



**Art + Design 3D Laboratories Equipment Fundamentals Guide**



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# Procedures, Policies & Safety Regulations

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School of Art + Design provides educational resources consisting of laboratories, classrooms, presentation rooms, studios and equipment. The 3-D fabrication laboratories have power and hand tools and other equipment used for three-dimensional modeling tasks.

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## Procedures and Policies

### Entering and Using the Three-Dimensional Fabrication Laboratories (shops)

Activities within the labs and use of Art+Design resources are restricted to educational pursuits and class work only and are subject to video surveillance. Access privileges to the labs are established through coursework and an orientation in the use of tools and equipment and by passing a mandatory safety test. Three-Dimensional Fabrication Laboratories are considered a dangerous work area and access is strictly controlled. Be cautious and alert when in the shops. You must always have your *i-Card* with you in the labs, when you leave, you'll need it to get back in and assistants may ask to see your *i-Card* any time you are in the laboratories.

Only registered users are allowed to enter the Art+Design 3D Fabrication Labs. **YOU MUST SWIPE YOUR *i-Card* AT LAB 12, 20, 32 DOOR EACH ENTRY. YOU MAY NOT USE ANOTHER PERSON'S LAB PRIVILEGES AND YOU CANNOT AUTHORIZE ANYONE TO USE YOUR *i-Card* OR EQUIPMENT ACCESS PRIVILEGES. YOU CANNOT BRING VISITORS OR GUESTS INTO THE LABS AND YOU SHOULD NOT OPEN THE DOOR FOR OTHERS TO ENTER. SOME LAB ENTRANCE DOORS WILL SOUND AN ALARM IF HELD OPEN TOO LONG. Do not hold doors open for others - everyone must use an *i-Card* to enter a lab. *i-Cards* STOP OPENING DOORS TEN MINUTES BEFORE CLOSING TIME. Power will be shut off 15 minutes prior to scheduled closing to allow for clean-up time.**

Some 3D Labs will be unavailable during times when the rooms are scheduled for class use.

Return all tools to their proper storage areas and never attempt to remove or "borrow" tools for use outside of the laboratories.

Clean up after yourself. **FOOD AND DRINK ARE NOT PERMITTED** in the lab areas. **MATERIAL STORAGE SPACE IS NOT AVAILABLE IN THE 3D LAB AREAS.**

Treat work surfaces with consideration. Do not cut or drill into worktables. Use paper to protect surfaces from paint, glue, etc..

Glued objects left to dry in the shop must be marked with the owner's name and the date when glued. Nearby machines are not to be used for any gluing operations.

Report broken or malfunctioning equipment immediately to an assistant or online using the School's website link to report problems with resources.

Plaster or paint should never be put into sinks or poured down drains. Always use a protective mask when air-borne particles are created during a process.

Spray painting must be done in an approved ventilated booth while wearing a personal respirator. Spray painting elsewhere will be considered vandalism.

You can use the School of Art + Design's website to report problems and to submit feedback.

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## General Safety Regulations for Laboratory Use

Never work alone.

You may not use tools or equipment you have not been trained to use and then only when you are thoroughly familiar with best practices and safe operation.

Before leaving a piece of equipment: be certain it is turned off, has stopped moving, and is cleaned off and ready for the next user.

Always turn on dust collection devices when provided for procedures or machinery. Electrical equipment should never be used near water.

Wood containing nails, concrete, paint or other foreign matter may NOT be cut, sanded, or otherwise machined in the 3D Labs.

Plaster ruins most common wood working equipment (power and hand tools) and therefore plaster finishing must be done with tools identified for that purpose.

All spray painting must be done in a spray booth. Use flammable chemicals only in properly vented areas. Dispose of rags used for solvents in the red metal cans.

Familiarize yourself with locations of fire extinguishers, first aid kits, and emergency eye wash stations.

### Proper attire is required when using any Three-Dimensional Fabrication Laboratory resources

*Closed-toed shoes must be worn in the labs.*

*Tie back long hair, secure loose clothing and sleeves, and remove neckties and loose jewelry.*

*Appropriate eye protection must be worn when operating power equipment and some hand tools.*

*An appropriate dust mask or respirator should be worn when performing dust or fume producing tasks.*

### Safe operation of the equipment requires the full attention of the operator

*Boisterous or rough play, running, throwing objects, or any kind of distracting behavior is strictly prohibited.*

*Do not speak to or distract anyone who is operating equipment.*

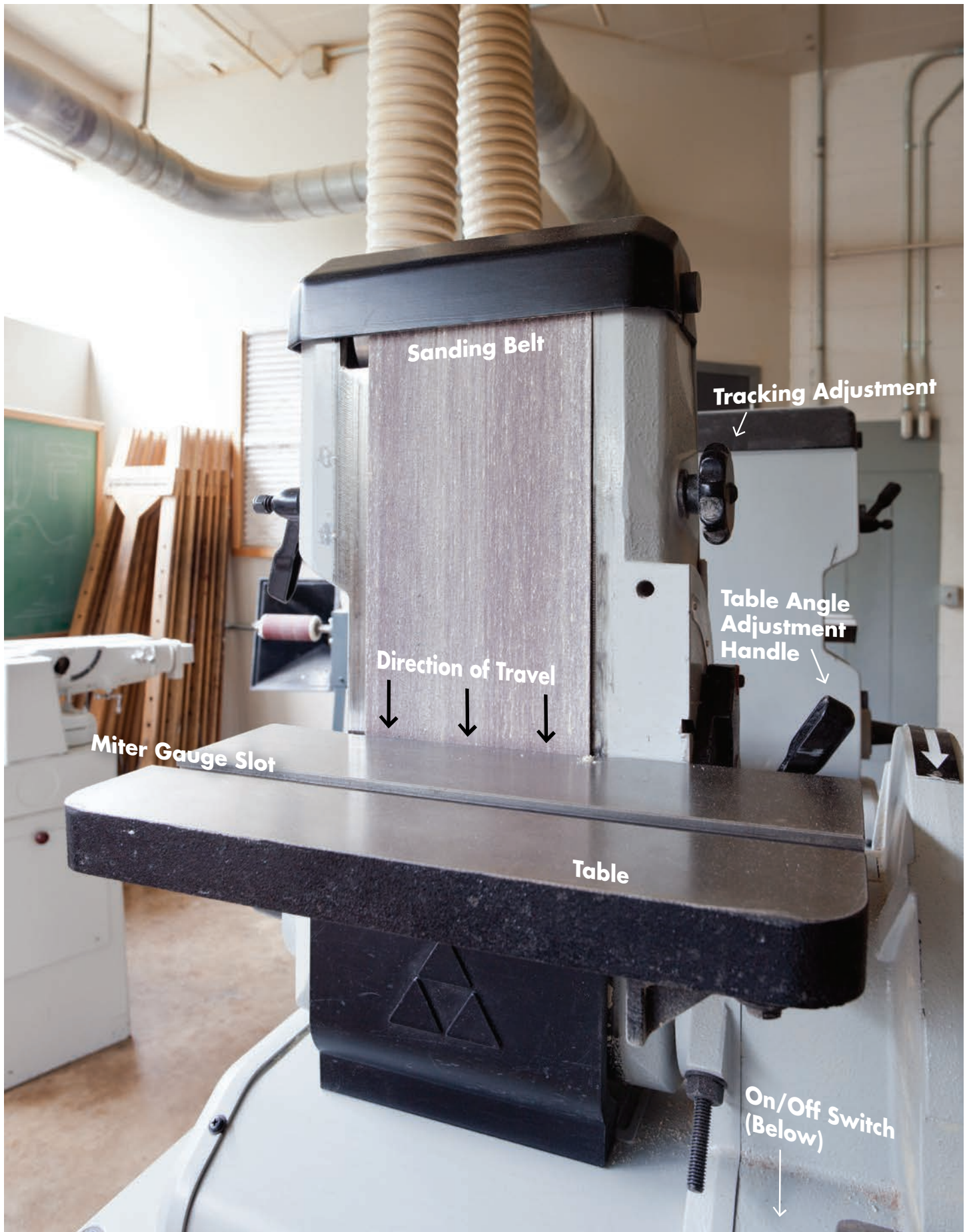
*Headphones or portable stereos may not be worn while working in the Three-Dimensional Fabrication Laboratories.*

*Do not operate power equipment if you have taken medication that can make you dizzy, drowsy, or otherwise impaired.*

*Inform your instructor or the lab supervisor if you have a condition that requires special accommodations.*

**Failure to comply with any policy or regulation may result in the loss of your laboratory privileges.**





## Belt Sander

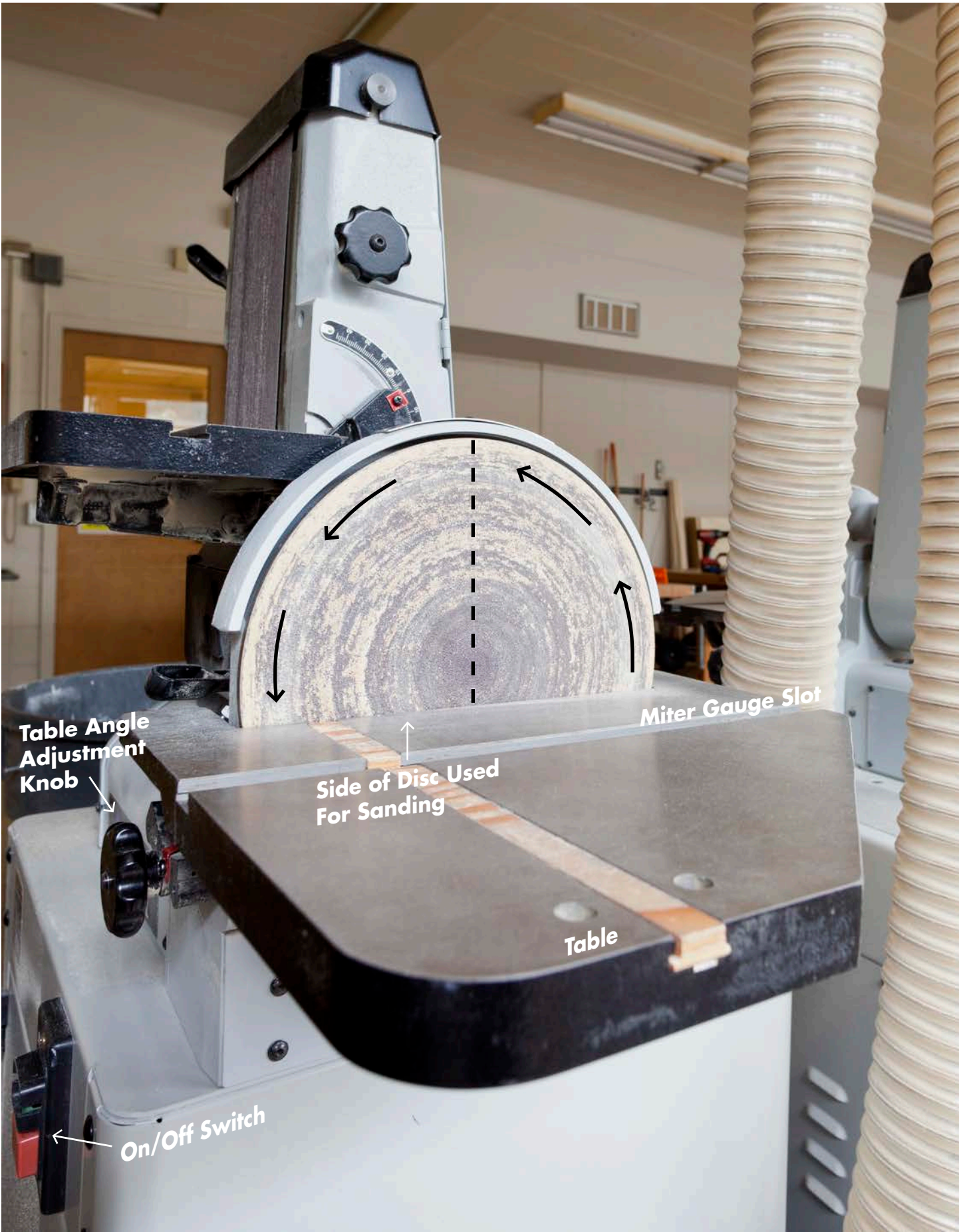
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## Belt Sander

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1. Used for sanding wood, wood products, foams, and plastics. No metals, glass, ceramics, concrete, or plaster. Painted material should not be sanded on the belt sander.
2. Belts are one continuous loop around two rollers.
3. The belt travels in a downward direction.
4. The belt has tracking adjustment on the side of the belt sander.
5. Material should rest on the table and be moved across the face of the belt with light pressure.
6. The slot in the table is to accept a miter gauge to assist in sanding.
7. The table can be adjusted to various angles by loosening the arm on the right side of the sander.
8. A square should be used to check the position of the table when a 90-degree angle is desired. Do not assume that the last person checked to make sure that the table was adjusted square to the face of the sanding belt.
9. The belt sander can be operated in a vertical or horizontal position. This adjustment is to be made by the lab supervisor only.
10. Never sand small items on the belt sander. The sander may pull the item between the belt and the table causing serious injury to the operator's fingers. Small items should be sanded by hand, never on the belt sander. In some situations it is acceptable to use a sacrificial wooden extension piece and double sided tape to secure small items for sanding.
11. If sparks are observed or if the belt stops moving the operator should turn off the machine and adjust tracking or ask for assistance.
12. If the belt breaks while operating the belt sander the operator should first turn off the machine, then report the problem to the lab supervisor or instructor.
13. Report any malfunctions to instructor or lab supervisor.
14. Turn on the dust collector when operating the belt sander.
15. The operator must wear safety glasses or eye protection while using the belt sander.





# Disc Sander

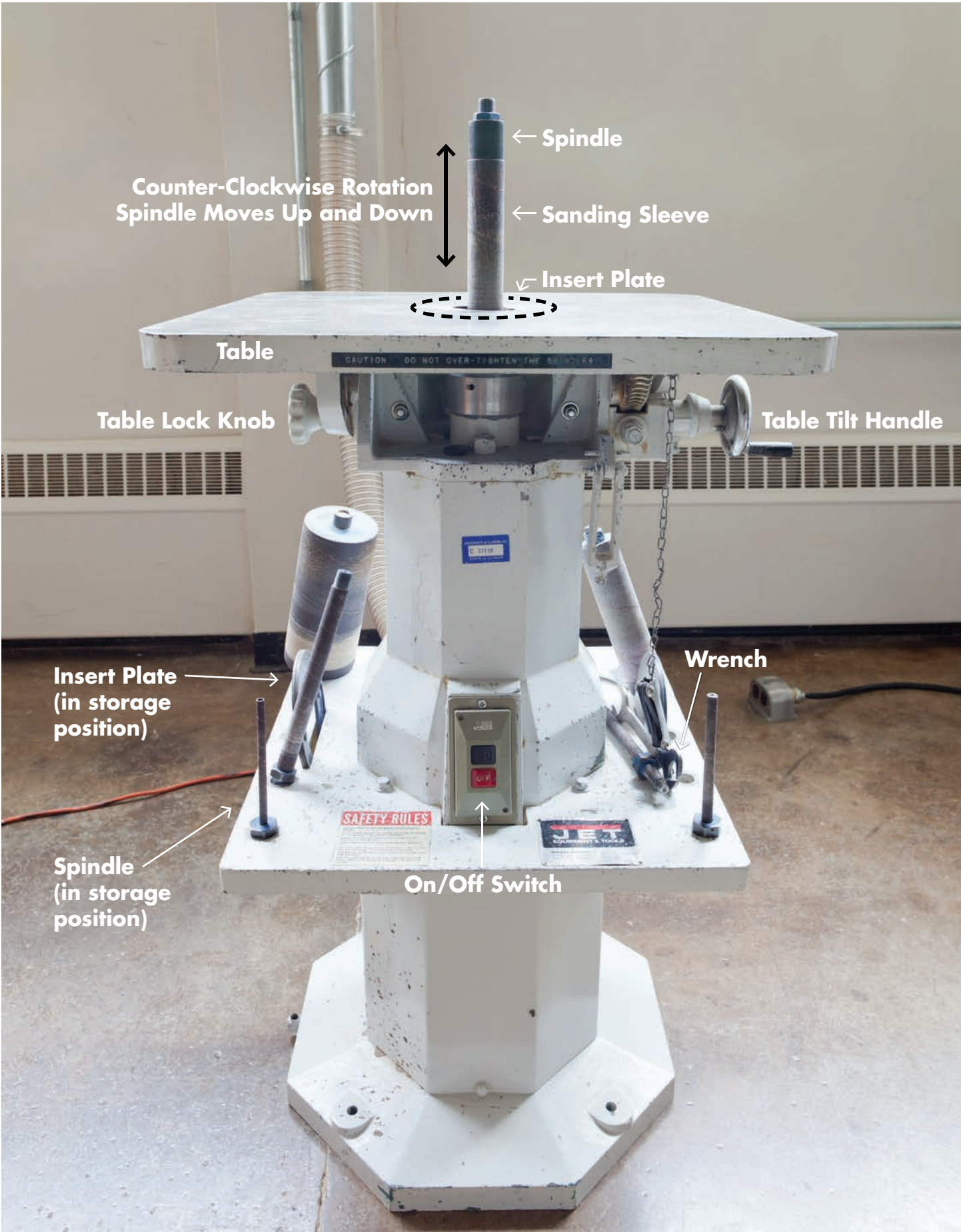
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## Disc Sander

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1. Used for sanding wood, wood products, foams, and plastics. No metals, glass, ceramics, concrete, or plaster. Painted material should not be sanded on the disc sander.
2. The disc travels in a counter clockwise direction.
3. Material should rest on the table and be sanded on the side of the disc moving in a downward direction.
4. The disc sander is sandpaper attached to a heavy metal plate.
5. When sanding the material should be moved across the half of the disc and not held in one position.
6. Light pressure should be used.
7. The table is has a slot to accept a miter gauge to assist in sanding operations.
8. The sander table can be angled to various positions using the knobs on both ends of the table.
9. A square should be used to check the position of the disc when a 90- degree angle is desired
10. Small items should never be held in fingers and sanded on the disc sander. The operator risks serious injury should a small item be grabbed by the sanding disc and pulled between the disc and the table. The operator's finger may be trapped between the disc and the table causing severe injury to his or her fingers.
11. Report any malfunctions to instructor or lab supervisor.
12. Before leaving the disc sander make sure power is turned off and the machine has stopped rotating.
13. Turn on the dust collector when using the disc sander.
14. The operator must wear safety glasses or eye protection when using the disc sander.





# Oscillating Spindle Sander

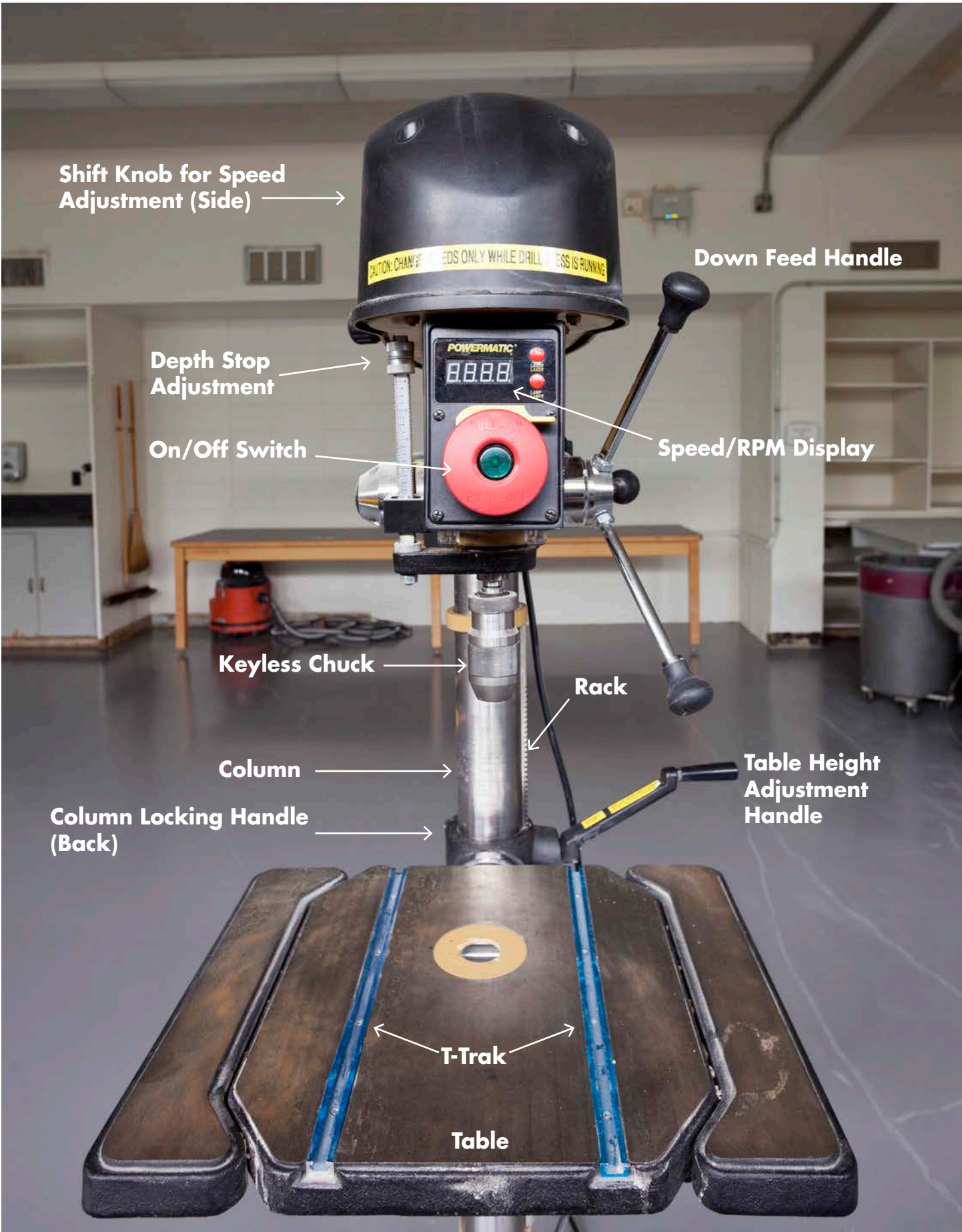


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## Oscillating Spindle Sander

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1. Used for sanding wood, wood products, foams, and plastics. No metals, glass, ceramics, concrete, or plaster. Painted materials should not be sanded on the oscillating spindle sander.
2. The name, oscillating spindle sander, refers to a spindle with sandpaper on it that rotates as it moves with an up and down motion.
3. This sander is appropriate for sanding concave and convex curves.
4. This sander is not appropriate for sanding straight cuts.
5. There are various size spindles for sanding various size curves. Select the spindle that most closely fits the curve being sanded.
6. Using the wrenches at the machine changes a spindle. The spindles for the sander in room 12 install in a counter clockwise direction. The spindles for the sanders in room 20 install in a clockwise direction.
7. The spindle should not be over tightened when being installed, it should only be hand-tightened.
8. Be sure to remove the wrenches before starting the sander.
9. While changing the spindles the operator should also change the insert plate. Select the insert that most closely matches the size of the spindle being used. Insert plates are used to bring the table closer to the spindle.
10. The table can be adjusted to various angles. For the sander in room 12 loosen both lock knobs under the table and manually re-position the table, then re-tighten the lock knobs. For the sanders in room 20, loosen the lock knob under the table then use the crank on the opposite side to re-position the table, and then re-tighten the lock knob.
11. Always maintain control of the material being sanded, and use light pressure.
12. Do not attempt to sand very small objects. They may become lodged between the table and the spindle. This would increase the possibility of injury to the operator.
13. Keep fingers away from the spindle while operating the sander to avoid injury.
14. Report any malfunction to the lab supervisor or instructor.
15. Turn on the dust collection system if it is attached to the sander.
16. The operator must wear safety glasses or eye protection while using the oscillating spindle sander.



Shift Knob for Speed Adjustment (Side) →

Down Feed Handle

Depth Stop Adjustment →

On/Off Switch →

Speed/RPM Display

Keyless Chuck →

Rack

Column →

Table Height Adjustment Handle

Column Locking Handle (Back) →

T-Trak

Table

# Drill Press

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## Drill Press

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1. The drill press is used for drilling holes into wood, wood products, foams, plastics, and metals. Not for drilling into glass, ceramics, concrete, or plaster.
2. Bits used on the drill press include:
  - A. High-speed twist drill bit, used for drilling in all materials listed. The only drill bit used for drilling into metals.
  - B. Spade or paddle bit, used for drilling in all materials listed except metals. To properly drill through wood with this bit, start from one side, then turn the piece over and finish drilling from the other side. This prevents the wood from tearing-out, as it would if it was drilled straight through from one side.
  - C. Forstner bits, used for drilling in all materials listed except metals. Forstner bits will leave a flat bottom to holes not drilled completely through the material.
  - D. Hole saw, used for drilling larger diameter holes in all materials except metals. The hole saw must pass all the way through the material being drilled.
3. The main parts of the drill press are:
  - A. The keyless chuck that holds the bits.
  - B. The on-off switch.
  - C. The down feed handles that moves the bit into or out of the material.
  - D. The blue Kreg T-Trak and Klamp system which holds materials securely on the table.
  - E. The table that moves up and down on the column.
  - F. The rack attached to the column, which is engaged with the gear attached to the table adjustment handle so it can be easily moved higher or lower.
  - G. The column-locking handle that locks the table at various heights.
  - H. The shift knob, which changes the speed of the drill for different types and thicknesses of material, as well as different bit size and type.
  - I. The depth stop, which is used to limit the depth of the hole being drilled.
4. A general rule associated with the drill press is; the harder the material, the slower the speed, and the larger the diameter hole being drilled the slower the speed.
5. When adjusting the table height, make sure to loosen the column locking handle to prevent damaging the rack.
6. Small items, especially sheet metal or plastic must be clamped to the table before drilling. Failure to do this may result in injury to the operator. The drill bit can grab the material causing it to spin dangerously.
7. C-clamps, or the Kreg T-Trak system are used to clamp materials to the table. To accomplish this on smaller items, the table may have to be positioned to one side to allow the c-clamp to reach the material.
8. Whenever a hole is being drilled through material, use scrap wood on top of the table to protect the table from being drilled into, or position the table so the drill bit clears the hole in the center of the table.
9. Vises or other clamping methods other than c-clamps may be necessary to hold objects while drilling.
10. Never grab metal strands from the drill bit while in operation. Stop the drill press and use pliers to remove the metal strands.
11. Remember when working with metals, two areas of concern are burns from hot metal and cuts from sharp edges.
12. Used a broom and dustpan, or the shop-vac to remove chips from the table.



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## Drill Press Continued

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13. When drilling plastics, especially acrylics, plan the work in advance. Try to avoid drilling too close to the edge. When drilling, move the bit in and out repeatedly. You risk cracking the plastic if you try to drill in one motion without removing the bit, because of the heat produced during the drilling operation.
14. Keep fingers away from the drill bits and the chuck while they are in motion.
15. Always stop the machine before making any adjustments, except for changing speeds with the shift knob.
16. When drilling metals it helps to use a lubricant such as oil to cool the drill bit and to produce a cleaner hole.
17. Report any malfunctions to the lab supervisor or instructor.
18. The operator must wear safety glasses or eye protection while using the drill press.



# Band Saw

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## Band Saw

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1. The band saw is used for cutting wood, wood products, foams, and plastics. No metals, glass, ceramics, concrete, or plaster are to be cut on the band saw.
2. The band saw blade is one continuous loop around two wheels.
3. Band saw blades vary in width. Generally the wider blades are more appropriate for straight cuts. The blades on the band saws here are generally between 3/16 and 3/8 inch wide.
4. You can make cuts on the band saw free hand, or you can use the fence or the miter gauge or a combination of the fence and the miter gauge. The fence is used to aide in making straight cuts. The miter gauge is used for making 90 degree or angle cuts.
5. Should a blade break while operating the band saw the operator should turn off the saw and report the problem to the lab supervisor or instructor. Do not remove or open the doors covering the wheels of the band saw. The upper wheel will continue to rotate for a long period of time. Opening the door while the wheel is rotating risks injury to you.
6. The band saws are equipped with a blade guard. The blade guard should be positioned within 1/4 inch of the thickness of the material being cut, or just slightly above the top of the material. The blade guard is repositioned by first loosening the lock knob on the right side of the band saw, next position the blade guard to the correct setting and then retighten the lock knob.
7. To prevent injury the operator's fingers should remain 3 inches away from the blade at all times.
8. The table can be tilted to an angle by loosening the knob or knobs under or behind the table and manually repositioning the table. With the table in the desired position, retighten the lock knob or knobs.
9. To reduce the risk of injury make all adjustments to the band saw while power is off.
10. The band saws in the basic lab are 14-inch band saws, meaning there is about 14 inches between the blade and the saw body. The band saws in the advanced lab are 20-inch band saws, meaning there is about 20 inches of space between the blade and the body of the saw.
11. The 20-inch band saws in the advanced lab have foot breaks to stop the blade from rotating after power is turned off. The 14-inch band saws in the basic lab do not have a breaking mechanism on them.
12. The 20-inch band saw in the advanced lab will cut material up to 12 inches in thickness. The 14-inch band saws in the basic lab will cut material up to 6-1/2 inches in thickness.
13. Band saw cutting guidelines:
  - A. If the table is tilted, use the fence on the lower not the upper part of the table. Remove the fence before tilting the table.
  - B. When cutting tight curves, first cut a number of straight lines into the curve, referred to as relief cuts, to allow the blade room to maneuver through the cut.
  - C. Do not cut spherical items while holding them by hand. When the blade makes contact with the spherical object it will spin out of control, possibility pulling the operator's fingers into the blade causing serious injury. To cut a spherical item safely, it must be secured to another piece of wood allowing the cut to be made with the operator's fingers out of harm.

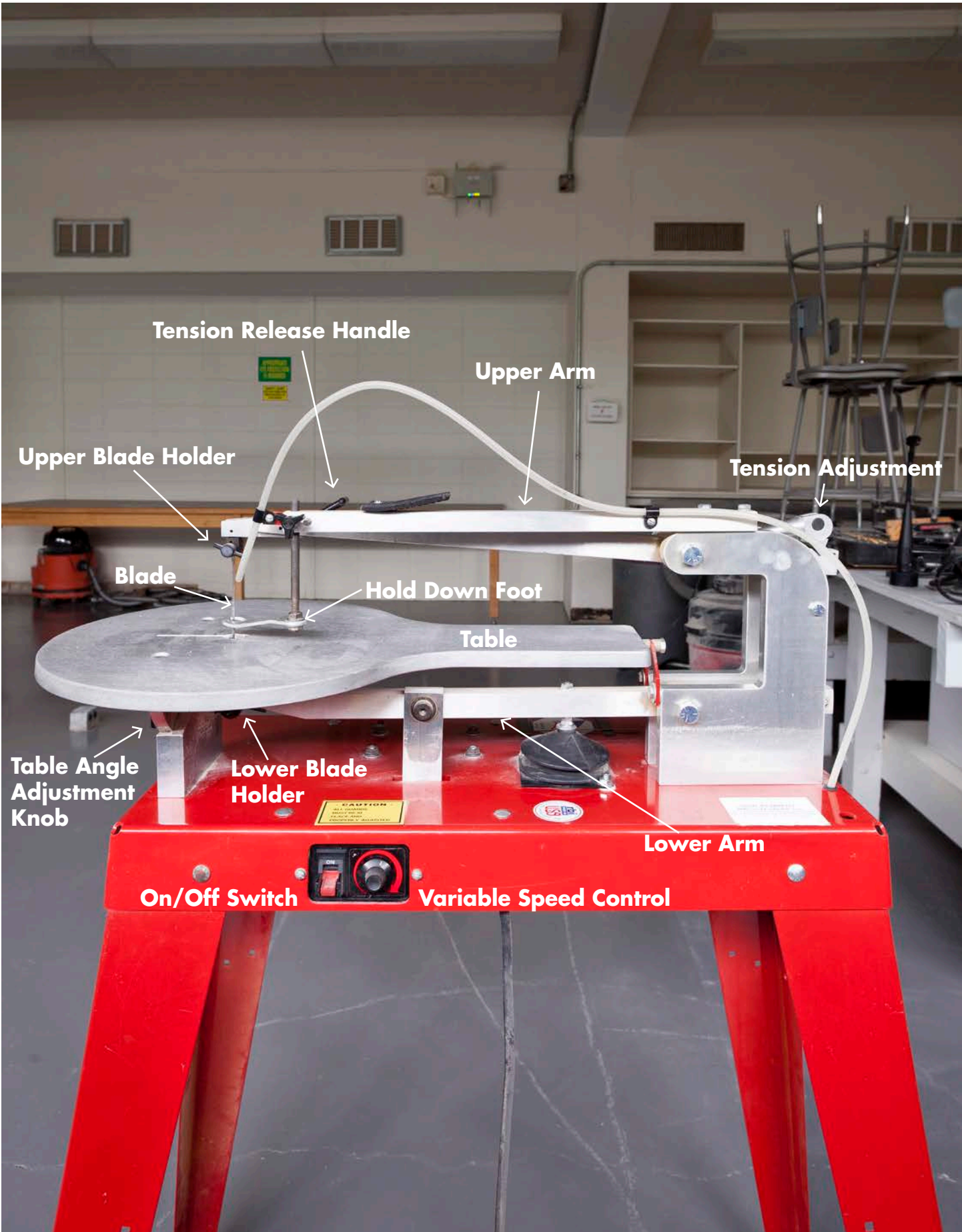


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## Band Saw Continued

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- D. Do not cut material that is in a circle or curved form by holding with fingers alone. Secure the circle or curved item to a scrap of material to prevent the possibility of injury resulting from the blade making contact with the curve causing the operator to lose control.
  - E. While cutting an item with an interior opening, make certain that you know where your fingers are in relation to the blade at all times.
  - F. Cutting cylindrical items lengthwise requires the object to be secured to scrap material to ensure a safe and straight cut.
  - G. The operator should never attempt to work too fast while making cuts on the band saw. Give only enough pressure to allow the blade to go through the material, do not force it.
  - H. Small items to be cut should be attached to a scrap piece of material to reduce the risk of injury to the operator.
  - I. Small pieces in close proximity to the blade should not be removed until the blade has come to a complete stop.
  - J. When using the fence, it is recommended that the operator starts the cut and letting go of the work, proceeds to the back of the band saw to finish pulling the material through the blade, do not pull the material back towards you, or the blade may come off the wheel.
  - K. To make compound cuts, first start with material in a block form. Indicate a top view and a side view on the block. Next cut one or the other of the views and then reassemble the pieces using masking tape. Rotate the block and cut the opposite view, finally remove all the excess material exposing the desired result.
  - L. While operating the band saw make sure there are no foreign objects on the table, such as pencils, pens, rulers, triangles, etc., which may come in contact with the blade.
  - M. When finished cutting make sure the blade has stopped and clean off the saw.
14. Report any malfunctions to the lab supervisor or instructor.
15. The operator must wear safety glasses or eye protection while using the band saw.



# Scroll Saw

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## Scroll Saw

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1. The scroll saw is used for cutting wood, wood products, foams, and plastics. No metals, glass, ceramics, concrete, or plaster.
2. The scroll saw has thin blades that move with an up and down motion, allowing tight curves to be cut.
3. The thickness of the material that can be cut is limited to the space between the upper arm and the table - approximately 2 inches. Thicker materials require a slower feed rate and are generally harder to cut. Optimum performance is achieved with thinner materials .125-.5 inch thick.
4. Changing blades requires following a number of steps:
  - A. The blade is held between the upper arm hold down and the lower blade holder.
  - B. Tension for the blade is released by moving the tension release handle on the upper arm forward.
  - C. Loosen the thumbscrew on the upper arm blade holder to release the blade.
  - D. To remove the blade, slide the lower blade holder from its position and bring it from under the table.
  - E. Loosening the thumbscrew on the lower blade holder releases the blade. On the saw stand there are slots for holding the blade holder while loosening or tightening the thumbscrew.
  - F. Install a new blade with the teeth on the blade pointing towards the holder. Note: In operation the teeth on the saw blade should be facing forward and down towards the table.
  - G. Next slide the blade through the opening in the table and reinstall the lower blade holder to its former position.
  - H. Bring the upper arm down until the blade can be placed in the upper blade holder. Position the blade to the top and toward the back of the upper blade holder before tightening the thumbscrew.
  - I. With the blade between the upper and lower blade holders, pull back on the tension release handle on the upper arm to put tension on the blade.
  - J. If there is too much or too little tension on the blade, adjustment of the cam at the back of the upper arm is necessary. Turn the threaded rod located at the back of the upper arm while the tension release handle is in the forward position. Move the tension release handle to the back position to reapply tension and check for desired results. Repeat this procedure until the correct tension is established.
5. The saw has variable speed control next to the on-off switch. The speed is adjusted by turning the knob to obtain the desired speed for the cutting operation. The general rule is the harder the material the slower the speed, the softer the material the faster the speed.
6. There is a hold down foot on the saw that may be placed on top of the material being cut to prevent it from bouncing on the table. Downward pressure on the material while making a cut is often necessary to maintain control.
7. The material should be moved directly into the blade while trying to avoid moving the blade from side to side.
8. To avoid injury do not attempt to cut very small items on this saw.
9. The table can be tilted to various angles by loosening the knob under the front of the table. The table can then be repositioned and the lock knob retightened.
10. Drilling a hole and sliding the blade through it can make it possible to cut an interior opening. Release the tension, then release the blade from the upper holder, and then feed the blade through the hole. Reinstall the blade in the upper blade holder and reapply the tension. The cut can now be performed without having to cut in from the edge.
11. Report any malfunctions to the lab supervisor or instructor.
12. The operator must wear safety glasses or eye protection while operating the scroll saw.