

**Faculty of Engineering
Workshop Services**

**STANDARD
OPERATING PROCEDURES
FOR
COMMON TOOL
&
MACHINING EQUIPMENT**

The information in this booklet is provided as a guide for the **minimum safety training** that shall be provided to personnel prior to being authorized to use of any of the following machining tools or pieces of equipment: Mill, Lathe, Planer, Drill Press, Pedestal Grinder, & Band Saw.

GENERAL SAFETY TIPS

- Safety glasses with side shields must be worn at all times.
- Do not wear loose clothing, loose neckwear or exposed jewelry while operating machinery.
- Do not work alone in a machine shop. (Implement the "buddy" system.)
- Long sleeves on shirts should be rolled up above the elbows.
- Pull back and secure long hair.
- Do not wear thin fabric shoes, sandals, open-toed shoes, and high-heeled shoes.
- A machinist's apron tied in a quick release manner should be worn.
- Always keep hands and other body parts a safe distance away from moving machine parts, work pieces, and cutters.
- Use hand tools for their designed purposes only.
- Report defective machinery, equipment or hand tools to the Technician.

McGill Workshop Safety policy:

www.mcgill.ca/ehs/programs-and-services/workshop

Workshop Rules:

www.mcgill.ca/ehs/programs-and-services/workshop/rules

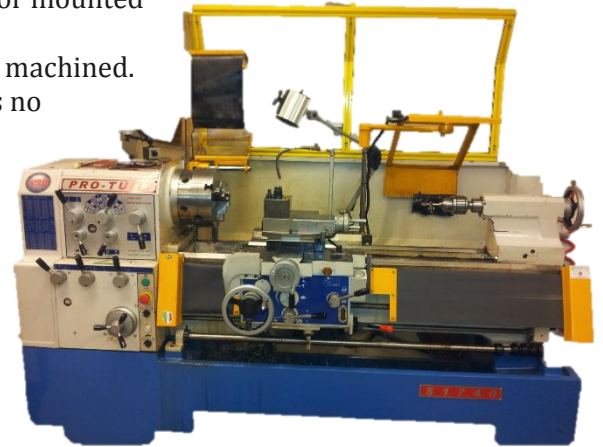


MACHINE SHOP SAFETY



WORKSHOP MACHINES - LATHE

- All stock must be properly secured in the lathe chuck or mounted prior to the machining process taking place.
- Use the correct sized clamp or vise for the stock being machined.
- Turn the chuck or faceplate by hand to ensure there is no binding or danger of the work striking any part of the lathe.
- Check to ensure the cutting tool will not run into the chuck or lathe dog. If possible, feed away from the chuck or dogs.
- Before starting the lathe, ensure the spindle work has the cup center imbedded; tail, stock and tool rests are securely clamped; and there is proper clearance for the rotating stock.
- Prior to starting the lathe, ensure that small diameter stock does not project too far from the chuck without support from the tail stock center.
- When using wood, do not mount a split work piece or one containing knots.
- When roughing stock, do not force the tool in the work piece or take too big a cut.
- The operator must always be aware of the direction and speed of the carriage or cross-feed prior to engaging the automatic feed.
- Never leave the key in the chuck. Do not let go of the key until it is free of the chuck and secured in its proper holding place.
- Select turning speed carefully. Large diameter stock must be turned at a very low speed. Always use the lowest speed to rough out the stock prior to final machining.
- The correct speed and feed for the specific material and cutting tool must be used. Stop the machine before making adjustments or measurements.
- Do not remove metal or wood chips from the table or stock by hand. Use a brush or other tool to properly remove chips or shavings from the table or stock.
- Never attempt to run the chuck on or off the spindle head by engaging the power.
- Do not stop the rotation of the chuck by reversing the power to the lathe unless tapping holes.
- Do not leave tools, bits or excess pieces of stock on the lathe bed.
- All belts and pulleys must be guarded. If frayed belts or pulleys are observed, the lathe must be taken out of service and the belts or pulleys replaced.
- Stop the machine immediately if odd noise or excessive vibration occurs.
- Only properly sharpened drill bits and cutting tools in good condition should be used. Dull drill bits and chipped or broken cutting tools must be removed from service.
- Disconnect the lathe from power source, Lock-out/Tag-out, if making repairs or servicing.





WORKSHOP MACHINES - MILL

- Keep all guards in place while operating the machine.
- While operating the milling machine allow no one else to touch it.
- Keep hands away from moving cutting tools.
- Do not make measurements of the stock while the milling machine is powered.
- Do not allow large quantities of chips to accumulate around the work piece or machine table. After stopping the machine, use a brush or rag to remove all excess chips from the mill bed and stock.
- Use a rag or Kevlar gloves to handle sharp cutting tools.
- Cutting tools must be securely fastened in the machine spindle with the proper accessory. Never try to tighten cutting bits or tools by hand.
- Do not power the machine to tighten or loosen cutting bits or tools.
- Work pieces and stock must be rigidly fastened to the mill bed with clamps, a vise, or special fixtures.
- **Use appropriate speeds** and feeds for the type and size of cutter being used and the material being machined.
- Make sure the cutting tool is clear of the work piece before starting the machine.



WORKSHOP MACHINES - PEDESTAL GRINDER

- Inspect the wheels before turning on the power. Do not use wheels that are chipped or cracked.
- Stand to one side of the wheel when turning on the power.
- Keep the tool rest as close to the grinding wheel as possible without touching it. The tool rest must be minimally within 1/8th of an inch of the grinding wheel.
- Prior to starting the grinder, ensure the tang at the top of the wheel opening is located within ¼ inch of the wheel.
- Prior to starting the grinder, ensure guards enclosing the outside of grinding wheel are in place.
- Prior to adjusting the work rest or tang, unplug the power to the grinder from the wall receptacle.
- If the grinder is hardwired into a box, Lock-out/Tag-out.
- Be alert and cautious when a grinding operation requires locating fingers close to the wheel.
- Feed the stock into the wheel with light to medium pressure. Do not force the piece.
- Do not use the side of the grinding wheel to shape stock.
- Stand erect in front of the grinder with both legs straight and slightly apart. Avoid stooping or leaning into the machine.





WORKSHOP MACHINES - DRILL PRESS

- Know the location of start and stop switches or buttons and keep the drill press table free of tools and other materials.
- Use only properly sharpened drill bits, sockets and chucks in good condition. Remove dull drill bits, battered tangs, or sockets from service.
- Do not remove by hand metal or wood chips from the table or stock. Use brushes or other tools to properly remove chips.
- Do not attempt to oil the machine or make adjustments to the work while the drill press is in motion.
- Do not insert a drill chuck key into the chuck until the power is shut off and the machine has come to a complete stop.
- All belts and pulleys must be guarded; if frayed belts or pulleys are observed, the drill press must be taken out of service and the belts or pulleys must be replaced.
- All stock must be properly secured with a vise or clamps prior to a machining process.
- If the stock slips in the vise or clamp, the operator must not attempt to hold the work with his/her hand or try to tighten the vise/clamp while the machine is in motion. Shutdown the power to the machine prior to re-tightening the loose stock.
- Use the correct speed and drill for the type of stock being machined.
- Use the appropriate bit for the stock being machined. Bits with feed screw or extremely long bits should not be used.
- The drill bit should be mounted the full depth and in the center of the chuck.
- Position the table and adjust the feed stroke eliminating the possibility of the bit striking the table.
- Feed the bit smoothly into the work. If the hole being drilled is deep, withdraw the bit frequently to remove shaving on the bit.
- Never attempt to remove a broken drill with a center punch or hammer.
- When an operator has finished working on the drill press, and before leaving the drill press for any reason, the power must be shut off and the machine must come to a complete stop.
- When an operator observes an unsafe condition on the drill press, or stock that is being worked on, they must report it immediately to the designated Technician and the press will be taken out of service until the problem has been corrected.





WORKSHOP MACHINES - BAND SAW

- Ensure the guard doors are closed and the blade is properly adjusted prior to turning on the machine.
- Adjust the upper guard assembly to within $\frac{1}{4}$ inch of the stock prior to starting the machine. Set the band saw at the appropriate speed for the type of stock being machined.
- Check to ensure the band saw blade is sharpened.
- Check to ensure the band saw is correct for the type of stock and correct speed being used.
- Allow the saw to reach full set speed prior to cutting stock.
- Do not force stock into the saw blade. Let the speed of the blade cut stock appropriately.
- Make “release” cuts before cutting long curves.
- Plan saw cuts to avoid backing out of curves in the stock.
- Never push a piece of stock with hands in front of the saw blade. Use a push stick.
- Keep hands at a safe distance on either side of the stock being machined.
- Use a push stick or board to push small or irregular sized stock.
- Small work pieces can also be secured with a tabletop vise or clamp.
- All round stock must be secured in a tabletop vise or clamp prior to starting the cut.
- Hold the stock flat on the table prior to starting the cut.
- If the saw blade binds on a piece of stock, turn the saw off and wait until it comes to a complete stop before attempting to remove the blade from the stock.
- Do not allow large quantities of chips to accumulate around the work piece or drill press table.
- After stopping the machine, use a brush or rag to remove all excess chips from the drill press table and stock.



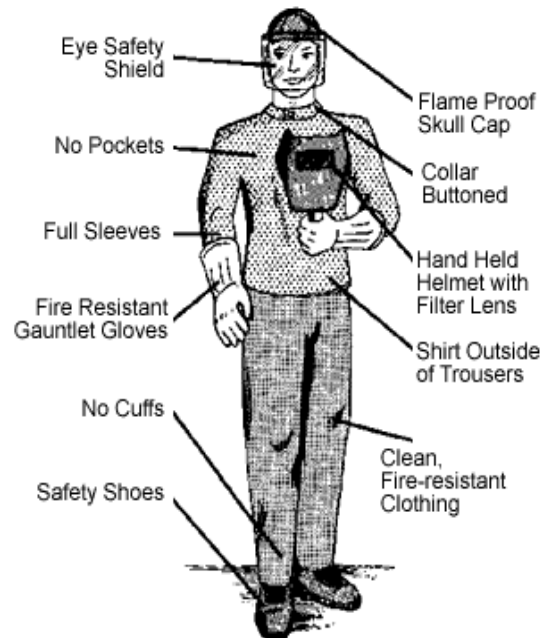


WELDING SHOP SAFETY



WELDING SAFETY RULES

- Access to the workshop areas is restricted to authorized personnel only.
- No welding may be undertaken unless the person is on the "Accessibility List" AND the technician-in-charge is satisfied that he/she is capable of doing so safely.
- Any person working in the welding workshop must be familiar with the University Health and Safety Policy.
- The welding fume extractor must be used during any welding operation.
- Personal Protective Equipment provided must be used when necessary.
- Barrier cream, lab coats, safety glasses/goggles and safety shoes are to be used as the work dictates.
- Long hair must be completely covered.
- Grinding machines can be operated by technical staff only, or users listed on the "Accessibility List" and eye protection must be worn.
- Do not carry dangerously heavy loads or loads that could obscure your vision.
- Smoking, eating and drinking in workshop areas is strictly prohibited.
- All equipment must be cleaned after use.
- Any materials, tools or equipment used must be put away.
- Tools and equipment must not be removed from the welding shop without the permission of the technician-in-charge.
- In the event of a fire, leave the building immediately and proceed to the assembly point.
- All accidents/incidents/occupational ill health **must** be reported to the technician and management.
- The technician-in-charge is authorized to enforce these rules.
- Report and problems or concerns regarding health, safety or security to the technician.





WOODWORKING SHOP SAFETY



SAFETY IS A STATE OF MIND: RULES TO LIVE BY

- **Don't hurry or work tired** – Most accidents happen because the woodworker did not take the time to prepare for just one quick cut. When you are tired or otherwise impaired, get out of the shop
- **If it makes you nervous, don't do it** – trust the voice in your head that warns you something isn't safe
- **Heed manufacturer's warnings** – safety instructions are there because someone somewhere got hurt.
- **Wear eye protection** – Even the smallest piece of flying wood or metal can make you blind! Don't risk it
- **Protect your hearing and your lungs** – hearing loss happens slowly and unnoticed, so keep that in mind. Wood dust and other particles that you breathe in can do cumulative damage to your lungs, so take precautions against that too.
- **Keep the woodshop clean and uncluttered** – you will avoid tripping over clutter and getting injured. Put all tools away after every operation. This rule applies to your person as well. Remove jewelry, roll up your sleeves, and tie up long hair.
- **Prevent accidents, but prepare for them** – a quick response can dead off a true disaster. Know where the first aid kit is kept, where the fire extinguishers are, and emergency numbers.



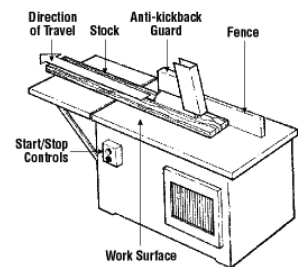
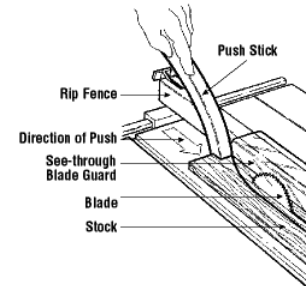
All woodworking machines can be dangerous if not used properly, so read the owner's manual carefully, make sure you understand instructions before attempting to use any woodworking machine, and learn the applications and limitations before use.



WOODWORKING MACHINES – TABLE SAWS

SAFETY PROCEDURES TO FOLLOW WHEN USING A TABLE SAW

- Wear safety glasses or a face shield.
- Wear hearing protection that is suitable for the level and frequency of the noise you are exposed to in the woodworking area.
- Pay particular attention to the manufacturer's instructions on reducing the risk of kickback.
- Choose proper blades for the type of work you are doing.
- Keep blades clean, sharp, and properly set.
- Use the guards provided with the saw or ones designed for use with the saw that you are using. Keep guards in place and in good working condition.
- Use a guard high enough to cover the part of the blade rising above the stock and wide enough to cover the blade when it is tilted. The blade height should be set so it does not extend more than about 3 mm (1/8 in) above the height of the piece being cut.
- Ensure that the fence is locked in position after the desired width has been set.
- Hold the work piece firmly down on the table and against the fence when pushing the wood through.
- Ensure that there is adequate support to hold a work piece; use extension tables or roller supports at the side or back for larger pieces. If an assistant is at the back (outfeed) end of the saw, an extension table should be in place so the back edge is about 1.2 m (4 ft) from the saw blade. The assistant should wait for the work piece to reach the edge of the extension table and should not reach toward the saw blade.
- Feed stock into the blade against the direction of its rotation.
- Move the rip fence out of the way when cross cutting. Never use it as a cut off gauge.
- Use a push stick when ripping narrow or short stock (e.g., when the fence is set less than about 15 cm (6 in) from the blade; when the piece is less than 30 cm (12 in) long or when the last 30 cm (12 in) of a longer piece is being cut). Refer to ripping applications in the manufacturer's instruction manual. See Woodworking Machines - Push Sticks for more information on push stick design.
- Keep hands out of the line of a saw blade.
- Use guard with a spreader (riving knife) and anti-kickback fingers for all ripping or cross cutting operations.
- Keep the body and face to one side of the saw blade out of the line of a possible kickback.
- Provide adequate support to the rear and sides of a saw table for wide or long stock.
- Be careful when waxing, cleaning, or servicing the table. Shut off and unplug (or lock out) a saw before doing any work on the saw.
- Keep area clean and clutter-free. Operate machines in a non-congested, well-lit area.
- Use the proper sawdust exhaust systems as required by operation.



WHAT TO AVOID

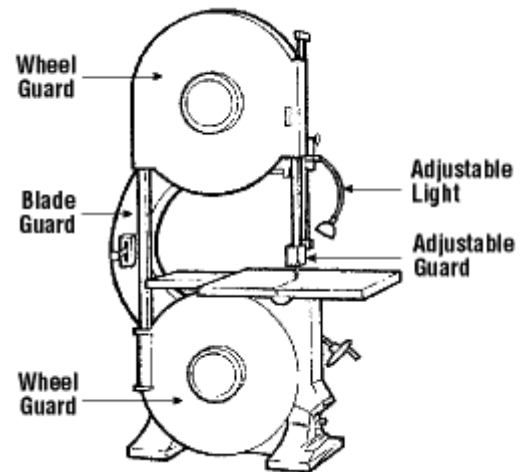
- **Do not saw freehand. Always hold the stock firmly against the mitre gauge or a rip fence to position and guide the cut.**
- **Do not reach around and over moving blades.**
- **Do not feed the work piece faster than the saw can accept.**
- **Do not leave a saw running unattended. Turn off the power and make sure the machine has stopped running before leaving the area.**



WOODWORKING MACHINES – BAND SAWS

SAFETY PROCEDURES TO FOLLOW WHEN USING A BAND SAW

- Anchor the band saw securely to the floor (or a workbench of appropriate height) to reduce vibration
- Wear safety glasses or a face shield.
- Wear hearing protection that is suitable for the level and frequency of the noise you are exposed to in the woodworking area.
- Make sure all guards are in place and properly adjusted. Ensure all band wheels are enclosed.
- Adjust blade guard height to about 3 mm or 1/8 inch above the top of the material being cut.
- Ensure the blade is tracking correctly and runs freely in and against the upper and lower guide rollers.
- Ensure the blade is under proper tension. A band saw equipped with automatic tension control is desirable.
- Use band saw blades that are sharp, properly set and otherwise suitable for the job (e.g., the right tooth pitch; tooth form; blade width).
- Hold stock firmly and flat on the table to prevent the stock from turning and drawing your fingers against the blade. Keep hands braced against the table.
- Use a push stick when you remove cut pieces from between the fence and saw blade or when your hands are close to the blade. Keep your hands on either side of the blade - not in line with the cutting line and the blade. See Woodworking Machines - Push Sticks for more information on push stick design.
- Make release (relief) cuts before tight curves when doing intricate scroll-type work.
- Keep the floor around a band saw clean and free of obstructions or clutter.
- Keep the machine properly oiled and serviced.
- Provide adequate lighting at the machine table. A light fixture with a flexible connection can provide essential lighting.



WHAT TO AVOID

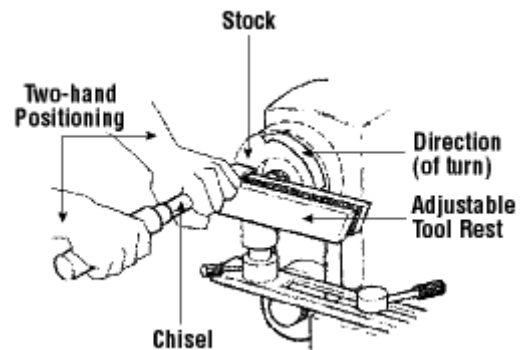
- **Do not use excessive force when pushing the wood past the blade.**
- **Do not back the stock away from the blade while the saw is in motion if the work piece binds or pinches on the blade.**
- **Do not stop a band saw by thrusting stock against the cutting edge or the side of a blade immediately after the power has been shut off.**
- **Do not remove sawdust or cuttings from the table by hand or with compressed air. Use a stick or brush.**
- **Do not leave a saw running unattended. Turn off the power and make sure the machine has stopped running before leaving the area.**



WOODWORKING MACHINES – WOOD TURNING LATHE

SAFETY PROCEDURES TO FOLLOW

- **Only experienced and trained lathe operators should be allowed to operate lathes**
- Wear safety goggles or face shield to protect from flying chips.
- Wear hearing protection suitable for the level and frequency of the noise in the woodworking area.
- Wear a dusk mask when dust is generated (e.g., during sanding operations).
- Work in well-lighted area.
- Before the lathe is turned on, ensure that all clamps and fittings are secure and that the work piece is free to turn.
- Use stock free of defects.
- Hold tools firmly with both hands and against the tool rest.
- Hold the stock securely on the faceplate or between the centres.
- Use only furnished or approved tools.
- Use sharp, well-maintained chisels and gouges.
- Select a speed that is appropriate for the job. Operate the lathe at a low speed and use a moderate cut depth to prevent splinters from flying out during roughing operations. The actual speed of the lathe depends on type of wood, a diameter of stock, nature of work being done and type of tool used.
- Adjust tool rests so that they are parallel and as close as possible to the stock. They should also be set high enough so that tools will cut into the wood slightly above the centre of the work being turned.
- Remove the tool rest when sanding or polishing.
- Use appropriate tools to hold the sand paper or emery paper whenever possible. Examples include a 'nut cracker' or the paper fixed to a piece of flat wood. If you must use your hands always hold the paper in a way that will not allow the paper to catch, pull or entangle around the stock.
- To make a faceplate turning, the one hand steadies the tip of the chisel, which holds the edge against the tool rest while the other hand guides the tool. Keep the tip of the chisel held higher than the handle.



WHAT TO AVOID

- **Do not wear** gloves, loose clothing, rings or jewelry around the neck that can hang outside one's clothing. Clothing should be comfortable but not so loose that it can catch on the machine or get entangled with any rotating parts or the wood being turned; shirts should be tucked in and long hair tied back.
- **Do not leave** a running lathe unattended - leave only after the lathe has been turned off and it has come to a complete stop.
- **Do not use** makeshift tools.
- **Do not use** stock containing checks, splits, cracks, or knots.



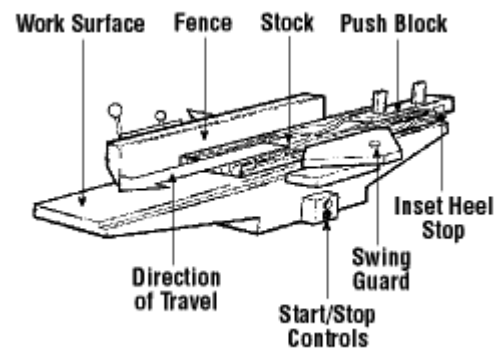
WOODWORKING MACHINES – JOINTERS and PLANERS

CHECK BEFORE STARTING YOUR MACHINE...

- that the knives set for the proper clearance and depth of cut and they sharp, balanced, and fastened securely.
- that the fence anchored in the proper position.
- that the guard can (swing or overhead) move freely and return over the cutting head.
- that the equipment properly lubricated.
- that all parts or accessories are in proper working condition.

SAFETY PROCEDURES TO FOLLOW

- Wear safety glasses or goggles.
- Wear hearing protection suitable for the level and frequency of the noise in the woodworking area.
- Allow only experienced and trained personnel to operate jointers and planers.
- Use only sharp, balanced and joined knives.
- Replace old square cutting heads with round heads which are safer.
- Ensure start and stop buttons are within easy reach of the operator.
- Make sure the swing guard pushes beside the stock as it passes over the cutting heads and returns against the fence after the stock is removed.
- Remove all wrenches and tools used in the set up from the table.
- Provide a minimum clearance of at least 3 feet greater than the length of the longest stock being worked.
- Construct hold-down push blocks to do beveling and surface operations.
- Use hold-down (double-handed) push blocks. These keep hands well away from the cutting head.
- Maintain an adequate amount of downward and forward force with push blocks as the knife blades on a revolving cutting head can take the stock from an operator's hands.



WHAT TO AVOID

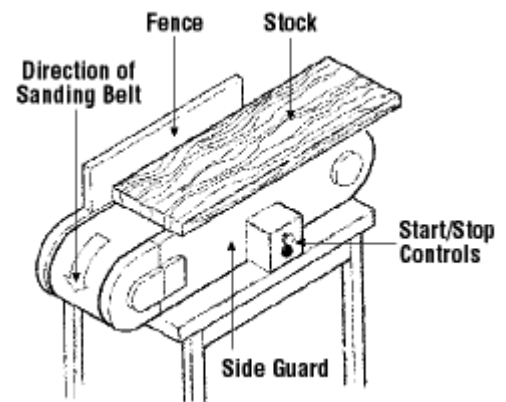
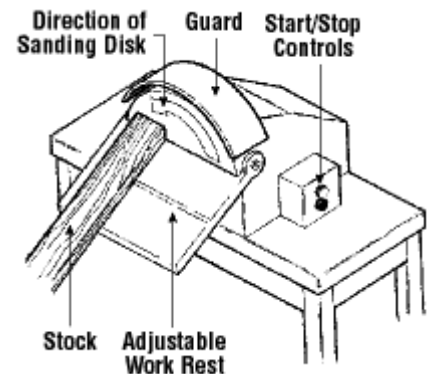
- **Do not leave** the machine running unattended. Shut off the power and make sure that the cutting head has stopped revolving.
- **Do not make cuts** deeper than .3 cm (1/16") in one pass.
- **Do not join** stock of pieces less than 30 cm (12") long, 2 cm (3/4") wide and less than .6 cm (1/4") thick.
- **Do not surface** stock less than 30 cm (12") long, 2 cm (3/4") wide or more than 15 cm (6") wide or less than 1.5 cm (5/8") thick.
- **Do not pass** hands over the cutters.
- **Do not remove** dust or particles of wood from a table by hand or with compressed air. Use a stick or brush.



WOODWORKING MACHINES – SANDERS

SAFETY PROCEDURES TO FOLLOW

- Wear goggles when operating sanders.
- Wear hearing protection suitable for the level and frequency of the noise in the woodworking area.
- Use sanders with the local exhaust ventilation (LEV) turned on. The LEV should be designed for the sander and well maintained to work effectively.
- Wear respiratory protection (e.g., dust masks) during sanding operations and clean up.
- Keep hands away from the abrasive surface.
- Hold small or thin pieces of stock in a jig or holding device to prevent injuries to the fingers or hands.
- Inspect abrasive belts before using them. Replace belts worn, frayed, or excessively worn in spots.
- Sand on the downward side of a disc sander so that the wood is driven onto the table by the machine's rotation.
- Enclose all drums, disk or belt sanding machines with an exhaust dust hood that covers all portions of the machine but the portion designed for the work feed.
- Adjust work rests on all manually fed sanders to provide minimum clearance between the belt and the rest. The work rest should be secured properly.
- Install abrasive belts that are the same width as the pulley drum.
- Adjust abrasive belt tension to keep the belt running the same speed as pulley-drum when the wood is in contact with the belt.
- Guard feed rollers to allow boards to pass, but keep operators' fingers and arms out.
- Install guards to prevent contacts at:
 - in-running nip points,
 - power transmission,
 - feed roll parts, and
 - the unused portion of the abrasion belt on the operator's side of the machine.



WHAT TO AVOID

- **Do not sand** small or thin hand-held work pieces.
- **Do not wear** loose clothing or jewelry while using revolving power tools. Tie back long hair or wear appropriate hair protection to prevent hair, clothing, or jewelry from being caught and pulled by sander belts and pulleys in motion.
- **Do not** operate sanders without the exhaust system operating.
- **Do not** operate sanders unless adequately guarded.
- **Do not** operate sanders unless the work rest is properly adjusted.