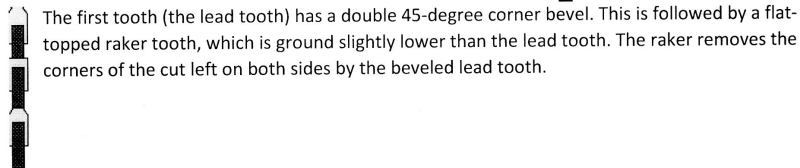
The tablesaw blade rotates at high speed towards you. If it turned away from you, it would not cut wood, but it would be ideal for launching the stock into space! The blade itself can have a variety of forms, depending on the use it is intended for. The circular steel saw plate, which gives the blade its size and shape as well as fixing it to the motor arbor, is also the surface onto which the cutting teeth - usually carbide (an alloy of cobalt and tungsten) - are attached.



The "kerf" of a blade is the amount of material it removes from the stock, or, in other words, the width of the cutting teeth (and therefore, the cut). The saw plate thickness is less than that of the teeth, as can be seen in this diagram, which provides relief between the stock and the blade.

There are other parts of the blade that assist in its efficiency, but we are not concerned with them in this explanation. The blade profile pictured here is an Alternate Top Bevel (or ATB), so called because each alternate cutting tip's bevel is on the opposite side, as shown. The bevel angle is usually 15 degrees and although two teeth will span the width of the kerf, this configuration will leave a slight "V" in non-through cuts.

Another configuration is the Square Top Tooth, designed for heavy cutting applications. The cutting teeth are ground square, perpendicular to the side of the saw plate.

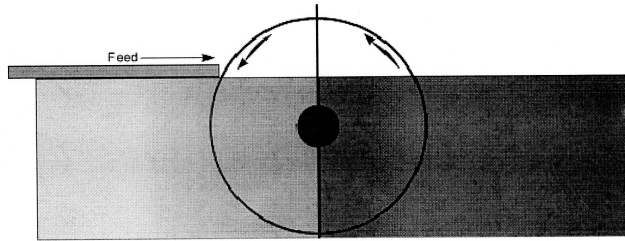


The first tooth (the lead tooth) has a double 45-degree corner bevel. This is followed by a flat-topped raker tooth, which is ground slightly lower than the lead tooth. The raker removes the corners of the cut left on both sides by the beveled lead tooth.

The final popular configuration is the Planer Combination. This uses a single raker with four alternating top bevels. The raker is ground both slightly lower and narrower than the ATB teeth. The raker removes the central "V" portion left by the ATB teeth, resulting in a very smooth cut.



No matter what profile the blade teeth have, the kerf will be wider than the saw plate. This allows the plate to run free within the kerf already cut into the stock as it is passed through the blade. If the saw plate were as wide as the cutting teeth, then the whole face of the saw plate would be in friction contact with the sides of the cut. This would generate a great deal of heat, which in the early part of the cut would be inconvenient, possibly marking the stock.

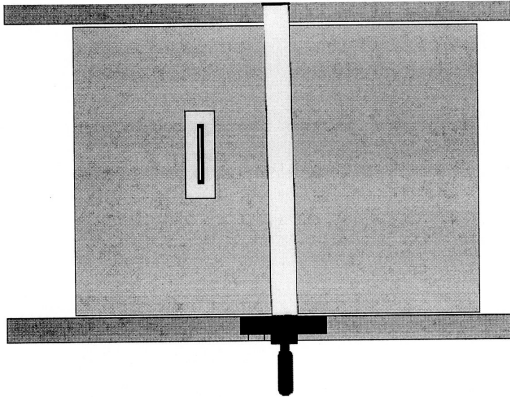


However, once the stock has passed the “center” of the blade (the vertical black line in the above diagram) and therefore the center of rotation, the “back” of the blade would then lift the stock upwards as soon as it overcame the weight of stock and/or any downward force applied to it. Once the stock weight (and/or force applied) has been overcome, the friction of the blade upon the stock will act just like a clutch in stick-shift, gaining a grip on the side of the cut by friction and propelling the wood in the direction of travel of the blade. This, unfortunately, is upwards and towards the front of the blade and therefore - towards YOU!

The circumference (perimeter) of a 10-inch saw blade is 31.4 inches. If the saw blade travels at 4,800 revolutions per minute (rpm), then the teeth are travelling at 150,720 inches per minute. To put that another way, that's 9,043,200 inches per hour, or 142.72 mph! Even allowing for the fact that some of the blade speed will be lost through load, that's still 120mph if 15% of the speed is lost – usually, an over-estimate. It is not surprising to realise, then, that any piece of stock propelled by a blade moving at that speed has the potential and inertia to travel a great distance and become a very dangerous projectile.

Thankfully, saw plates are not as wide as their cutting teeth and - in a perfect setup - will run freely within the width of the kerf of the cut and remain cool. The trouble is that “perfect setups” don't happen automatically, or naturally. Some saws may be perfectly set up right out of the box and may also remain so for their entire working life. I haven't found one or heard of one yet that has done both! Checking the setup of your tablesaw is not only essential for accuracy, it is also essential for your health and safety. Regular checking of a “perfect” setup is also necessary, as many things can affect it over use and time, particularly rough handling and/or poor technique.

Look at this diagram:



The fence is not parallel to the blade – it is skewed towards it at a slight angle.

As the stock is fed into such a setup, it will become pinched between the fence and the blade and the further it is pushed through, the worse the pinching effect will be. A square piece of stock will not pass through a smaller opening!

This is kickback waiting to happen (fence-induced kickback) - the stock cannot pass cleanly through the blade and will be forced sideways into the back of the blade by the fence. This is why it is ESSENTIAL to make sure that your fence is parallel to the blade.

Some woodworkers adjust their fence so that it “leans away” from the blade, even by just half the thickness of a business card. This removes the potential for such fence-induced kickback, whilst not adversely affecting the workpiece.

Riving Knives

The riving knife is a device that will greatly reduce the possibility of kickback, provided that it is properly adjusted.



If your riving knife is the same thickness as the blade kerf, adjust it to be in line with the blade. If your riving knife is thinner than the kerf, adjust it so that it aligns with the fence side of the kerf, as shown in the above diagram. The purpose of the riving knife is to prevent sideways pressure on the blade from stock which is passing through. Once the leading edge of the workpiece reaches the knife, it also serves to guide the cut and prevents the up-running teeth at the back of the blade from unnecessarily scoring the kerf.

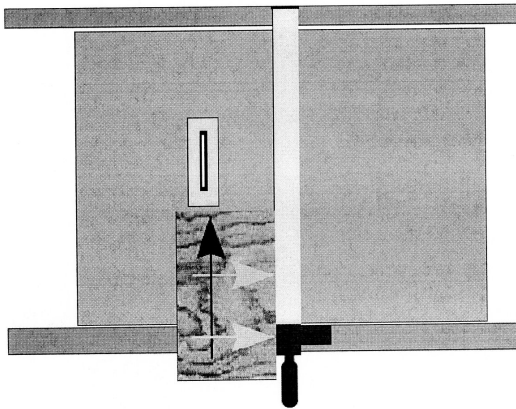
Another function of the riving knife is to serve as a form of rear guard, preventing off-cuts and knots from being caught by the up-running teeth and thrown towards you. Sometimes the kerf can narrow as it leaves the cutting teeth. When this happens it can pinch the back of the blade, causing the workpiece to be violently thrown upwards and forwards towards you. A properly adjusted riving knife will prevent this from happening, as it holds the cut open behind the blade.

If the opposite happens and the kerf spreads, the now-wider workpiece will press against the riving knife and the fence. This can increase the force required to feed the stock through the blade and should

immediately alert you. However, if there is no riving knife, or it is incorrectly fitted, the sideways pressure can push the workpiece against the up-running teeth and cause kickback.

Timber can become "case-hardened." When the material is cut, internal stresses are released. Some wood may have twisted or interlocked grain, or may have high moisture content. All of these conditions increase the possibility of kickback.

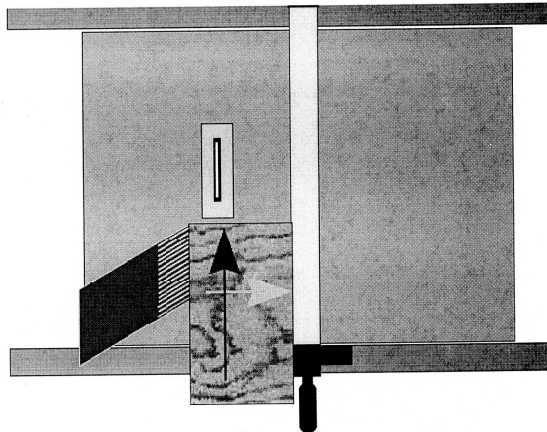
Prevention is Better Than Cure!



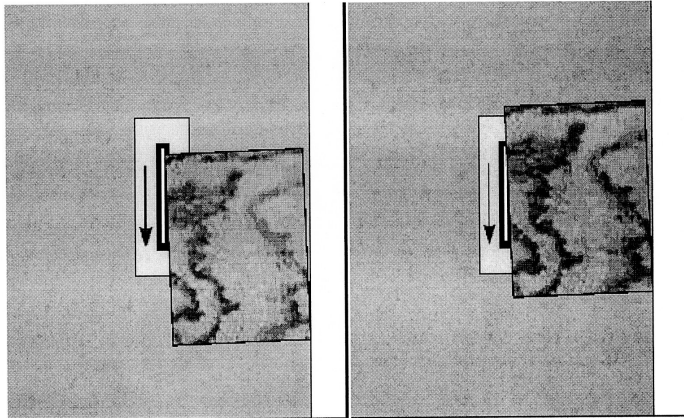
When feeding stock, ensure that it is held firmly against the fence by pressure in the direction of the fence (the green arrows). Once a good contact has been established with the fence, feeding can begin (blue arrow).

A featherboard can greatly assist in keeping stock tight against the fence, but can only be used horizontally in front of the blade.

Featherboards can also be used by clamping them vertically to the fence, where they will provide a downward force on the stock.



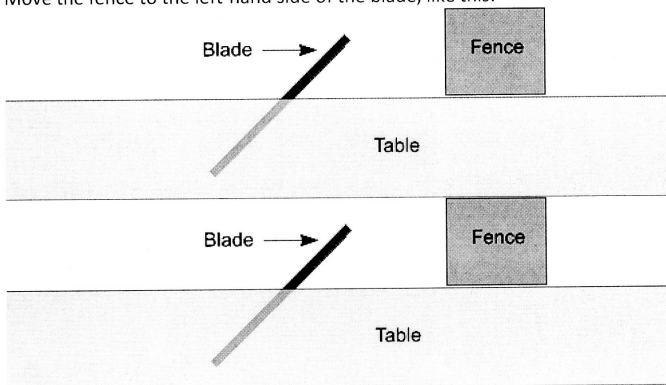
If you allow the stock to twist or skew, as soon as it reaches the back edge of the blade, the up-running teeth will launch it at you, in the direction of the blade rotation (red arrow).



Causes and Effects

- Always ensure that the edge of a workpiece against the fence is straight. If it is not straight, a crooked cut will occur.
- Always use the rip fence to guide the workpiece in a straight line when ripping. **Never freehand-cut a workpiece.** Free-handing causes crooked cuts and potential kickback.
- **Never tilt the blade so that the workpiece is trapped in the angle between the blade and the fence. This is a condition that has a very high potential of causing kickback:**

Move the fence to the left-hand side of the blade, like this:



Safety

- **Protective eyewear should always be worn when operating this machine.**
 - **Do not talk with observers while operating this machine.**
 - Cut only wood and wood based material with this saw.
 - **Material should be flat and straight. Do not attempt to cut bowed or twisted boards with this machine. This could cause a kickback.**
 - Hands and finger should be kept a minimum of 8" to the left or right side of blade.
 - **Do not cut pieces less than 12" with this saw.**
 - Do not operate saw with hands crossed. I.E., Left hand should always stay to the left of saw and used for holding material and right hand should always be used to operate saw switch.
 - No free cutting- always use the fence
- Rip Cuts should only be done on the radial arm saw

Procedure for crosscutting:

Cross-cutting on a radial arm saw can be a bit tricky, because the saw blade rotates in the same direction as the cut. As such, the operator needs to pull the saw through the cut, but at the same time, keep the saw blade from grabbing and pulling the blade through the cut too quickly. This is an even bigger problem when using a blade that is a bit dull, or when using a stacked dado blade set. To counter the saw's desire to pull through the wood quicker than necessary, the operator must pull at a slow, even pace while simultaneously not allowing the saw to push faster than desired. This becomes easier with practice.

1. Set arm angle using the angle stop and angle lock.
 2. Set saw height using height crank-
 3. Position stock flat on table and against
- Support longer stock with saw horse. Never free cut.**
4. Push motor fully to the rear before starting saw.
 - Place mark under blade using teeth to locate cut as shown.
 - Hold stock firmly against table and fence.
 5. Make cut. Finish cut.

NOTES:

- Always return cutting head to the rear of the table after each cross-cut.
- Wait for blade to stop before moving any- thing.

Forbidden Materials

- Cutting branches, wood with embedded nails or screws
- Cutting dowels
- Ripping solid timber along the grain
- Cutting short lengths of timber

Final Do's and Don'ts

A dull blade may cause a kickback. **Keep your saw blades sharp.**

A build-up of pitch or sap on the surface of the saw blade will increase the thickness of the blade and therefore increase friction on the saw plate. These conditions will increase the likelihood of kickback. **Keep your saw blades clean.**

Do not cut wet wood, it **produces higher friction against the saw blade.** Additionally, the blade can load with wet sawdust, which again increases the likelihood of kickback.

Be very careful with pitchy, knotty or warped wood. These flaws are much more likely to create pinching and - therefore - kickback.

Never use a bent, broken or warped saw blade. The potential for binding and therefore kickback is greatly increased.

A build-up of sap on the blades, dullness and free-handing a cut can all cause a blade to overheat. **Overheating a saw blade can cause it to warp and create kickback.**

Never use the Sliding Miter Table in such a way that the wood is also in contact with the rip fence at the point of cut! To cut repeat lengths using the SMT, clamp or T-nut a short block of wood (a stop-block) to the fence close to the front rail and set this block the required distance from the blade. Butt your stock to the stop-block to set the correct length, then as you move the SMT towards the blade to make the cut the wood will clear the stop-block and be guided only by the SMT, which will ensure that the stock is not in contact with the rip fence.