



BUILDING SYSTEMS LAB SAFETY MANUAL

Emergency Contact Information

MU Health Center
1021 Hitt St., 4th floor
(573) 882-7481

MU Campus Police
901 Virginia Avenue
(573) 882-7201
Emergency 911

MU Office of Student Conduct
G206 MU Student Center
Columbia, MO 65211
(573) 882-5543
conduct@missouri.edu

MU Environmental Health and Safety
(573) 882-7018

Poison Control: 1-800-222-1222

Lab Hours and Supervision

The Building Systems Lab is located in 6 Gentry Hall. During the regular school year, the Building Systems Lab is open for your use Monday through Thursday from 10am until approximately 6pm. The Lab is closed over weekends, holidays, and breaks.

- Guests are allowed in Lab only with permission. Guests must not use any University equipment or facilities, and are required to wear safety equipment while in the Lab.
- Students may not use Lab equipment without supervision.
- Students may make an appointment with the supervising instructor for special Lab hours.

Emergency equipment

- A **First Aid Kit** is located in the Lab, near the lockers. If you do not see one, ask your instructor.
- **Fire extinguishers** are located near the east entrance and the west end of the lab. If you do not see one, ask your instructor.

Personal Safety

Lifting

Back injuries can occur from lifting heavy objects. Get help if the object weighs more than 50 pounds. Proper lifting uses the muscles of your legs, while keeping your back straight and holding the load close to your body. Never lift and twist your waist at the same time.

Motion-related injuries

To prevent motion-related injuries, select appropriate tools and use neutral postures (for example, a straight wrist) while performing tasks. Take frequent rest breaks to stretch muscles, and alternate tasks to use and rest different muscles. Use as light a grip as possible when holding tools. If you cannot relieve joint pain by taking time off or reducing stress on the joint, seek medical assistance. Repetitive motion disorders can be disabling if not treated early.

Repetitive motion injuries

Repetitive motion, particularly of the hands, wrists, and arms, can lead to painful inflammation of muscles, tendons, and nerves over time and cause the eventual deterioration of those tissues. The symptoms associated with repetitive-motion disorders can include pain, warmth, swelling, and difficulty moving the joint involved. Continuous, often extreme bending of wrist, elbow, and shoulder joints leads to these disorders.

Carpal tunnel syndrome

Grip positions that use high-force finger pinching along with a bent wrist have been associated with the disorder called carpal tunnel syndrome. Sanding in awkward postures is an example of high-risk repetitive tasks.

Vibration injuries

Using power tools for long periods of time may result in vibration injuries. Vibration injuries can affect the nerves, vascular system and muscles to varying degrees; if allowed to progress, they can cause irreversible loss of function in fingers and hands. Early signs are tingling, numbness and whitening of fingers and hands, and impaired sensitivity and dexterity.

Existing health conditions

Be sure to let your instructor know about any health conditions that may affect your safety or ability to perform the tasks that will be expected in the lab. It is the student's responsibility to inform a faculty member if they need to substitute technical procedures because of an existing health condition.

Pregnancy

If you are pregnant, nursing, or planning a pregnancy you should avoid solvents and some adhesives.

Asthma

If you have asthma, be sure to let your instructors know. Always carry your inhaler or other supplies you may need. Tell your instructor where you keep these items so they can help in case of an episode. Avoid the following materials and equipment:

Allergies

If you have serious allergies, be sure to let your instructor know. Always carry any supplies you may need to suppress a reaction. Tell your instructor where you keep these items so they can help in case of an episode.

Contact lenses

In dusty environments, contact lenses can trap dust against your eye and cause irritation. When working near solvents they can trap gases or in some cases even partially melt and adhere to your eyes. Wearing glasses instead can offer you additional protection in any environment where your eyes may be at risk.

Prescription drugs

If you are using any prescription drug that can influence your ability to operate machinery, you must notify your instructor. Do not risk injury by attempting to work while impaired.

Alcohol and recreational drugs

As is the case in all campus facilities, alcohol and smoking are prohibited in the Lab. Never use hazardous materials, tools or equipment while under the influence of alcohol or drugs.

Hazardous Materials:

The Lab uses materials that can pose a health hazard if handled improperly. It is important to learn the risks inherent in the use of these materials to yourself and others and how to minimize those risks, for your future health and for the safety of those around you.

Finishes and Sealants

A wide variety of finishes and sealants (acrylic, oil, polyurethane) may be used to finish wood projects. As they cure, some of the chemical components evaporate into the air. They may reach high concentrations if used in large volume or if the work area is poorly ventilated. These materials are often irritants and may be toxic by skin contact or inhalation. Some are skin and respiratory sensitizers. Finishes and sealants may only be used in designated areas with a ventilation system in place.

Wood dust

Occupational exposure to high levels of wood dust causes a type of nasal cancer. The dusts from many hardwoods are sensitizers, and both hardwoods and softwoods can cause allergic reactions of the eyes, skin and respiratory system. Wood dust can also be toxic (for example, ebony, rosewood, blackwood, sequoia, and redwood). When possible, use common hardwoods instead of rare tropical hardwoods, or more highly toxic hardwoods, particularly if you have a history of allergies.

Preserved wood

Many of the preservatives used to treat wood are toxic (for example, pentachlorophenol, chromated copper arsenate, zinc, and copper naphthenate). Exposures can occur from sawing wood or from handling the wood with bare hands. Pressure treated wood is not allowed in the Lab without special permission.

Storage

Labeling

Labels on incoming containers from manufacturers must not be removed or defaced. Containers with unknown contents are prohibited in the Lab.

No chemical storage in lockers

No toxic or flammable chemicals may be stored in personal lockers.

Flammable storage

All containers of flammable chemicals must be stored in flammables cabinets.

General Lab Safety

Follow these guidelines for general lab safety:

- NO PHONES OR IPODS, headphones, or other personal technology devices ON YOUR PERSON while in the lab. Cell phones can cause distractions, which lead to accidents and injury.
- Please take note of all posted signs and instructions—they are for your safety.
- Use only tools and equipment approved or provided by the supervisor or instructor.
- Know the hazards associated with your work. Be sure you are fully educated on the proper use and operation of any tool before beginning work.

- Maintain good housekeeping standards.
 - Students must clean up area used every time work is finished. If you have not completed your project and must leave the shop you must clean area prior to leaving.
 - Keep the work area free from slipping/tripping hazards (oil, cords, debris, etc.).
 - Students must clean and return all tools to proper location when finished.
 - Utilize the dust collection system properly.
- No horseplay allowed in shop. Do not distract anyone using equipment.
- Leave tool and equipment guards in place until ready to use.
- Know where fire extinguishers are located and how to use them.
- If you are not sure of what you are doing, ASK.
- Ensure that the ventilation system in the finishing booth is on while in use to prevent exposure from vapors of glues, lacquers, paints and from dust and fumes.
- If you come in to lab to work outside of regularly scheduled class, and there is another class in session, ask permission from the instructor before beginning to work.

Personal Protection

In order to use any of the tools, you are required to have personal protection equipment.

- Safety glasses (Z 87.1 rated)
 - ALWAYS WEAR SAFETY GLASSES when working with tools. Additional protection using goggles or face shields may be necessary for the following types of work:
 - Grinding, Chipping
 - Welding
 - Use of Chemicals
- Hearing protection (ear plugs) - Hearing protection is designed to soften or lower the noise generated, not to completely block sound.
- Dust mask (rated for sanding)
- Proper attire
 - Closed toe shoes, preferably leather, tennis shoes are good (no flip-flops or sandals, and no slick bottom dress shoes)
 - Apron or over shirt
 - No loose clothing
 - No ties, scarves, or hoodie strings
 - No capes, fringe, or other draping clothing
 - No jewelry: rings, bracelets, dangling earrings or long necklaces
 - Hair must be tied back
 - No skirts, short shorts or loose long sleeves (below the elbow)
 - "Shorts" that cover to the knee are acceptable
 - Long sleeves must be able to be rolled up to the elbow
- Suitable Gloves (preferably leather), when working with the following:
 - Scrap metal or wood
 - Sharp-edged stock
 - Unfinished lumber
 - Any power tool

Proper notification

Please inform your instructor of ANY physical, medical, etc., issues that may interfere with use of the Lab.

- Your information is confidential and will only be shared with necessary personnel in an emergency.

Report all injuries to your instructor immediately. In an emergency, dial 911.

Project Safety

Before beginning work in the lab, be sure you are certified to use the tools necessary for your project. If a procedure is potentially hazardous to others in the area, warn fellow students accordingly.

Notify your supervisor if you notice any unsafe conditions such as the following:

- Defective tools or equipment
- Improperly guarded machines

Inform other students if you see an unsafe work practice; however, be careful not to distract a person who is working with power tools.

Hand Tools General Safety

Hand tools are non-powered tools. They include wrenches, hammers, chisels, screw drivers, and other hand-operated mechanisms. Even though hand tool injuries tend to be less severe than power tool injuries, hand tool injuries are more common. Because people take everyday hand tools for granted, they forget to follow simple precautions for safety.

The most common hand tool accidents are caused by the following:

- Failure to use the right tool
- Failure to use a tool correctly
- Failure to keep edged tools sharp
- Failure to report a defective tool
- Failure to store tools safely

Lighting and electrical cords

- Do not use electrical cords if they are worn, or if the inner wires are exposed. Show worn out cords to your instructor.
- Arrange cords to avoid creating a trip hazard.
- Unplug cords by grasping the plug and pulling; do not pull them out by the cord.

Hot glue guns

- Do not allow hot parts of the gun to come in contact with skin, clothing or flammable objects.
- Make sure to use proper ventilation.
- Do not come in contact with the heated glue. It will stick to skin and can produce serious burns.

Heat guns

- Do not allow hot parts of the gun to come in contact with skin, clothing or flammable objects.
- Make sure to use proper ventilation.
- Do not heat easily flammable objects or materials.

POWER TOOLS OPERATION AND SAFETY

I. Power Tools General Safety

Power tools can be extremely dangerous if they are used improperly. Common accidents associated with power tools include abrasions, cuts, lacerations, amputations, burns, electrocution, and broken bones.

These accidents are often caused by the following:

- Touching the cutting, drilling, or grinding components
- Getting caught in moving parts
- Being struck by particles that normally eject during operation
- Touching hot tools or workpieces

Power Tools General Safety Tips:

- NEVER leave a tool running while unattended.
- Checking Tools/Parts
 - Never try to open, make any major adjustment or change a blade on any stationary machine. An instructor or the woodshop assistant must do all maintenance. If a tool needs adjustment, a new blade, etc. turn off the machine and ask your instructor or the assistant to make the adjustment.
 - Use the correct tool for the job. Do not use a tool or attachment for something it was not designed to do.
 - Select the correct bit, blade, cutter, or grinder wheel for the material at hand. This precaution will reduce the chance for an accident and improve the quality of your work.
 - Keep all guards in place.
 - Disconnect power tools before performing maintenance or changing components.
 - When possible, secure work pieces with a clamp or vise to free the hands and minimize the chance of injury. Use a jig for pieces that are unstable or do not lie flat.
 - NEVER disable or tamper with safety releases or other automatic switches.
- Tool Operation:
 - Always let tools come up to full speed before starting a procedure, and let the machine come to a full stop before leaving it. Never start a tool with its blade in contact with your work.
 - Always operate tools at the correct speed for the job at hand. Working too slowly can cause an accident just as easily as working too fast.
 - Watch your work when operating power tools. Stop working if something distracts you.
 - Do not rely on strength to perform an operation. The correct tool, blade, and method should not require excessive strength. If undue force is necessary, you may be using the wrong tool or have a dull blade. Excessive force can cause INJURY.
 - Before clearing jams or blockages on power tools, disconnect from power source. Do not use your hand to clear jams or blockages, use an appropriate tool.
 - NEVER reach over equipment while it is running.
 - When the chance for operator injury is great, use a push stick to move material through a machine.
 - Keep a firm grip on portable power tools. These tools can be difficult to control.
 - DO NOT operate power tools when you are sick, fatigued, or taking strong medication.

II. TABLE SAW

Uses: Crosscutting, Ripping, Bevel Cuts,
Dadoing

A. GENERAL SAFETY PRACTICES:

1. Before you operate the Table Saw:

- Obtain supervision from instructor to operate table saw.
- Use only sharp blades of the proper type for the job.
- Be sure blade is correctly installed in saw. Make certain power is off and properly disconnected before removing blade insert. To loosen arbor nut, turn wrench toward normal direction of travel holding blade with waste piece of wood. Do not overtighten arbor nut when replacing blade.
- Be sure that all adjustments are tight and the table part of the saw is free of tools, chips, small pieces of wood or other materials.
- Be sure the floor is clean and free from scraps and rubbish. Do not work on wet or slippery floors. Non-skid materials are recommended.
- Study the adjustments and make sure you understand them before starting to work.

2. While operating the Table Saw:

- Do not stand in line with the blade while sawing or allowing fingers to hands to be in line of cut.
- Do not talk to anyone while using the saw. The operator should be the only person inside the safety zone.
- Saw only material that has a straight edge.
- Use a push stick for ripping narrow pieces and a push shoe to keep your hands above the blade.
- Hold material against the ripping fence when ripping, and miter gauge when crosscutting. Never saw freehand.
- Never use the ripping fence for a gauge when crosscutting short pieces.
- Do not place the hands over or in front of the blade. Never reach over the blade.
- Turn off the saw before removing short pieces from near the blade.
- Be sure the power is off before adjusting or working on the saw.

3. Avoiding Kickback

- *Kickback* is caused when the blade catches the workpiece and violently throws it back to the rear of the saw, towards the operator. It can be thrown very hard and can injure the operator.
- *Blade must be sharp and clean.* Novices often do not recognize the importance of using a clean and sharp blade. Pitch buildup on a blade greatly increases friction and decreases the quality of the cut, causing burning. Pitch also increases the probability of kickback.
- *Saw must be aligned.* The blade must be adjusted so that it is parallel with the miter grooves and the rip fence. If the blade is out of parallel, it is possible for the workpiece to be pinched between the blade and the rip fence, which will cause violent kickback.
- *Push the workpiece past the blade.* Do not release a workpiece until it is past the blade and removed from the saw. Turn the saw off before removing small cut off pieces.
- *Always maintain control.* Do not execute a cut where you do not have complete control of the situation. Make sure there are no obstructions. Do not cut a workpiece that is too large to handle.
- *Do not use the rip fence as a guide during crosscuts.* If you need cuts, use a stop block in front of the blade so the workpiece is not in contact with the rip fence during the cut. It is easy for the workpiece to twist out of perpendicular at the end of the cut and thus get caught by the blade and thrown.
- *Be careful about flaws in the wood.* Cutting through a loose knot can be dangerous. Cutting a warped or twisted board along the rip fence is dangerous because it can get pinched between the fence and blade

B. SAFE OPERATION PROCEDURES:

1. Crosscutting

- **It is recommended that all students use the MITER SAW for crosscuts. If unavailable, adhere to the following guidelines:**

- Always use the miter gauge when crosscutting. A wood facing is recommended for the miter gauge.
- NEVER use the ripping fence as a guide when crosscutting short pieces. Use a stop on the miter gauge or stop blocks clamped to the ripping fence or the table top.
- Use a crosscut or combination blade. Always use sharp blades. Make sure blade is always cutting down towards front or operator's side of table.
- Adjust the depth of cut so that the teeth clear the thickness of material by the depth of the teeth.
- Place board against the miter gage and saw the board along the cutting line.
- Do not force work through the saw.

2. Ripping:

- Use a ripping or combination blade.
- Use ripping fence as a guide. NEVER SAW FREEHAND.
- Double check cutting width. Also check front and back of blade so fence will not bind material to blade. Check to make sure the fence is parallel to the blade.
- When ripping narrow pieces use a push stick.
- Be sure guards are in place for all sawing operations.
- Use a helper or a roller stand to support long pieces of material while sawing.
- Adjust blade to proper height, 1/4" above the material being sawed.
- Do not force material into blade. If blade overheats stop saw immediately and check for dullness or binding of blade.

3. Dadoing or Plowing:

- Use a Dado blade.
- Raise the saw to the desired depth of cut. Make a pass on a waste piece before cutting into actual work piece.

4. Bevel Cuts (Ripping):

- Use a combination or ripping blade.
- Adjust saw by tilting the arbor to the angle desired.
- Adjust blade to proper height 1/4" above work.
- Adjust ripping fence to desired width of cut.

5. Bevel Cut (Crosscutting):

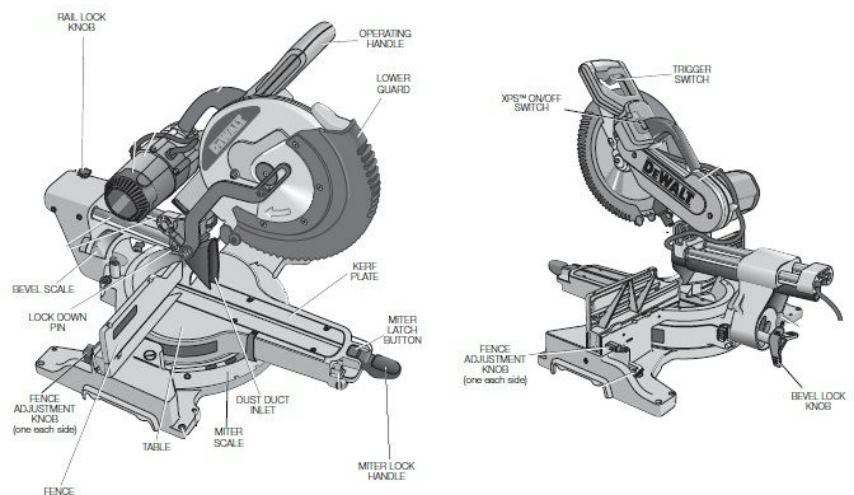
- Use a combination or crosscutting blade.
- Use miter gauge (not the ripping fence) and follow the steps as listed above for Bevels.

III. SLIDING COMPOUND MITER SAW

Uses: Crosscuts; "Compound" because it can cut a miter and bevel simultaneously. "Sliding" because it can cut pieces more than 8" wide.

A. GENERAL SAFETY PRACTICES

- **STABILITY.** Make sure the miter saw is placed on a secure supporting surface and does not



slip or move during use.

- TIGHTEN ALL CLAMP HANDLES, knobs and levers prior to operation. Loose clamps can cause parts or the workpiece to be thrown at high speeds.
- ALWAYS USE A SHARP, CLEAN BLADE. Check the blade to see if it runs true and is free from vibration. A dull or a vibrating blade can cause damage to the machine and/or serious injury.
- ALLOW THE MOTOR TO COME TO FULL SPEED prior to starting cut. Starting the cut too soon may cause damage to the machine or blade and/or serious injury.
- NEVER CUT METALS or masonry. Either of these can cause the carbide tips to fly off the blade at high speeds causing serious injury.
- NEVER CUT MULTIPLE BOARDS SIMULTANEOUSLY.
- NEVER HAVE ANY PART OF YOUR BODY IN LINE WITH THE PATH OF THE SAW BLADE.
- DO NOT PERFORM FREEHAND OPERATIONS (workpiece not supported by table and fence). Hold the work firmly against the fence and table.
- USE ONLY BLADES OF THE CORRECT SIZE AND TYPE specified for this tool to prevent damage to the machine and/or serious injury.
 - MAKE CERTAIN the blade rotates in the correct direction. The teeth on the blade should point in the direction of rotation as marked on the saw.
- KEEP ARMS, HANDS, AND FINGERS AWAY FROM THE BLADE to prevent severe cuts. Clamp all workpieces that would cause your hand to be within 6" (152 mm) of the saw blade.
 - NEVER REACH AROUND OR BEHIND THE SAW BLADE. A blade can cause serious injury.
 - DO NOT REACH UNDERNEATH THE SAW unless it is unplugged and turned off. Contact with saw blade may cause personal injury.
 - DO NOT place either hand in the blade area when the saw is connected to the power source.
 - NEVER CROSS ARMS IN FRONT OF BLADE while using tool. Always make a dry run (unpowered) before making a finish cut so that you can check the path of the blade or severe personal injury may result.
- NEVER LOCK THE SWITCH IN THE "ON" POSITION. Severe personal injury may result.
- TURN OFF THE MACHINE and allow the blade to come to a complete stop before raising the arm and prior to cleaning the blade area, removing debris in the path of the blade, before servicing or adjusting tool. A moving blade can cause serious injury.
- PROPERLY SUPPORT LONG OR WIDE WORKPIECES. Loss of control of the workpiece can cause injury.

B. SAFE OPERATION PROCEDURES

1. CROSSCUTS

A crosscut is made by cutting wood across the grain at any angle. A straight crosscut is made with the miter arm at the zero degree position. Set and lock the miter arm at zero, hold the wood firmly on the table and against the fence. With the rail lock knob tightened, turn on the saw by squeezing the trigger switch. When the saw comes up to speed (about 1 second) lower the arm smoothly and slowly to cut through the wood. Let the blade come to a full stop before raising arm.

Using the Sliding Motion: When cutting anything larger than a 2 x 8 (51 x 203 mm [2 x 6 (51 x 152) at 45° miter]) use an out-down-back motion with the rail lock knob loosened. Pull the saw out, toward you, lower the saw head down toward the workpiece, and slowly push the saw back to complete the cut. Do not allow the saw to contact the top of the workpiece while pulling out. The saw may run toward you, possibly causing personal injury or damage to the workpiece.

2. BEVEL CUTS

A bevel cut is a crosscut made with the saw blade leaning at an angle to the wood. In order to set the bevel, loosen the bevel lock, and move the saw to the left or right as desired. (It is necessary to move the fence to allow clearance.) Once the desired bevel angle has been set, tighten the bevel lock firmly.

Bevel angles can be set from 49° right to 49° left and can be cut with the miter arm set between 50° left or 60° right. At some extreme angles, the right or left side fence might have to be removed. To remove the left or right fence, unscrew the fence adjustment knob several turns and slide the fence out.

IV. BAND SAW

Uses: Freehand Cutting, Irregular shapes and irregularly shaped wood

A. GENERAL SAFETY PRACTICES

- Set the blade evenly with the proper amount of tension.
- Check the blade rotation and make sure teeth point downward toward table.
- Adjust upper blade guard to just clear workpiece.
- Hold workpiece firmly against table.
- Wood must be flat against table and held firmly. Never cut round or unstable wood without secondary support (such as a jig). The downward force of the blade will twist round or unstable stock as it cuts, causing the blade to bind, kink, and break.
- Never force a curved cut tighter than what is allowed by the blade width. Noisy cutting or burning can be signs you are trying to make a cut that is too tight.
- Keep your hands on either side of the cut line. Never reach across the cut line for any reason.
- DO NOT stand to the right of the band saw.
- DO NOT remove jammed piece until blade has come to a complete stop.
- Be sure the radius of your cutting area is not too small for the saw blade.
- If you hear a rhythmic click, check the saw blade for cracks.
- NEVER pull workpiece towards yourself
- Utilize fence or miter gauge if making straight cuts
- If the blade stops/jams, turn the machine off and inform the instructor.



V. STANDING PLANER

Uses: Remove old finishes and major blemishes. Squaring up rough stock and smoothing surfaces.

A. GENERAL SAFETY PRACTICES

- Examine wood for knots, nails, and other defects before placing it in the planer.
- Do not plane against the grain of the wood.
- Let go of the materials as the feeder rolls catch. Do not follow the work with your hands.
- Do not run boards that are more than 2 inches shorter than the distance between the infeed and outfeed rolls. The minimum board length is 9". The maximum board width is 20".



- Clear area of tools or loose articles before operating.
- Use a push stick if a board stops with its end on the infeed table.
- If a board sticks under the cutter head, turn off the machine to keep from burning the cutter knives.
- KEEP HANDS AWAY from infeed rollers and cutter head.
- Turn the power OFF before removing shavings
- DO NOT OPERATE while gear cover is open.

VI. DRILL PRESS/MORTISER

- Securely fasten work materials to prevent spinning. Never use your hands to secure work materials.
- Use a center punch to score the material before drilling.
- Run the drill at the correct speed. Forcing or feeding too fast can break drill bits.
- Never attempt to loosen the chuck unless the power is off.
- Lower the spindle before removing a chuck.
- Never use a regular auger bit in a drill press.
- Frequently back the drill out of deep cuts to clean and cool the bit.
- Never leave the drill running unattended

VII. POWER SANDERS

- Ensure that sanding belts are not too tight or too loose.
- Use the correct grade of abrasive material.
- Ensure that the distance between a circular sander and the edge of the table is not greater than 1/4 inch.
- Do not push materials against sanders with excessive force.
- Sand only on the downstroke side of a disk sander.
- Do not hold small pieces by hand. Use a jig for pieces that are difficult to hold securely.