

Tool Overview

The following is an overview of the tools in the Materials Lab. Anyone wishing to use these tools must attend an orientation session, as well as seek individualized instruction on any tool with which they are not familiar. This manual is not intended to replace such individualized instruction, but to familiarize the reader with the capabilities of the machines.

Consult with a Lab Staff before performing any procedure you are unfamiliar with. He or She will be the one to decide if the material and the process are appropriate, and will be able to suggest the safest and most efficient way to do it.

Do not hesitate to ask Lab Staff if you have any questions, and do not proceed with any work until such questions have been answered.

General Safety Rules

CLOTHING

Dress appropriately for your work. Remove coats, jackets and sweaters.

Roll up loose sleeves. Remove loose jewelry. And tie back long hair.

WEAR SHOES. NO SANDLES ARE ALLOWED IN THE MATERIALS LAB.

EYE PROTECTION:

Wear safety glasses, goggles or a face shield when operating power tools.

Do not watch the welder without a welding hood.

Do not operate the plasma cutter without tinted safety glasses

Be sure you have enough light to see what you are doing.

HEARING PROTECTION

If the operation you are performing is creating excessive noise, it is advised that you use the hearing protection provided.

HEADPHONES

The use of headphones is prohibited in the Materials Lab.

Wood Working Tools

Vertical Panel Saw

The vertical panel saw is a circular saw blade mounted to tracks. It allows the user to place a large sheet of plywood or other sheet goods in a fixed frame while moving the blade through it. It is a much easier and safer way to cut large panels down to a workable size.

Uses:

Rough sizing of 4' X 8' sheet goods

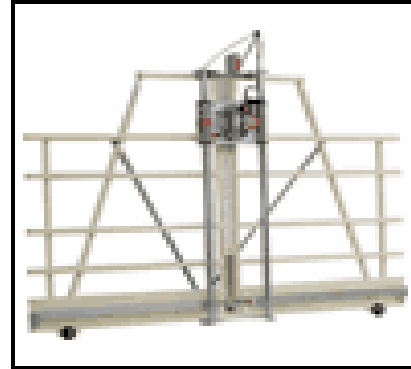
Safety concerns:

Wear eye protection

Do not push the saw too fast

Limitations:

Best used for larger pieces



Sliding Table Saw (Laguna)

The sliding table saw is best used to crosscut materials up to 48" wide. It is equipped with a table on ball bearings that slides past the blade. Because the material is clamped to the table, the operator's hands do not need to be near the blade while cutting. It can also be used to rip, if the table is locked in place. This saw can accommodate a 10" or 12" blade

Uses:

Crosscutting and ripping wood and plastics

Straight line ripping (putting a straight edge on uneven material)

Dado, Rabbet, and Kerf cutting

Tenons (with proper tooling)

Safety concerns:

Don't cut badly warped material

Beware of Kickback

Always use blade guard

Use push stick if blade is within 5" of fence

Do not cut material shorter than 12"

Use support stand for long and heavy material

Sliding table must be locked in place before ripping

Material must not touch the rip fence and the miter fence at the same time

Limitations:

Straight cuts only

Maximum thickness 3" to 3 3/4"



Wood and Plastics Only

Angle limit 45 degrees

Table Saw (SawStop)

The table saw is best used to rip materials up to 36" wide. It can also be used to crosscut, but the sliding table saw is better for that. This saw can accommodate a 10" blade, or an 8" dado blade. The blade may be tilted to cut bevels.

CAUTION: This specific table saw is equipped with a safety device that is triggered by conductive material.

DO NOT CUT CONDUCTIVE MATERIAL ON THIS SAW

This includes all metals as well as foil faced materials and TREATED WOOD. If in doubt about any material check with Materials Lab Staff.

Anyone triggering the device with unapproved materials will be charged \$250.00 to replace the blade and brake.

For more information go to www.sawstop.com

Uses:

- Ripping wood and plastics
- Dado, Rabbet, and kerf cutting
- Tenoning

Safety concerns:

- Use support stand for long and heavy material
- Use push stick if blade is within 6" of fence
- Don't cut badly warped material
- Beware of Kickback
- Always use blade guard
- Do not cut material shorter than 12"
- Material must not touch the rip fence and the miter gauge at the same time
- To change blades, please see Materials Lab Staff

Limitations

- Straight cuts only
- Maximum thickness 3" to 3 ¾"
- Wood and Plastics Only
- Angle limit 45 degrees



Bandsaw

The bandsaw is primarily used to cut exterior curves. It can also be used to cut straight lines. The width of the blade determines the minimum radius that can be cut. The diameter of the wheels that support the blade determines the maximum cutting width. The College has three 14" bandsaws and one 20" bandsaw. The saw's tables can also be tilted for angle cuts.

Uses:

- Freehand cutting of curves and irregular shapes
- Crosscutting
- Ripping
- Re-sawing lumber

Safety concerns:

- Use support stand for long and heavy material
- Always adjust the blade guard
- Do not allow round stock to spin
- Keep material flat on the table at all times
- Keep hands on either side of the blade
- Do not force cut
- Wait for blade to stop before retrieving material
- If blade breaks, turn off machine

Limitations

- Wood, Plastics Only, non-ferrous metals
- Angle limit 45 degrees
- Height limit 6" and 20"
- Width limit 14" and 20"



Horizontal Mortiser

The horizontal mortiser is primarily used to cut pockets in the edges of wood. It consists of a horizontal table and a movable horizontal chuck. The material is clamped to the table while the cutting tool is moved through a range of limited motions to cut a mortise, or pocket, of any width and depth.

Uses:

- Cutting mortises in wood and plastic

Safety concerns:

- Wear eye protection
- Always clamp material flat to table

Limitations:

- Table may be tilted up to 45 degrees



Sliding Compound Miter Saw

The miter saw makes cuts by pulling a spinning blade down onto a workpiece in a short, controlled motion. The workpiece is typically held against a fence, which provides a precise cutting angle between the blade and the longest workpiece edge. In standard position, this angle is fixed at 90°, but the angle of the blade can be changed relative to the fence.

The compound feature allows the angle of the cutting blade to be changed relative to the horizontal plane. While the sliding feature allows the blade to be moved several inches along the cutting plane during the cut.

The college has two miter saws; one has a 12" blade and is suited for larger work. The other has an 8½" blade and is better suited for smaller work.

Uses:

Makes quick, accurate crosscuts up to 12" wide

Most frequently used to cut wood, although some plastics and light metals can also be cut

Safety concerns:

Wear eye protection

Use safety clamp when cutting smaller workpieces (eight inches or smaller).

Limitations

Maximum cutting width 12"

Maximum angle 60 degrees



Disc Sander

The disc sander has 16" diameter discs. It is used to sand outside curves and flats on wood and plastic. The table may be tilted for angled edges

Uses:

Freehand sanding

Bevel, chamfer and square stock

Safety concerns:

Wear eye protection.

Hold work on table at all times.

Keep fingers away from disc. The motion of the disk will pull

Fingers between the disk and table.

Sand on side of disc that is traveling down.

Limitations

Width limit is 7"



Horizontal Belt Sander

The horizontal sander is used to sand curves and flats on wood and plastic. It has a 6" wide sanding belt that is 20" long. The table may be tilted for angled edges

Uses:

Shaping wood and plastics

Safety concerns:

Tie back hair and loose clothing

Limitations:

Sanding area is 6" X 20"



Horizontal Drum Sander

The horizontal Drum sander is used to sand curves and contours on wood and plastic. It has two 6" diameter sanding drums. There is no table. This sander is best used for freeform shapes.

Uses:

Shaping wood and plastics

Safety concerns:

Tie back hair and loose clothing

Wear eye protection



Oscillating Spindle Sander

The Oscillating spindle sander is used to sand concave curves in a variety of materials. It uses cylindrical drums covered with sandpaper. These drums rotate vertically and oscillate up and down. Holding the material flat to a table ensures accurate angles.

Uses:

Sanding concave contours on wood, and plastics

Can be used on inside curves

Sanding drums available in various diameters

Safety concerns:

Wear eye protection

Limitations:

Table may be tilted 45 Degrees



Downdraft Sanding Table

The downdraft sanding table maintains a downward air flow through the table top and filters dust from the air before returning it to the room.

Uses:

Control dust when sanding and shaping

Safety concerns:

Wear eye protection

Dust masks are still recommended

Check filters often to maintain their effectiveness

Limitations

Table size is 28" X 39"



Jointer

The jointer is used to machine a square or angled face on wood and some plastics. It has a revolving cylinder cutterhead with three knives. The size of the jointer is determined by the width of the knives. The Materials lab has an 8" jointer. The infeed table is adjustable to vary the depth of cut.

Uses:

Edge jointing

Correcting warp or twist on face of boards

Beveling

Tapering

Safety concerns:

Use support stand for long and heavy material

Don't trail fingers over edges of boards

Always use cutterhead guard

Do not cut material shorter than 10"

Hands should never be directly above the cutterhead.

Use safety paddles when surfacing.

Be prepared for kickback

Limitations:

Maximum 8" material width

Minimum length 10"

Wood and some Plastics Only

Will not ensure parallel sides

Angle limit 45 degrees

Do not surface MDF, Masonite or plywood



Planer

The planer is used to shave the surface of wood and to bring it to proper thickness. Like the jointer, it has a wide cutterhead with three knives. It planes the top surface of a board parallel to the opposite side. The College has two planers.

Uses:

- Plane stock to desired thickness
- Smooth rough lumber
- Plane faces of lumber to be parallel

Safety concerns:

- Stand to side of planer while operating
- Cut maximum 1/16"
- Minimum board length is 12"
- Plane solid wood only. Other materials may shatter.

Limitations

- NEW, SOLID LUMBER ONLY. Do not plane plywood, MDF, Masonite, foam, or plastics.
- No used wood
- No stock shorter than 12"
- Maximum width 20"



Scroll Saw

The scroll saw moves a small blade up and down through a tiltable table. It is used to make curved cuts in wood and plastic. The scroll saw is similar to the bandsaw, but is better suited for fine detail and interior holes. The College has two scroll saws.

Uses:

- Cutting detailed curves in wood, plastic and non ferrous metal.
- Cutting blind holes through material

Safety concerns:

- Wear eye protection

Limitations:

- Table may be tilted 45 degrees
- Material thickness limited to 2"



Wood Lathe

The wood lathe is used to turn radially symmetrical parts on a horizontal axis. It is primarily used to turn wood, but can also turn light foam. The material is clamped between two rotating ends, and carving tools rest on a rigid bar are used to shape the part. The College has one wood lathe.

Uses:

Turning radially symmetrical parts

Safety concerns:

Tie back hair and loose clothing

Limitations:

Maximum diameter is 12"

Bed length is 36"



Vacuum Former

The vacuum former heats thermoplastic sheetgoods and pulls them down over a form using air pressure provided by a vacuum pump. The forms are usually custom made and must withstand the heat of the chosen material. The plastic is clamped into a frame and heated in a large oven. As the plastic becomes elastic, it is pulled down over the form, a vacuum is applied from below the form and the plastic conforms almost exactly to the detail of the form.

Uses:

Forming 3D shapes from sheet plastic

Safety concerns:

Be sure work is firmly clamped in frame

Be aware of pinch points before lowering frame

Limitations:

Maximum form base is 36" X 36"

Must use one of three standard size sheets:

17" X 17"

23" X 29"

41" X 41"



Paper Sheer

The paper sheer is a specialized tool designed to clamp and cut entire reams of paper at a time. It has two primary functions. First, it clamps a stack of paper using a handwheel, and then a large lever pushes a knife through the paper very cleanly.

Uses:

Cutting PAPER only

Safety Concerns:

Keep hands and fingers away from blade at all times
Do not allow lever to hit you in the head,
Or to crush your hand.

Limitations:

Maximum width is 20"
Paper sheer remains locked up when not in use.
See Lab Staff for Key.



CNC Router (Shop Bot)

The Shop Bot is a Computer Numerically Controlled router. It has a vertical spindle into which a variety of cutters can be chucked. This SPINDLE is moved on the X and Y axis by a set of Servo motors and rack and pinion gears. Another servo motor moves the Z axis up and down. The table remains stationary.

Uses:

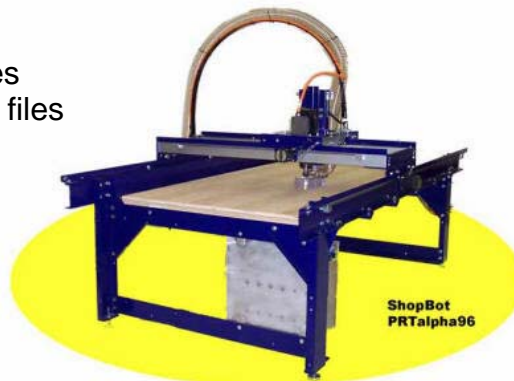
Cutting sheet goods from CAD files
Cutting contour models from CAD files

Safety Concerns:

Wear eye protection
Use hearing protection
Keep hands and body away
from moving parts
Be sure stock is well clamped

Limitations:

Table size is 48" X 96"
Z travel is 12"
Must be controlled by the computer. There is no manual control



Metal Working Tools

Vertical Mill

The vertical mill has a vertical spindle, like the drill press, but with an X-Y table that permits positioning the work. Milling cutters are held in the spindle and rotate on its axis. The spindle has the ability to be extended in the Z axis allowing plunge cuts and drilling. The college has two Vertical mills.

Uses:

Precise machining of metals, plastics and wood

Safety concerns:

Wear eye protection

Be sure work is firmly clamped to table

Limitations:

Work area is 30" X 12"

Z axis travel limited to 8 inches



CNC Mills

A CNC vertical mill has a vertical spindle, like the others, but X, Y and Z motion is controlled by a computer and servo motors, hence the name Computer Numerical Control.

A 2½ Axis mill controls the Z axis, but is limited in its travel, and usually does not move at the same time as the X and Y axis. The college has one 2½ axis mill, it is an EZ Trac DX, manufactured by Bridgeport.

A 3 axis CNC mill has an X-Y table, and a Z spindle that is controlled by a computer. With all three axis in motion complex shapes and surfaces can be machined. The college has one 3 axis mill, it is a Proto Trac SMX manufactured by SouthWestern Industries.

Uses:

Precise machining of metals, plastics and wood.

Can be programmed at machine or in separate CAM programs (MasterCam, VisualMill etc.)

Limitations:

2½ Axis:

Work area is 30" X 12"

Z axis travel limited to 8 inches

3 Axis:

Work area is 31" X 17" X 23" Z travel



Drill Press

The drill press is used to drill and bore vertical holes accurately. It has a chuck that will accommodate up to a ½” shank. The spindle speed can be changed to drill different materials, and the depth can be set for repetitive drilling. The College has 4 drill presses

Uses:

Drilling and boring a variety of materials

Safety concerns:

- Clamp small objects
- Tie back hair and secure loose clothing
- Never leave key in chuck
- Use lower speeds for larger bits

Limitations:

- Chuck to column distance is 8”
- Maximum vertical travel is 8”



Metal Lathe

The metal lathe is used to turn radially symmetrical parts on a horizontal axis. It is primarily used to turn metal, but can also turn plastics. The material is clamped between two rotating ends, is machined with various tools clamped to a tool rest. The tool's position is controlled by the operator using hand cranks and helical drives. It can be used to make screws and internal threads. The College has three metal lathes.

Uses:

- Precise machining of metals, plastics and wood
- Machining screws and internal threads.

Safety concerns:

- Wear eye protection
- Be sure work is firmly clamped in the chuck
- DO NOT LEAVE CHUCK KEY IN CHUCK

Limitations

- Maximum diameter is 8”
- Bed length is 48”



Horizontal Bandsaw

The horizontal bandsaw is used to crosscut metal stock. Stock is clamped to a horizontal table and a continuous blade moves down through it to cut precise square or angled cuts. The feed rate is automatic and adjustable. The blade is cooled by a flood coolant, comprised mostly of water.

Uses:

Crosscutting metal stock

Safety concerns:

Wear eye protection

Be sure work is firmly clamped to table

Limitations:

Maximum width is 8"

Maximum angle to cut is 45 deg



Finger Brake

The finger brake is used to make straight bends in light gauge sheet metal. The fingers on it are removable and positionable in order to accommodate complex designs. Metals thinner than .04" are clamped in the brake and a hinged bar is pulled up to make bends from 1 degree to 150 degrees. The College has one finger brake.

Uses:

Bending light gauge sheet metal

Safety concerns:

Be sure work is firmly clamped in break

Be aware of pinch points before clamping or bending

Limitations:

DO NOT BEND MATERIAL THICKER THAN .04"

Maximum width is 41"

Maximum angle to bend is 150 deg

DO NOT BEND WIRE OR ROD IN THE BRAKE



Bar Brake

The bar brake is used to make straight bends on the edges of light gauge sheetmetal. Metals thinner than .06” are clamped in the brake and a hinged bar is pulled up to make bends from 1 degree to 170 degrees. The metal can then be repositioned and bent farther to create a folded edge. The College has one bar brake.

Uses:

Bending edges of light gauge sheet metal

Safety concerns:

Be sure work is firmly clamped in break

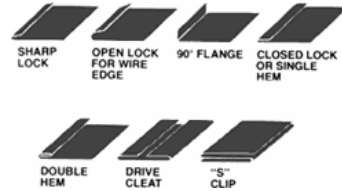
Be aware of pinch points before clamping or bending

Limitations

DO NOT BEND MATERIAL THICKER THAN .06”

Maximum width is 36”

DO NOT BEND WIRE OR ROD IN THIS BREAK



Magnetic Brake

The magnetic brake makes straight bends in sheet metal. It uses a powerful electromagnet to clamp the stock, while the bottom half of the brake is raised to affect bends from 1 degree to 100 degrees. The top “fingers” can be repositioned, but the lower bar is solid. The College has one magnetic brake.

Uses:

Bending light gauge sheet metal. Steel and Aluminum

Safety concerns:

Be sure work is firmly clamped in break

Be aware of pinch points before clamping or bending

Limitations:

DO NOT BEND MATERIAL

THICKER THAN .06”

Maximum width is 48”

Maximum angle to bend is 150 deg

DO NOT BEND WIRE OR ROD

IN THE BRAKE



Slip Roller

The slip roller is used to roll sheetmetal into cylindrical forms. It works by rolling the material through three adjustable rollers. As the third roller is gradually moved closer to the other two, the sheetmetal is bent into an increasingly tighter diameter. There are also grooves in the rollers for rolling wire and rod.

Uses:

Rolling cylindrical forms in sheet metal

Safety concerns:

Be aware of pinch points before rolling

Limitations

DO NOT BEND MATERIAL THICKER THAN .06"

Maximum width is 24"

DO NOT ROLL WIRE ON THE FLATS OF THE ROLLERS

Only roll wire in the grooves



Metal Sheer

The metal sheer cuts light gauge metal up to .06" thick. It cuts by pushing a foot pedal which lowers a sharp knife through the material. The metal sheer can also be used to cut cardboard and some plastics.

Uses:

Cutting straight lines on steel, aluminum, cardboard and plastic

Safety Concerns:

Be aware of pinch points

Be sure fingers are never in the path of the blade

Limitations:

Maximum width is 36"

Maximum thickness is .06"



Disc Sander (metal)

The metal disc sander has 12" diameter discs. It is used to sand outside curves and flats on steel and aluminum. The table may be tilted for angled edges

Uses:

- Freehand sanding
- Bevel, chamfer and square stock
- Deburr cut metal edges

Safety concerns:

- Wear eye protection.
- Sparks will fly.
- Hold work on table at all times.
- Keep fingers away from disc. The motion of the disc will pull fingers between the disc and table.
- Sand on side of disc that is traveling down.



Limitations

- Width limit is 5"

Tubing Roller

The tube and bar roller is similar to the slip roller, in that it uses three wheels to roll curves on metal tubing and bar stock. One wheel is driven by an electric motor, while the other two force the stock into shape.

Uses:

- Rolling curves on round, square, and angled metal stock.

Safety Concerns:

- Be aware of pinch points at all times

Limitations:

- 1/2" square stock
- 3/4" X 1/4" angle
- 1" tube



Hydraulic Tubing Bender

The hydraulic tubing bender uses a hydraulic ram to bend metal tubing around a die.

Uses:

Bending metal tubing to a fixed diameter from 1 degree to 190 degrees.

Safety Concerns:

Watch for pinch points

Wear safety glasses

Limitations:

Must use one of 6 dies:

$\frac{3}{4}$ " tube X $2\frac{1}{2}$ " radius

$\frac{7}{8}$ " tube X $2\frac{1}{2}$ " radius

1" tube X 3" radius

$1\frac{1}{4}$ " tube X $4\frac{1}{2}$ " radius

$1\frac{1}{2}$ " tube X 6" radius

$1\frac{3}{4}$ " tube X $6\frac{1}{2}$ " radius



Spot Welder

Spot welding is a type of resistance welding used to weld various sheetmetals. The process uses two shaped copper electrodes to concentrate electric current and force between the overlapping parts to be welded. The result is a small "spot" that is quickly heated to the melting point, forming a nugget of welded metal after the current is removed.

Uses:

Welding overlapping mild or stainless steel

Safety Concerns:

Closed Toe Shoes required

Welding gloves and protective clothing required.

Limitations:

Only welds metal in the 0.5-2.0mm thickness range.

Will not weld aluminum



MIG Welder

The Metal Inert Gas welder feeds a continuous electrode to the welding tip as an electrical arc fuses like metals in an inert gas shield. The electrode is consumed and also acts as a filler rod. The MIG welder is the simplest welder to learn to operate.

Uses:

Welding mild or stainless steel

Safety Concerns:

Welding helmet must be used Welding arcs can cause blindness

Closed Toe Shoes required

Welding gloves and protective clothing required.

Limitations:

Can weld aluminum but only after extensive setup time

Welds are not as strong as TIG



TIG Welder

The Tungsten Inert Gas welder fuses like metals in an inert gas shield. Unlike the MIG welder, the electrode is not consumed. The TIG welder requires advanced welding experience.

Uses:

Welding mild or stainless steel or aluminum

Typically used for structural welding

Safety Concerns:

Welding helmet must be used Welding arcs can cause blindness

Closed Toe Shoes required

Welding gloves and protective clothing required.

Limitations:

Filler must be added manually, if required



Plasma Torch

The plasma torch is used to cut metals up to 3/8" thick. It uses a powerful electric arc to create plasma out of a blast of ordinary dried air to vaporize or literally "plasmalize" the medium

Uses:

Cutting steels and aluminum

Safety Concerns:

Brazing (#5) goggles should be worn

Closed Toe Shoes required

Welding gloves and protective clothing required.

Limitations:

Cannot cut non conductive materials

Cannot cut copper or brass

Maximum thickness 3/8"



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