



Machine Shop Policies and Procedures

The College of Engineering & Computational Sciences machine shop consists of a full-service shop that provides machining, assembly and fabrication services in support of research projects and instructional laboratories for CECS students, staff, and faculty working on CECS projects.

Location & Hours of Operation

Brown Hall W130
9:00 am – 6:00 pm
Monday – Friday

Shop Manager

John Jezek
303-273-3668
jjezek@mines.edu

Table of Contents

- 1.** Duties of Shop Manager
- 2.** Shop Use Policy
- 3.** Safety Equipment
- 4.** General Shop Safety Rules
- 5.** Guidelines for Medical Emergencies
- 6.** Tool Safety, Warnings, Caution
 - A.** Hand Tools
 - B.** Angle Grinder
 - C.** Circular Saw
 - D.** Combo Sander
 - E.** Cut Off Saw
 - F.** Drill Press
 - G.** General Power Tool
 - H.** Horizontal Band Saw
 - I.** Lathe
 - J.** Mill
 - K.** Miter Saw
 - L.** Plasma Cutter
 - M.** Portable Drill
 - N.** Recipro Saw
 - O.** Safety Rules for Working with Solvents and Resins
 - P.** Welding

Duties of Machine Shop Manager

- Teach proper shop usage and safety at a minimum on a once-a-month basis
- Ensure that all tools are in good working condition
- Replace and fix broken tools and equipment
- Provide assistance to employees and students
- Keep the Machine Shop in order and safe
- Enforce the rules of the Machine Shop
- Maintain an active list of students approved for Machine Shop usage.

Shop Use Policy

All undergraduate and graduate students enrolled in CECS courses, and CECS faculty and staff are eligible to work in the shop. All shop users must do the following before using the shop:

- Attend Basic Shop Safety and Operating Procedures conducted by the Shop Manager before shop usage.
- Take and pass Safety Exam given by Shop Manager
- Sign an agreement document to abide by the rules and regulations of this document.

All CECS students, faculty, and staff must do the following when using the shop:

- Sign in and out of shop
- Follow all safety rules and procedures while in the machine shop, including the use of protective equipment as required.
- Always work with another approved user or supervisor in the Machine Shop.
 - Student use of tools or equipment is to be supervised by Shop Manager or Faculty Member
 - If Shop Manager or Faculty Member is not present, at least two students must be in the shop at all times during the use of tools or equipment. Use of the shop must still be approved by Shop Manager or trained proxy, approved by Shop Manager and Department Head. Shop Manager or trained proxy is responsible for the safety of the students while in the Machine Shop. If working in the Machine Shop without Shop Manager, users must make sure the door is locked when they leave.
- Never perform tasks for which they have not been trained.
- Always ask, and get assistance with, any new or unusual work to be done in the shop.
- Clean and return to proper storage place all equipment and tools used.
- Report any broken, damaged, or malfunctioning equipment.

Regardless of user experience, the amount of prior experience required before one can use the machine shop without supervision is at the discretion of the Shop Manager.

Any violation of these rules and/or unsafe or improper use of machine or tools, not listening to or following instructions, or lack of judgment will result in a warning and possibly loss of shop use privileges.

Safety Equipment

W130 Machine Shop

W120 3D printer, Laser etcher, and Wood Prototype Shop

Location of Safety Equipment

- **Fire extinguisher** – W130 just inside door on west wall
- **Telephone** – W130 Inside Shop Manager office
- **Power shut off** – W130 just inside door on west wall
- **Fire alarm** – Hallway outside W130 between double doors and overhead door
- **Personal protection equipment**
 - Safety Glasses** W130 just inside door on west wall
 - Welding Helmets & Smock** W130 on east wall of welding booth
 - Welding Gloves** W130 in cabinet drawer next to welding booth
- **First aid kit** – W130 over sink next to Shop Manager office
- **Eye wash** – W130 next to Shop Manager office
W120 next to chemical sink
- **Chemical sink** – W120 south wall
- **Hooded vent** – W120 south wall

General Shop Safety Rules

- Safety glasses, or appropriate goggles / face shields are required in the shop at all times, whether working or not!!
- Shoes must be worn in any shop area. No one wearing sandals will be allowed to enter any shop area. The minimum footwear must cover the entire foot.
- Do not operate any item of equipment unless you are familiar with its operation and have been authorized to operate it. If you have any questions regarding the use of equipment ask the Shop Manager.
- Do not use any equipment if it is not functioning correctly or you are unsure.
- Avoid excessive use of compressed air to blow dirt or chips from machinery to avoid scattering chips. Never use compressed air guns to clean clothing, hair, or aim at another person.
- In case of injury, no matter how slight, you must report it to the Shop Manager.
- Do not attempt to remove foreign objects from the eye or body. If chemicals get in the eye(s), wash eye(s) for 15 minutes in an open flow of water before proceeding for medical treatment. Notify the Shop Manager immediately.
- Machines must be shut off when cleaning, repairing, or oiling.
- Do not wear ties, loose clothing, long sleeves, jewelry, gloves, etc. around moving or rotating machinery. Long hair must be tied back or covered to keep it away from moving machinery. Hand protection in the form of suitable gloves should be used for handling hot objects, glass or sharp-edged items.
- Wear appropriate clothing for the job (i.e. do not wear short sleeve shirts or short pants when welding).
- Do not work in the shop if tired, or in a hurry.
- Do not work in the shop if you are ill, have been using alcoholic beverages or under the influence of intoxicants.
- Never indulge in horseplay in the shop areas.
- All machines must be operated with all required guards and shields in place.
- A brush or gentle air blasts should be used for removing chips, shavings, etc. from the work area. Never use your hands.
- Keep all body parts clear of the point of operation of machines by using special tools or devices, such as, push sticks, hooks, pliers, etc. NEVER use a rag near moving machinery.
- A hard hammer should not be used to strike a hardened tool or any machine part. Use a soft faced hammer.
- Practice cleanliness and orderliness in the shop areas. Never leave a dirty piece of equipment.
- Keep the floor around machines clean, dry and free from trip hazards. Do not allow chips to accumulate.
- Think through the entire job before starting. Ask the Shop Manager if you are ever unsure for any reason.
- Before starting a machine, always check it for correct setup and always check to see if machine is clear by operating it manually, if possible.
- Food is allowed in the machine shop, but only in specific areas, well away from any chemicals or contaminants.
- Don't rush or take chances. Don't say you know how to do something, when you don't. Obey all safety rules at ALL times.

- If you have not worked with a particular material before, check the hazardous materials data sheets book for any specific precautions to be taken while working with the material. Also, ask the Shop Manager before cutting any unusual material.
- Heavy sanding and painting should only be done in well ventilated areas, preferably outside.
- Follow all appropriate precautions when working with solvents, paints, adhesives or other chemicals. Use appropriate personal protective equipment.
- Check the power cords and plugs on portable tools for before using them.
- Personal entertainment devices with ear pieces cannot be used while using Machine Shop
- Always store oily rags in an approved metal container.
- Obey all posted signs, warnings, posters and special instructions.

Guidelines for Medical Emergencies

Injuries, no matter how small, must be reported to the Shop Manager immediately. Anyone who is injured, other than small superficial cuts and abrasions, must be seen by a medical professional as soon as possible.

Serious Injuries that Threaten Life or Limb.

1. Notify Shop Manager!
2. Call Campus Safety at 911 or 303-273-3333
3. Request an ambulance, give location.
4. Describe the nature of the problem and stay on the phone.
5. If alone, watch for emergency personnel and guide them to the victim. Otherwise, send someone.

Emergencies Which Might Need Professional Care.

1. Notify Shop Manager!
2. Follow these procedures if you are unsure of the severity of an injury (broken vs. sprained, etc...)
3. If transportation is available, take victim to nearest hospital or care center.
4. If transportation is not available, follow the procedures for "Serious Injuries" above.

Minor Emergencies Not Requiring Professional Care.

1. Notify Shop Manager!
2. Provide appropriate first aid.
3. Help victim to rest comfortably.
4. Reassure victim and encourage them to seek additional care if necessary.

Tool Safety

Hand Tools

1. Only tools that are in good condition shall be used in operations. They shall be properly cleaned after use, and cutting tools shall be kept sharp.
2. Do not carry tools in your pockets. They shall be carried in a tool kit or in hand in such a manner as to prevent injury by stabbing, dropping, pinching, and the like. Some rules for specific tools follow.
3. Hammers: Before using a hammer, check the head for a tight fit. If the hammer has a cracked head or a loose or cracked handle, return it to the tool crib for replacement. Hammers that have burrs, loose chips, or signs of mushrooming shall not be used.
4. Wrenches: Use the correct wrench for the job to be done. Pull rather than push on the handle of the wrench. Do not place extensions on wrench handles for more leverage. Use the proper sized wrench.
5. Knives: Keep your hands and the knife handles clean, dry, and free of grease. Do not place knives on shelves or table edges where they might fall. Keep the blade in a sheath when the knife is not in use.
6. Pliers: Wear eye protection when using pliers to clip wire ends. Hold the wire and pliers so that the ends, when snipped, are directed towards the ground.
7. Impact tools, such as drift pins, wedges, and chisels, shall be kept free of mushroomed heads.
8. The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight in the tool.
9. Appropriate personal protective equipment should be worn due to hazards that may be encountered while using portable power tools and hand tools.
10. Floors should be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.
11. Hand tools are non-powered. They include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

The greatest hazards posed by hand tools result from misuse and improper maintenance.

Tool Safety

Angle Grinder

DO NOT let comfort or familiarity with product (gained from repeated use) replace strict adherence to grinder safety rules. If you use this tool unsafely or incorrectly, you can suffer serious personal injury.

1. Always use safety glasses or goggles.
2. Obtain permission from instructor before using the saw.
3. Always use proper guard with grinding wheel. A guard protects operator from broken wheel fragments.
4. Accessories must be rated for at least the speed recommended on that may affect the tools operation. If damaged, have the tool serviced before using. Many accidents are caused by poorly maintained tools.

SPECIFIC SAFETY RULES

5. Hold tool by insulated gripping surfaces when performing an operation where the cutting tool may contact hidden wiring or its own cord. Contact with a “live” wire will make exposed metal parts of the tool “live” and shock the operator.
6. When using depressed center grinding wheels, be sure to use only fiberglass-reinforced wheels.
7. Ordinary sun glasses are NOT safety glasses.
9. Check the wheel carefully for cracks or damage before operation. Replace cracked or damaged wheel immediately. Run the tool (with guard) at no load for about a minute, holding tool away from others. If wheel is flawed, it will likely separate during this test.
10. Use only flanges specified for this tool.
11. Be careful not to damage the spindle, the flange (especially the installing surface) or the lock nut. Damage to these parts could result in wheel breakage.
12. NEVER use tool with wood cutting blades or other saw blades. Such blades when used on a grinder frequently kick and cause loss of control leading to personal injury.
13. Hold the tool firmly.
14. Keep hands away from rotating parts.
15. Make sure cord is clear of wheel. Do not wrap cord around your arm or wrist. If control of tool is lost, cord may become wrapped around you and cause personal injury.
16. Make sure the wheel is not contacting the work piece before the switch is turned on.
17. Before using the tool on an actual work piece, let it run for a while. Watch for vibration or wobbling that could indicate poor installation or a poorly balanced wheel.
18. Use the specified surface of the wheel to perform the grinding.
19. Watch out for flying sparks. Hold the tool so that sparks fly away from you and other persons or flammable materials.
20. Do not leave the tool running. Operate the tool only when hand-held.
21. Do not touch the work piece immediately after operation; it may be extremely hot and could burn your skin.
23. ALWAYS wear proper apparel including long sleeve shirts, leather gloves and shop aprons to protect skin from contact with hot grindings.
24. Use of this tool to grind or sand some products, paints and wood could expose user to dust containing hazardous substances. Use appropriate respiratory protection.

25 Always be sure that the tool is switched off and unplugged before adjusting or checking function on the tool.

SAVE THESE INSTRUCTIONS WARNING: MISUSE or failure to follow the safety rules stated in this instruction manual may cause serious personal injury.

CAUTION:

- Never actuate the shaft lock when the spindle is moving. The tool may be damaged. Press the shaft lock to prevent spindle rotation when installing or removing accessories
- Before plugging in the tool, always check to see that the switch actuates properly and returns to the "OFF" position when the rear of the slide switch is depressed.
- It should never be necessary to force the tool. The weight of the tool applies adequate pressure. Forcing and excessive pressure could cause dangerous wheel breakage.
- ALWAYS replace wheel if tool is dropped while grinding
- NEVER bang or hit grinding disc or wheel onto work.
- Avoid bouncing and snagging the wheel, especially when working corners, sharp edges etc. This can cause loss of control and kickback. • NEVER use tool with wood cutting blades and other saw blades. Such blades when used on a grinder frequently kick and cause loss of control leading to personal injury.
- After operation, always switch off the tool and wait until the wheel has come to a complete stop before putting the tool down.

ALWAYS hold the tool firmly with one hand on housing and the other on the side handle. Turn the tool on and then apply the wheel or disc to the work piece. In general, keep the edge of the wheel or disc at an angle of about 15 degrees to the work piece surface. During the break-in period with a new wheel, do not work the grinder in the B direction or it will cut into the work piece. Once the edge of the wheel has been rounded off by use, the wheel may not cut well in two directions

Tool Safety

Circular Saw

SPECIFIC SAFETY RULES

DO NOT let comfort or familiarity with product (gained from repeated use) replace strict adherence to circular saw safety rules. If you use this tool unsafely or incorrectly, you can suffer serious personal injury.

Danger:

1. Keep hands away from cutting area and the blade. Keep your second hand on auxiliary handle, or motor housing. If both hands are holding the saw, they cannot be cut by the blade.
2. Do not reach underneath the work piece. The guard cannot protect you from the blade below the work piece. Do not attempt to remove cut material when blade is moving. Blades coast after turn off. Wait until blade stops before grasping cut material.

CAUTION:

3. Adjust the cutting depth to the thickness of the work piece. Less than a full tooth of the blade teeth should be visible below the work piece.
4. Never hold piece being cut in your hands or across your leg. Secure the work piece to stable platform. It is important to support the work properly to minimize body exposure, blade binding, or loss of control. A typical illustration of proper hand support, work piece support, and supply cord routing (if applicable).
5. Hold power tool by insulated gripping surfaces when performing an operation where the cutting tool may contact hidden wiring or its own cord. Contact with a "live" wire will also make exposed metal parts of the power tool "live" and shock the operator.
6. When ripping always use a rip fence or straight edge guide. This improves the accuracy cut and reduces the chance of blade binding.
7. Always use blades with correct size and shape (diamond versus round) of arbor holes. Blades that do not match the mounting hardware of the saw will run eccentrically, causing loss of control.
8. Never use damaged or incorrect blade washers or bolt. The blade washers and bolt were specially designed for your saw, for optimum performance and safety of operation.
9. Causes and Operator Prevention of Kickback:
 - kickback is a sudden reaction to a pinched, bound or misaligned saw blade, causing an uncontrolled saw to lift up and out of the work piece toward the operator;
 - when the blade is pinched or bound tightly by the kerf closing down, the blade stalls and the motor reaction drives the unit rapidly back toward the operator;
 - if the blade becomes twisted or misaligned in the cut, the teeth at the back edge of the blade can dig into the top surface of the wood causing the blade to climb out of the kerf and jump back toward the operator.

Kickback is the result of saw misuse and/or incorrect operating procedures or conditions and can be avoided by taking proper precautions as given below.

Maintain a firm grip with both hands on the saw and position your arms to resist kickback forces. Position your body to either side of the blade, but not in line with the blade. Kickback could cause the

saw to jump backwards, but kickback forces can be controlled by the operator, if proper precautions are taken.

- When blade is binding, or when interrupting a cut for any reason, release the trigger and hold the saw motionless in the material until the blade comes to a complete stop. Never attempt to remove the saw from the work or pull the saw backward while the blade is in motion or kickback may occur. Investigate and take corrective actions to eliminate the cause of blade binding.
- When restarting a saw in the work piece, center the saw blade in the kerf and check that saw teeth are not engaged into the material. If saw blade is binding, it may walk up or kickback from the work piece as the saw is restarted.
- Support large panels to minimize the risk of blade pinching and kickback. Large panels tend to sag under their own weight. Supports must be placed under the panel on both sides, near the line of cut and near the edge of the panel.
- To minimize the risk of blade pinching and kickback, when cutting operation requires the resting of the saw on the work piece, the saw should be rested on the larger portion and the smaller piece cut off.
- To avoid kickback, do support board or panel near the cut.
- Do not use dull or damaged blades. Unsharpened or improperly set blades produce narrow kerf causing excessive friction, blade binding and kickback. Keep blade sharp and clean. Gum and wood pitch hardened on blades slows saw and increases potential for kickback. Keep blade clean by first removing it from tool, then cleaning it with gum and pitch remover, hot water or kerosene. Never use gasoline.
- Blade depth and bevel adjusting locking levers must be tight and secure before making cut. If blade adjustment shifts while cutting, it may cause binding and kickback.
- Use extra caution when making a "plunge cut" into existing walls or other blind areas. The protruding blade may cut objects that can cause kickback. For plunge cuts, retract lower guard using retracting handle.
- ALWAYS hold the tool firmly with both hands. NEVER place your hand or fingers behind the saw. If kickback occurs, the saw could easily jump backwards over your hand, leading to serious personal injury.
- Never force the saw. Forcing the saw can cause uneven cuts, loss of accuracy, and possible kickback. Push the saw forward at a speed so that the blade cuts without slowing.

10. Check lower guard for proper closing before each use. Do not operate the saw if lower guard does not move freely and close instantly. Never clamp or tie the lower guard into the open position. If saw is accidentally dropped, lower guard may be bent. Raise the lower guard with the retracting handle and make sure it moves freely and does not touch the blade or any other part, in all angles and depths of cut. To check lower guard, open lower guard by hand, then release and watch guard closure. Also check to see that retracting handle does not touch tool housing. Leaving blade exposed is VERY DANGEROUS and can lead to serious personal injury.

11. Check the operation of the lower guard spring. If the guard and the spring are not operating properly, they must be serviced before use. Lower guard may operate sluggishly due to damaged parts, gummy deposits, or a build-up of debris.

12. Lower guard should be retracted manually only for special cuts such as "plunge cuts" and "compound cuts." Raise lower guard by retracting handle and as soon as blade enters the material, the lower guard must be released. For all other sawing, the lower guard should operate automatically.

13. Always observe that the lower guard is covering the blade before placing saw down on bench or floor. An unprotected, coasting blade will cause the saw to walk backwards, cutting whatever is in its

path. Be aware of the time it takes for the blade to stop after switch is released. Before setting the tool down after completing a cut, be sure that the lower guard has closed and the blade has come to a complete stop.

14. Use extra caution when cutting damp wood, pressure treated lumber, or wood containing knots.

Adjust speed of cut to maintain smooth advancement of tool without decrease in blade speed.

15. Avoid Cutting Nails. Inspect for and remove all nails from lumber before cutting.

16. Place the wider portion of the saw base on that part of the workpiece which is solidly supported, not on the section that will fall off when the cut is made.

17. Never attempt to saw with the circular saw held upside down in a vise. This is extremely dangerous and can lead to serious accidents.

18. Some material contains chemicals which may be toxic. Take caution to prevent dust inhalation and skin contact. Follow material supplier safety data.

19. Do not stop the blades by lateral pressure on the saw blade.

20. Always use blades recommended in this manual. Do not use any abrasive wheels. 21. Wear a dust mask and hearing protection when use the tool.

SAFETY NOTICE:

WARNING statements describe conditions that may lead to personnel injury including potentially fatal injuries if the machine is not properly used and warnings are not properly followed.

Caution statements describe conditions that may lead to equipment damage. Electrical shock can cause serious or fatal injury. Only qualified personnel should install, maintain or troubleshoot this equipment.

WARNING:

- Do not operate this grinder until you are sure that you are completely familiar with the safe operation of the grinder, all accessories and safety equipment. Improper use can lead to severe injury. This manual defines proper use of this equipment. Before using this equipment for any other use, please consult Baldor. Contact Baldor if you do not understand any procedure or operation concerning this grinder or this manual.
- Prevent electrical shock hazard and accidental machine operation. Always disconnect grinder from the power source before servicing, changing accessories (such as wheels, tool rest, spark arrestor, etc.) or before performing maintenance.
- Avoid accidental starting. Make sure switch is in "OFF" position before connecting to power source.
- Be sure the system is properly grounded before applying power. Do not apply power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. Follow the National Electrical Code (NEC) and local codes for the safe installation of this equipment.
- Always use safety glasses with side shields (or full face shield) when operating grinder. Do not use ordinary eyeglasses. Also use face or dust mask if cutting operation is dusty.
- Unsuitable accessories or attachments added to this machine can create hazards. Baldor accessories are specifically designed to be used with this grinder. Use accessories or attachments only in the proper intended manner. Accessories or attachments obtained from another source may cause hazards. Consult the manufacturer before use.
- Keep guards in place and in working order. Guards are design to prevent injury. Never operate this equipment if a guard is damaged, missing or improperly installed.

- Remove adjusting keys and wrenches from this product after use. Check to see that keys and adjusting wrenches are removed from grinder before turning it on. Projectiles can cause severe injury to yourself or others.
- Keep work area clean and well lighted. Clutter and poor lighting invites accidents.
- Don't use in dangerous environment. Don't use grinders in damp or wet locations, or expose them to rain. Electrical shock can cause serious or fatal injury. Follow the National Electrical Code (NEC) and local codes for the safe installation of this equipment.
- Do not wear loose clothing, neckties, rings, bracelets, or other jewelry to get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.
- Don't over reach. Keep proper footing and balance at all times. A rotating wheel or belt can catch an article of clothing and cause personnel injury.
- Secure work. Use clamps to secure the work piece when practical. It's safer than using your hand and it keeps hands away from wheel.
- When starting a grinder for the first time, or after installing a replacement grinding wheel, it is most important that the operator stand aside for at least one minute of rotation at full speed. This is the correct practice since grinding wheels can disintegrate if they have received damage during shipping or handling.
- Always have the grinder switch in the "OFF" position when changing the position of the pivot arm. Do not attempt to change the pivot arm position while the belt is moving as this will create a hazardous situation for the operator.
- Never install a wheel that is damaged, such as a chip or crack on any surface. A damaged wheel can disintegrate while rotating at a high RPM or when work is placed against the wheel. This can severely harm the operator or others in the area.
- Check damaged parts. Before further use of the grinder, a guard or other part that is damaged should be carefully checked to assure that it will operate properly and perform its intended function. Check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.
- Use proper extension cord. Make sure your extension cord is in good condition. When using an extension cord, be sure it is rated for the voltage and current rating of your product. An undersized cord will cause a drop in line voltage resulting in loss of power and overheating. Table 1 shows the correct wire size to use depending on cord length and nameplate ampere rating. If in doubt, use the next heavier gauge. The smaller the AWG gauge number, the heavier the cord.
- Dust created during grinding, sawing, power sanding, drilling, and other activities may contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.
- Keep children and visitors away. Remove starter keys turn off master switches. Padlock equipment or work area when not in use.
- Never leave grinder running unattended. Always turn power off after use.

Caution

- Don't force grinder. It will do the job better and safer at the feed rate for which it was designed.
- Use right tool. Don't force tool or attachment to do a job for which it was not designed.

- Maintain grinder with care. Keep grinder clean for best and safest performance. Always use guard and eye shield. Operating the grinder without the guard and eye shield or with damaged guard and eye shield must not be attempted because of the hazard this introduces.
- Do not over tighten wheel nut. A damaged grinding wheel can disintegrate in all directions. An over tightened wheel nut can stress the grinding wheel and cause it to disintegrate during operation. Wheel nut should be tightened just enough to prevent grinding wheel from slipping on shaft when grinding. Use only flanges furnished with this grinder. The flanges furnished with the grinder are designed to grip the grinding wheel without introducing excessive stresses in the wheel.
- Replace a cracked or chipped wheel immediately. A cracked wheel will disintegrate when operated, causing a hazard to operator and nearby personnel. If a wheel has a chip or crack on any surface, do not use it.
- Maintain $1/8$ or less clearance between tool rest and wheel. This clearance is necessary to prevent the work piece from becoming wedged between the wheel and tool rest and restricting nip areas in the machine.
- Grind on grinding face (periphery) of wheels only. Grinding on side of wheel weakens the wheel and may cause wheel breakage. Also, grinding on the side of wheel introduces an additional hazard due to absence of a tool rest.

Tool Safety

Combo Sander

WARNINGS

As with all machines, there is a certain amount of hazard involved with the use of this sander. Use the machine with the respect and caution demanded where safety precautions are concerned. When normal safety precautions are overlooked or ignored, personal injury to the operator can result.

Read, understand and follow the safety and operating instructions found in this manual. Know the limitations and hazards associated with this machine.

Electrical grounding - Make certain that the machine frame is electrically grounded and that a ground lead is included in the incoming electrical service. In cases where a cord and plug are used, make certain that the grounding plug connects to a suitable ground. Follow the grounding procedure indicated in the National Electrical Code.

Eye safety - Wear an approved safety shield, goggles, or glasses to protect eyes. (NOTE: Common eyeglasses are only impact-resistant, they are not safety glasses.)

Personal protection - Before operating the machine, remove tie, rings, watch and other jewelry and roll up sleeves above the elbows. Remove all loose outer clothing and confine long hair. Protective type footwear should be used. Where the noise exceeds the level of exposure allowed in Section 1910.95 of the OSHA Regulations, use hearing protective devices. Do not wear gloves.

Guards - Keep the machine guards in place at all times when the machine is in use. If removed for maintenance purposes, use extreme caution and replace guards on completion of the maintenance task before operating the sander. DO NOT operate the machine with the guards off except for the belt end guard which swings away to allow for contour sanding. Keep that guard in place except when contour sanding and swing it back into position immediately after completing the contour sanding task.

Work area - Keep the floor around the machine clean and free of scrap material, saw dust, oil and other liquids to minimize the danger of tripping or slipping. Make certain the work area is well lighted and that a proper exhaust system is used to minimize dust. Powermatic recommends the use of anti-skid floor strips on the floor area where the operator normally stands and that each machine's work area be marked off.

Provide adequate work space around the machine.

Avoid accidental starting: Make certain motor switch is in off position before connecting power to the machine.

Operator position - Maintain a balanced stance and keep your body under control at all times. Do not over-reach. Do not stand in line with the belt in the direction that it is moving when the work stop is not in use.

Belt and Disc Direction - Proper belt direction is from the idler pulley towards the drive pulley. Proper disc rotation is counterclockwise facing the disc.

CAUTION: Sand on the section of the disc from the center to the left edge. DO NOT use the right hand portion for sanding.

Housekeeping - Before turning on machine, remove all extra equipment such as keys, wrenches, scrap, and cleaning rags away from the machine.

Careless acts. Give the work you are doing your undivided attention. Looking around, carrying on a conversation, and "horseplay" are careless acts that can result in serious injury.

Disconnect machine before performing any service or maintenance.

Hand safety - Keep fingers and hands away from the belt or disc. DO NOT clear sawdust from the table with the hands; use a brush. On small or thin parts, use a push stick or jig to keep the hands from contacting the abrasive. If using the fence, avoid getting fingers too close to the fence to prevent pinching.

Never wear gloves while operating the sander.

Machine capacity - Do not try to force the sander to remove material faster than the power available from the drive motor. The use of light pressure on either disc or belt sanding and moving the part back and forth will maximize belt or disc life, help to minimize the chances of an accident and keep the force within the capacity of the drive motor.

Machine adjustments - Make all machine adjustments with power off except belt tracking. Belt tracking should be checked manually before starting the sander, but final adjustment may have to be made after starting up the sander.

Table safety - Be sure the table is locked in position before placing stock on it and that its front edge is within 1/16" or less, of the disc or belt.

Job completion - If the operator leaves the machine area for any reason, the sander should be turned "off" and the abrasive belt and disc should come to a complete stop before his/her departure. In addition, if the operation is complete, he should clean the sander and the work area. Never clean the sander with power "on" and never use the hands to clear sawdust and debris; use a brush.

If you are not thoroughly familiar with the operation of sanders, obtain advice from your supervisor, instructor or other qualified person.

Drugs, alcohol, medication - Do not operate this machine while under the influence of drugs, alcohol, or any medication.

Health hazards - Some dust created by power sanding, sawing, grinding, drilling and other construction activities contains chemicals known to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:

* Lead from lead-based paint.

* Crystalline silica from bricks and cement and other masonry products.* Arsenic and chromium from chemically-treated lumber.

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals, work in a well-ventilated area, and work with approved safety equipment, such as those dust masks that are specifically designed to filter out microscopic particles.

Familiarize yourself with the following safety notices used in this manual:

Caution

This means that if precautions are not heeded, it may result in minor injury and/or possible machine damage.

Keep in mind that abrasive sanding develops heat, so burns can occur on wood if you try to remove material too fast. With metal, it may be necessary to have a container of water nearby to keep the work piece cool enough to hold it by hand.

Warning

This means that if precautions are not heeded, it may result in serious or possibly even fatal injury.

Read and understand the entire contents of this manual before attempting set-up or operation! Failure to comply may cause serious injury.

Belt Grinding and Polishing

- NEVER run an abrasive belt on unfamiliar machinery.
- USE workplace fixtures whenever possible: a secured workpiece affords some protection if workplace jamming occurs.
- ADEQUATE exhaust/ventilation systems should be used to avoid inhalation of dust particles due to grinding operations.
- DO NOT use machinery for purposes other than intended in their design.
- ALWAYS check grinder spindle for run-out (wobble), contact wheel for balance, face trueness and run-out, and idler pulley for run-out balance.
- INSPECT machinery for safe operating conditions: the abrasive belt, idler assembly and contact wheel should be enclosed within sheet metal hood; adjustable deflector should be installed within ¼" of abrasive belt working surface: employ special precautions with inflammable or other hazardous materials.

Tool Safety

Portable Cut Off Saw (Chop saw)

SPECIFIC SAFETY RULES

DO NOT let comfort or familiarity with product (gained from repeated use) replace strict adherence to portable cut-off safety rules. If you use this tool unsafely or incorrectly, you can suffer serious personal injury.

1. Wear hearing protection during extended periods of operation.
2. Use only wheels having a maximum operating speed at least as high as “No Load RPM” marked on the tool’s nameplate. Use only fiberglass-reinforced cut-off wheels.
3. Check the wheel carefully for cracks or damage before operation. Replace cracked or damaged wheel immediately. Run the tool (with guard) at no load for about a minute, keeping tool away from others. If wheel is flawed, it will likely separate during this test.
4. Secure the wheel carefully.
5. Use only flanges specified for this tool.
6. Be careful not to damage the spindle, the flange (especially the installing surface) or the bolt. Damage to these parts could result in wheel breakage.
8. Hold the handle firmly.
9. Keep hands away from rotating parts.
10. Make sure the wheel is not contacting the work piece before the switch is turned on.
11. Before using the tool on an actual work piece, let it run for a while. Watch for vibration or wobbling that could indicate poor installation or a poorly balanced wheel.
12. Watch out for flying sparks when operating. They can cause injury or ignite combustible materials.
13. Remove material debris from the area that might be ignited by sparks. Be sure that others are not in the path of the sparks. Keep a properly charged extinguisher closely available.
14. Use the cutting edge of the wheel only. Never use side surface.
15. Do not attempt to keep the trigger in the ON position.
16. If the wheel stops during operation, makes an odd noise or begins to vibrate, switch off the tool immediately.
17. Turn off the tool and wait for the wheel to stop before moving work piece or changing settings.
18. Do not touch the work piece immediately after operation; it is extremely hot and could burn your skin.

Safety Rules

Drill Press

Basic Operation

Always use a back-up piece of scrap wood to cover the table. This protects both the table and the drill bit.

Place material to be drilled in such a way as to come into contact with the left side of the column. This prevents the material from spinning.

WARNING!

If the work piece is not large enough to come into contact with the column, use a clamp or drill press vise that is securely fastened to the table! Failure to comply may cause serious injury!

Feed the bit into the material with only enough force to allow the drill bit to work. Feeding too slowly may cause burning of the work piece. Feeding too quickly may cause the motor to stop and/or the drill bit to break.

Generally speaking, the smaller the drill bit, the greater the RPM required. Wood requires higher speeds than metal. Metal is usually drilled at slower speeds.

In dusty environments frequently blow out any dust that accumulates inside the motor.

Lubrication

Periodically lubricate the gear and the rack, the table elevation mechanism, the splines (grooves) in the spindle, and the teeth of the quill with #2 tube grease.

WARNING

- Wear eye protection.
- Always keep guards in place and in proper operating condition. Do not operate the machine without the guards for any reason.
- Support work piece adequately at all times during operation; maintain control of work at all times.
- This drill press is designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper and safe operation of a drill press, do not use until proper training and knowledge has been obtained.

REMOVE ADJUSTING KEYS AND WRENCHES. Form a habit of checking to see that keys and adjusting wrenches are removed from the machine before turning it on.

KEEP THE WORK AREA CLEAN. Cluttered areas and benches invite accidents.

DON'T USE IN A DANGEROUS ENVIRONMENT. Don't use power tools in damp or wet locations, or expose them to rain. Keep work area well lighted.

KEEP CHILDREN AWAY. All visitors should be kept a safe distance from the work area.

MAKE THE WORKSHOP KIDPROOF with padlocks, master swatches, or by removing starter keys.

DON'T FORCE THE MACHINE. It will do the job better and safer at the rate for which it was designed.

USE THE RIGHT TOOL. Don't force a machine or attachment to do a job for which it was not designed.

USE THE PROPER EXTENSION CORD. Make sure your extension cord is in good condition.

When using an extension cord, be sure to use one heavy enough to carry the current your machine will draw. An undersized cord will cause a drop in the line voltage resulting in power loss and overheating. The table following shows the correct size to use depending on the cord length and nameplate ampere rating. If in doubt, use the next heavier gauge. Remember, the smaller the gauge number, the heavier the cord.

WEAR PROPER APPAREL. Do not wear loose clothing, gloves, neckties, rings, bracelets, or other jewelry which may get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.

ALWAYS USE SAFETY GLASSES. Also use face or dust masks if the cutting operation is dusty. Everyday eyeglasses only have impact resistant lenses; they are not safety glasses.

DON'T OVERREACH. Keep proper footing and balance at all times.

MAINTAIN TOOLS WITH CARE. Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.

ALWAYS DISCONNECT THE MACHINE FROM THE POWER SOURCE BEFORE SERVICING.

REDUCE THE RISK OF UNINTENTIONAL STARTING. Make sure the switch is in the off position before plugging in.

USE RECOMMENDED ACCESSORIES. The use of accessories and attachments not recommended by JET may cause hazards or risk of injury to persons.

NEVER STAND ON A MACHINE. Serious injury could occur if the machine is tipped.

CHECK DAMAGED PARTS. Before further use of the machine, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function - check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

NEVER LEAVE THE MACHINE RUNNING UNATTENDED. TURN POWER OFF. Don't leave the machine until it comes to a complete stop.

SOME DUST CREATED by power sanding, sawing, grinding, drilling and other construction activities contains chemicals known to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:

Lead from lead based paint, crystalline silica from bricks and cement and other masonry products, and arsenic and chromium from chemically-treated lumber. Your risk from those exposures varies,

depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specifically designed to filter out microscopic particles.

DO NOT operate tool while under the influence of drugs, alcohol or any medication.

DO NOT drill pieces of material that are too small to be safely supported.

WHEN drilling a large work piece, provide additional support at table height.

ADDITIONAL INFORMATION regarding the safe and proper operation of this product is available from the National Safety Council, 1121 Spring Lake Drive, Itasca, IL 60143-3201, in the Accident Prevention Manual for Industrial Operations and also in the safety Data Sheets provided by the NSC. Please also refer to the American National Standards Institute ANSI 01.1 Safety Requirements for Woodworking Machinery and the U.S. Department of Labor OSHA 1910.213 Regulations.

General Power Tool Safety

WARNING Read all safety warnings and all instructions. Failure to follow the warnings and instructions may result in electric shock, fire and/or serious injury.

Save all warnings and instructions for future reference.

The term "power tool" in the warnings refers to your (corded) power tool or battery-operated (cordless) power tool.

Work area safety

1. Keep work area clean and well lit. Cluttered or dark areas invite accidents.
2. Do not operate power tools in explosive atmospheres, such as in the presence of flammable liquids, gases or dust. Power tools create sparks which may ignite the dust or fumes.
3. Keep children and bystanders away while operating a power tool. Distractions can cause you to lose control.

Electrical Safety

4. Power tool plugs must match the outlet. Never modify the plug in any way. Do not use any adapter plugs with earthed (grounded) power tools. Unmodified plugs and matching outlets will reduce risk of electric shock.
5. Avoid body contact with earthed or grounded surfaces such as pipes, radiators, ranges and refrigerators. There is an increased risk of electric shock if your body is earthed or grounded.
6. Do not expose power tools to rain or wet conditions. Water entering a power tool will increase the risk of electric shock.
7. Do not abuse the cord. Never use the cord for carrying, pulling or unplugging the power tool. Keep cord away from heat, oil, sharp edges or moving parts. Damaged or entangled cords increase the risk of electric shock.
8. When operating a power tool outdoors, use an extension cord suitable for outdoor use. Use of a cord suitable for outdoor use reduces the risk of electric shock.
9. If operating a power tool in a damp location is unavoidable, use a ground fault circuit interrupter (GFCI) protected supply. Use of a GFCI reduces the risk of electric shock.

Personal Safety

10. Stay alert, watch what you are doing and use common sense when operating a power tool. Do not use a power tool while you are tired or under the influence of drugs, alcohol or medication. A moment of inattention while operating power tools may result in serious personal injury.
11. Use personal protective equipment. Always wear eye protection. Protective equipment such as dust mask, non-skid safety shoes, hard hat, or hearing protection used for appropriate conditions will reduce personal injuries.
12. Prevent unintentional starting. Ensure the switch is in the off-position before connecting to power source and/or battery pack, picking up or carrying the tool. . Carrying power tools with your finger on the switch or energizing power tools that have the switch on invites accidents.

13. Remove any adjusting key or wrench before turning the power tool on. A wrench or a key left attached to a rotating part of the power tool may result in personal injury.
14. Do not overreach. Keep proper footing and balance at all times. This enables better control of the power tool in unexpected situations.
15. Dress properly. Do not wear loose clothing or jewelry. Keep your hair, clothing, and gloves away from moving parts. Loose clothes, jewelry or long hair can be caught in moving parts.
16. If devices are provided for the connection of dust extraction and collection facilities, ensure these are connected and properly used. Use of dust collection can reduce dust-related hazards.

Power tool use and care

17. Do not force the power tool. Use the correct power tool for your application. The correct power tool will do the job better and safer at the rate for which it was designed.
18. Do not use the power tool if the switch does not turn it on and off. Any power tool that cannot be controlled with the switch is dangerous and must be repaired.
19. Disconnect the plug from the power source and/or the battery pack from the power tool before making any adjustments, changing accessories, or storing power tools. Such preventive safety measures reduce the risk of starting the power tool accidentally.
20. Store idle power tools out of the reach of children and do not allow persons unfamiliar with the power tool or these instructions to operate the power tool. Power tools are dangerous in the hands of untrained users.
21. Maintain power tools. Check for misalignment or binding of moving parts, breakage of parts and any other condition that may affect the power tool's operation. If damaged, have the power tool repaired before use. Many accidents are caused by poorly maintained power tools.
22. Keep cutting tools sharp and clean. Properly maintained cutting tools with sharp cutting edges are less likely to bind and are easier to control.
23. Use the power tool, accessories and tool bits etc. in accordance with these instructions, taking into account the working conditions and the work to be performed. Use of the power tool for operations different from those intended could result in a hazardous situation.

SERVICE

24. Have your power tool serviced by a qualified repair person using only identical replacement parts. This will ensure that the safety of the power tool is maintained.
25. Follow instruction for lubricating and changing accessories.
26. Keep handles dry, clean and free from oil and grease.

USE PROPER EXTENSION CORD. Make sure your extension cord is in good condition. When using an extension cord, be sure to use one heavy enough to carry the current your product will draw. An undersized cord will cause a drop in line voltage resulting in loss of power and overheating. Table 1 shows the correct size to use depending on cord length and nameplate ampere rating. If in doubt, use the next heavier gage. The smaller the gage number, the heavier the cord.

Tool Safety

Horizontal Band Saw

The Wilton Models 7020/7040 Horizontal Cut-Off Bandsaws are ruggedly built, precision machines designed for either wet or dry applications. The 2 HP motor along with the worm gear reduction drive train in an oil bath, transmits smooth and positive power to the blade. This drive system coupled with the recirculating coolant system keeps the blade running cool and true, which results in longer blade life.

- Misuse of this machine can cause serious injury.
- For safety, machine must be set up, used and serviced properly.
- Read, understand and follow instructions in the Operating Instructions and Parts Manual which was shipped with your machine.

When Setting up Machine:

- Always avoid using machine in damp or poorly lighted work areas.
- Always be sure the machine support is securely anchored to the floor or the work bench.

When Using Machine: - Always wear safety glasses with side shields (See ANSI Z87.1)

- Never wear loose clothing or jewelry.
- Never overreach - you may slip and fall.

When Servicing Machine:

- Always disconnect the machine from its electrical supply while servicing.
- Always follow instructions in Operating Instructions and Parts Manual when changing accessory tools or parts.
- Never modify the machine without consulting Wilton Corporation.

You - the Stationary Power Tool User – Hold the Key to Safety.

Read and follow these simple rules for best results and full benefits from your machine. Used properly, Wilton's machinery is among the best in design and safety. However, any machine used improperly can be rendered inefficient and unsafe. It is absolutely mandatory that those who use our products be properly trained in how to use them correctly. They should read and understand the Operating Instructions and Parts Manual as well as all labels affixed to the machine. Failure in following all of these warnings can cause serious injuries.

Machinery General Safety Warnings

1. Always wear protective eye wear when operating machinery. Eye wear shall be impact resistant, protective safety glasses with side shields which comply with ANSI Z87.1 specifications. Use of eye wear which does not comply with ANSI Z87.1 specifications could result in severe injury from breakage of eye protection.
 2. Wear proper apparel. No loose clothing or jewelry which can get caught in moving parts. Rubber soled footwear is recommended for best footing.
 3. Do not overreach. Failure to maintain proper working position can cause you to fall into the machine or cause your clothing to get caught pulling you into the machine.
 4. Keep guards in place and in proper working order.
- Do not operate the machine with guards removed.

5. Avoid dangerous working environments. Do not use stationary machine tools in wet or damp locations. Keep work areas clean and well lit.
6. Avoid accidental starts by being sure the start switch is OFF before plugging in the machine.
7. Never leave the machine running while unattended. Machine shall be shut off whenever it is not in operation.
8. Disconnect electrical power before servicing. Whenever changing accessories or general maintenance is done on the machine, electrical power to the machine must be disconnected before work is done.
9. Maintain all machine tools with care. Follow all maintenance instructions for lubricating and the changing of accessories. No attempt shall be made to modify or have makeshift repairs done to the machine. This not only voids the warranty but also renders the machine unsafe.
10. Machinery must be anchored to the floor.
11. Secure work. Use clamps or a vise to hold work, when practical. It is safer than using your hands and it frees both hands to operate the machine.
12. Never brush away chips while the machine is in operation.
13. Keep work area clean. Cluttered areas invite accidents.
14. Remove adjusting keys and wrenches before turning machine on.
15. Use the right tool. Don't force a tool or attachment to do a job it was not designed for.
16. Use only recommended accessories and follow manufacturer's instructions pertaining to them.
17. Keep hands in sight and clear of all moving parts and cutting surfaces.
18. All visitors should be kept at a safe distance from the work area. Make workshop completely safe by using padlocks, master switches, or by removing starter keys.
19. Know the tool you are using — its application, limitations, and potential hazards

Safety Instructions on Sawing Systems

1. Always wear leather gloves when handling saw blade. The operator shall not wear gloves when operating the machine.
2. All doors shall be closed, all panels replaced, and other safety guards in place prior to the machine being started or operated.
3. Be sure that the blade is not in contact with the work piece when the motor is started. The motor shall be started and you should allow the saw to come up to full speed before bringing the saw blade into contact with the work piece.
4. Keep hands away from the blade area.
5. Remove any cut off piece carefully while keeping your hands free of the blade area.
6. Saw must be stopped and electrical supply must be cut off before any blade replacement or adjustment of blade support mechanism is done, or before any attempt is made to change the drive belts or before any periodic service or maintenance is performed on the saw.
7. Remove all loose items and unnecessary work pieces from the area before starting machine.
8. Bring adjustable saw guides and guards as close as possible to the work piece.
9. Always wear protective eye wear when operating, servicing, or adjusting machinery. Eyewear shall be impact resistant, protective safety glasses with side shields complying with ANSI Z87.1 specifications. Use of eye wear which does not comply with ANSI Z87.1 specifications could result in severe injury from breakage of eye protection.
10. Nonslip footwear and safety shoes are recommended.
11. Wear ear protectors (plugs or muffs) during extended periods of operation.
12. The work piece, or part being sawed, must be securely clamped before the saw blade enters the work piece.
13. Remove cut off pieces carefully, keeping hands away from saw blade.

14. Saw must be stopped and electrical supply disconnected before reaching into cutting area.
15. Avoid contact with coolant, especially guarding your eyes.
16. Wait for the blade to finish the cut. The motor will stop and the coolant will stop flowing.
17. Drain coolant back into the saw, from hollow pieces.
18. Wipe up all coolant spills.
19. When completing cuts: all chips and scrap must be removed, excess coolant should be wiped from the machine, and if necessary mop spilled coolant on the floor.

Operating Instructions Controls

Setting Blade Speed

1. The blade speed is controlled by an adjustment mechanism on the right end of the saw. Speed increases when the adjustment knob is turned counterclockwise. Speed decreases when the knob is turned clockwise.
2. A placard on the drive belt guard provides recommended speeds for various materials.
3. A speed indicator is provided on the barrel of the adjustment mechanism. The indicator provides speed indications in feet per minute and meters per minute. (The meters per minute values are shown in parenthesis on the indicator.)
4. The feed rates on the placard are expressed in meters per minute. The feed rate graduations available on the indicator may not match the recommended feed rate. An approximate speed may therefore be required. For example, to set a speed rate of 25 meters per minute, the indicator would be set about midway between 21 meters per-minute and the 30 meters-per-minute graduations.

WARNING: TO CHANGE SPEED, THE SAW MOTOR MUST BE OPERATING.

5. Turn the speed adjustment knob to the desired rate setting as determined by the material being cut.

Speed and feed adjustments are sometime better left to the more experienced.

Tool Safety

LATHE

Warnings

This manual is intended to familiarize you with the technical aspects of this milling machine. It is not, nor was it intended to be, a training manual.

These lathes are designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper and safe operation of a lathe, do not use until proper training and knowledge have been obtained.

1. Read and understand the entire instruction manual before attempting set-up or operation of this machine.
2. Always wear approved safety glasses/face shields while using this machine.
3. Make certain the machine is properly grounded.
4. Before operating the machine, remove tie, rings, watches, other jewelry, and roll up sleeves above the elbows. Remove all loose clothing and confine long hair. Do not wear gloves.
5. Keep the floor around the machine clean and free of scrap material, oil and grease.
6. Keep machine guards in place at all times when the machine is in use. If removed for maintenance purposes, use extreme caution and replace the guards immediately.
7. Do not over reach. Maintain a balanced stance at all times so that you do not fall or lean against blades or other moving parts.
8. Make all machine adjustments or maintenance with the machine unplugged from the power source.
9. Use the right tool. Don't force a tool or attachment to do a job which it was not designed for.
10. Replace warning labels if they become obscured or removed.
11. Make certain the motor switch is in the OFF position before connecting the machine to the power supply.
12. Give your work undivided attention. Looking around, carrying on a conversation and "horse-play" are careless acts that can result in serious injury.
13. Keep visitors a safe distance from the work area.
14. Use recommended accessories; improper accessories may be hazardous.
15. Keep hands away from all moving parts (belts, cutters, gears, etc.).
16. Never operate this machine under the influence of alcohol or drugs.
17. Read and understand all warnings posted on the machine.
18. This manual is intended to familiarize you with the technical aspects of this milling machine. It is not, nor was it intended to be, a training manual.
19. This machine is designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper safe use of milling machines, do not use this machine until proper training and knowledge has been obtained.
20. Failure to comply with all of these warnings may cause serious injury.

WARNING Read and understand the entire instruction manual before attempting assembly or operation.

- These lathes are designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper and safe operation of a lathe, do not use until proper training and knowledge have been obtained.

- Always wear approved safety glasses/face shields while using this machine.
- Make certain the machine is properly grounded.
- Before operating the machine, remove tie, rings, watches, other jewelry, and roll up sleeves above the elbows. Remove all loose clothing and confine long hair. Do not wear gloves.
- Keep the floor around the machine clean and free of scrap material, oil and grease.
- Keep machine guards in place at all times when the machine is in use. If removed for maintenance purposes, use extreme caution and replace the guards immediately.
- Do not over reach. Maintain a balanced stance at all times so that you do not fall or lean against blades or other moving parts.
- Make all machine adjustments or maintenance with the machine unplugged from the power source.
- Use the right tool. Don't force a tool or attachment to do a job which it was not designed.
- Replace warning labels if they become obscured or removed.
- Make certain the main power switch is in the OFF position before connecting the machine to the power supply.
- Give your work undivided attention. Looking around, carrying on a conversation and "horseplay" are careless acts that can result in serious injury.
- Keep visitors a safe distance from the work area.
- Use recommended accessories; improper accessories may be hazardous.
- Make a habit of checking to see that keys and adjusting wrenches are removed before turning on the machine.
- Never attempt any operation or adjustment if the procedure is not understood.
- Keep fingers away from revolving parts and cutting tools while in operation.
- Keep belt guard in place and in working order.
- Never force the cutting action.
- Do not attempt to adjust or remove tools during operation.
- Always keep cutters sharp.
- Never operate this machine under the influence of alcohol or drugs.
- Failure to comply with all of these warnings may cause serious injury

Tool Safety

Mill

WARNING

Read and understand the entire instruction manual before attempting set-up or operation of this machine.

1. This machine is designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper safe use of milling machines, do not use this machine until proper training and knowledge has been obtained.
2. Always wear approved safety glasses/face shields while using this machine.
3. Make certain the machine is properly grounded.
4. Before operating the machine, remove tie, rings, watches, other jewelry, and roll up sleeves above the elbows. Remove all loose clothing and confine long hair. Do not wear gloves.
5. Keep the floor around the machine clean and free of scrap material, oil and grease.
6. Keep machine guards in place at all times when the machine is in use. If removed for maintenance purposes, use extreme caution and replace the guards immediately.
7. Do not over reach. Maintain a balanced stance at all times so that you do not fall or lean against blades or other moving parts.
8. Make all machine adjustments or maintenance with the machine unplugged from the power source.
9. Use the right tool. Don't force a tool or attachment to do a job which it was not designed for.
10. Replace warning labels if they become obscured or removed.
11. Make certain the motor switch is in the OFF position before connecting the machine to the power supply.
12. Give your work undivided attention. Looking around, carrying on a conversation and "horse-play" are careless acts that can result in serious injury.
13. Keep visitors a safe distance from the work area.
14. Use recommended accessories; improper accessories may be hazardous.
15. Keep hands away from all moving parts (belts, cutters, gears, etc.).
16. Never operate this machine under the influence of alcohol or drugs.
17. Read and understand all warnings posted on the machine.
18. This manual is intended to familiarize you with the technical aspects of this milling machine. It is not, nor was it intended to be, a training manual.
20. Failure to comply with all of these warnings may cause serious injury.

WARNING

Keep people a safe distance away from the milling machine while it is being operated.

CAUTION!

Do not operate the mill before lubricating the machine fully. Failure to comply may result in damage to the machine.

Tool Safety

Miter Saw Warnings

1. **KNOW YOUR POWER TOOL.** Read the owner's manual carefully. Learn the tool's applications and limitations, as well as the specific potential hazards peculiar to it.
2. **KEEP GUARDS IN PLACE** and in working order.
3. **REMOVE ADJUSTING KEYS AND WRENCHES.** Form habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
4. **KEEP WORK AREA CLEAN.** Cluttered areas and benches invite accidents.
5. **DON'T USE IN DANGEROUS ENVIRONMENT.**
Don't use power tools in damp or wet locations, or expose them to rain. Keep work area well lighted. Don't use tool in presence of flammable liquids or gases.
6. **KEEP CHILDREN AWAY.** All visitors should be kept safe distance from work area.
7. **MAKE WORKSHOP KID PROOF** with padlocks, master switches, or by removing starter keys.
8. **DON'T FORCE TOOL.** It will do the job better and safer at the rate for which it was designed.
9. **USE RIGHT TOOL.** Don't force tool or attachment to do a job for which it was not designed.
10. **WEAR PROPER APPAREL.** Do not wear loose clothing, gloves, neckties, rings, bracelets, or other jewelry which may get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.
11. **ALWAYS USE SAFETY GLASSES.** Also use face or dust mask if cutting operation is dusty. Everyday eyeglasses only have impact resistant lenses, they are NOT safety glasses.
12. **SECURE WORK.** Use clamps or a vise to hold work when practical. It's safer than using your hand and it frees both hands to operate tool.
13. **DON'T OVERREACH.** Keep proper footing and balance at all times.
14. **MAINTAIN TOOLS WITH CARE.** Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.
15. **DISCONNECT TOOLS** before servicing; when changing accessories such as blades, bits, cutters, and the like.
16. **REDUCE THE RISK OF UNINTENTIONAL STARTING.** Make sure switch is in off position before plugging in.
17. **USE RECOMMENDED ACCESSORIES.** Consult the owner's manual for recommended accessories. The use of improper accessories may cause risk of injury to persons.
18. **NEVER STAND ON TOOL.** Serious injury could occur if the tool is tipped or if the cutting tool is unintentionally contacted.
19. **CHECK DAMAGED PARTS.** Before further use of the tool, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function – check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.
20. **DIRECTION OF FEED.** Feed work into a blade or cutter against the direction of rotation of the blade or cutter only.
21. **NEVER LEAVE TOOL RUNNING UNATTENDED. TURN POWER OFF.** Don't leave tool until it comes to a complete stop.
22. **REPLACEMENT PARTS.** When servicing use only identical replacement parts.
23. **POLARIZED PLUGS.** To reduce the risk of electric shock, this equipment has a polarized plug (one blade is wider than the other). This plug will fit in a polarized outlet only one way. If the plug does not fit

fully in the outlet, reverse the plug. If it still does not fit, contact a qualified electrician to install the proper outlet. Do not change the plug in any way.

VOLTAGE WARNING: Before connecting the tool to a power source (receptacle, outlet, etc.) be sure the voltage supplied is the same as that specified on the nameplate of the tool. A power source with voltage greater than that specified for the tool can result in **SERIOUS INJURY** to the user - as well as damage to the tool. If in doubt, **DO NOT PLUG IN THE TOOL**. Using a power source with voltage less than the nameplate rating is harmful to the motor.

USE PROPER EXTENSION CORD Make sure your extension cord is in good condition. When using an extension cord, be sure to use one heavy enough to carry the current your product will draw. An undersized cord will cause a drop in line voltage resulting in loss of power and overheating. Table 1 shows the correct size to use depending on cord length and nameplate ampere rating. If in doubt, use the next heavier gage. The smaller the gage number, the heavier the cord.

ADDITIONAL SAFETY RULES

DO NOT let comfort or familiarity with product (gained from repeated use) replace strict adherence to miter saw safety rules. If you use this tool unsafely or incorrectly, you can suffer serious personal injury.

1. Wear eye protection.
2. Keep hands out of path of saw blade. Avoid contact with any coasting blade. It can still cause severe injury.
3. Do not operate saw without guards in place. Check blade guard for proper closing before each use. Do not operate saw if blade guard does not move freely and close instantly. Never clamp or tie the blade guard into the open position.
4. Do not perform any operation freehand. The workpiece must be secured firmly against the turn base and guide fence with a vise during all operations. Never use your hand to secure the workpiece.
5. Never reach around saw blade.
6. Turn off tool and wait for saw blade to stop before moving workpiece or changing settings.
7. Unplug tool before changing blade or servicing.
8. Always secure all moving portions before carrying the tool.
9. Do not use the tool in the presence of flammable liquids or gases.
10. Check the blade carefully for cracks or damage before operation. Replace cracked or damaged blade immediately. Gum and wood pitch hardened on blades slows saw and increases potential for kickback. Keep blade clean by first removing it from tool, then cleaning it with gum and pitch remover, hot water or kerosene. Never use gasoline to clean blade.
11. Use only flanges specified for this tool.
12. Be careful not to damage the arbor, flanges (especially the installing surface) or bolt. Damage to these parts could result in blade breakage.
13. Make sure that the turn base is properly secured so it will not move during operation. Use the holes in the base to fasten the saw to a stable work platform or bench. **NEVER** use tool where operator positioning would be awkward.
14. For your safety, remove the chips, small pieces, etc. from the table top before operation.
15. Avoid cutting nails. Inspect for and remove all nails from the workpiece before operation.
16. Make sure the shaft lock is released before the switch is turned on.
17. Be sure that the blade does not contact the turn base in the lowest position.

18. Hold the handle firmly. Be aware that the saw moves up or down slightly during start-up and stopping.
19. Make sure the blade is not contacting the work piece before the switch is turned on.
20. Before using the tool on an actual work piece, let it run for a while. Watch for vibration or wobbling that could indicate poor installation or a poorly balanced blade.
21. Wait until the blade attains full speed before cutting.
22. Stop operation immediately if you notice anything abnormal.
23. Do not attempt to lock the trigger in the on position.
24. Be alert at all times, especially during repetitive, monotonous operations. Do not be lulled into a false sense of security. Blades are extremely unforgiving.
25. Always use accessories recommended in this manual. Use of improper accessories such as abrasive wheels may cause an injury.
26. NEVER hold work piece on right side of blade with left hand or vice versa. This is called cross-armed cutting and exposes user to risk of SERIOUS PERSONAL INJURY as shown in the figure. ALWAYS use vise to secure work piece.
27. Do not abuse cord. Never yank cord to disconnect it from the receptacle. Keep cord away from heat, oil, water and sharp objects.
28. NEVER stack work pieces on the table top to speed cutting operations. Cut only one piece at a time.
29. Some material contains chemicals which may be toxic. Take caution to prevent dust inhalation and skin contact. Follow material supplier safety data.

CAUTION:

- Always be sure that the tool is switched off and unplugged before adjusting or checking function on the tool.
- When turning the turn base, be sure to raise the handle fully.
- After changing the miter angle, always secure the turn base by tightening the grip firmly.

Switch action

- Before plugging in the tool, always check to see that the switch trigger actuates properly and returns to the "OFF" position when released.
- When not using the tool, remove the lock-off button and store it in a secure place. This prevents unauthorized operation.
- Do not pull the switch trigger hard without pressing in the lock-off button. This can cause switch breakage.

WARNING:

- NEVER use tool without a fully operative switch trigger. Any tool with an inoperative switch is HIGHLY DANGEROUS and must be repaired before further usage.
- For your safety, this tool is equipped with a lock-off button which prevents the tool from unintended starting. NEVER use the tool if it runs when you simply pull the switch trigger without pressing the lock-off button. Return tool to a Makita service center for proper repairs BEFORE further usage.
- NEVER tape down or defeat purpose and function of lock-off button.

CAUTION:

- Always be sure that the tool is switched off and unplugged before carrying out any work on the tool. Installing or removing saw blade.

- Always be sure that the tool is switched off and unplugged before installing or removing the blade.
- Use only the Makita socket wrench provided to install or remove the blade. Failure to do so may result in over tightening or insufficient tightening of the hex bolt. This could cause an injury.

WARNING:

- It is extremely important to always secure the work piece properly and tightly with the vise. Failure to do so can cause the tool to be damaged and/or the work piece to be destroyed. PERSONAL INJURY MAY ALSO RESULT. Also, after a cutting operation, DO NOT raise the blade until the blade has come to a complete stop.

CAUTION:

- When cutting long work pieces, use supports that are as high as the top surface level of the turn base. Do not rely solely on the vertical vise and/or horizontal vise to secure the work piece. Thin material tends to sag. Support work piece over its entire length to avoid blade pinch and possible KICKBACK.
- The work piece must be secured firmly against the turn base and guide fence with the vise during all operations.
- Grip the work piece only when the projection is at the topmost position. Failure to do so may result in insufficient securing of the work piece. This could cause the work piece to be thrown, cause damage to the blade or cause the loss of control, which can result in PERSONAL INJURY.
- Always support long work pieces level with the top surface of the turn base for accurate cuts and to prevent dangerous loss of control of the tool. OPERATION
- Before use, be sure to release the handle from the lowered position by pulling the stopper pin.
- Make sure the blade is not contacting the work piece, etc. before the switch is turned on.
- Do not apply excessive pressure on the handle when cutting. Too much force may result in overload of the motor and/or decreased cutting efficiency. Push down handle with only as much force as is necessary for smooth cutting and without significant decrease in blade speed.
- Gently press down the handle to perform the cut. If the handle is pressed down with force or if lateral force is applied, the blade will vibrate and leave a mark (saw mark) in the workpiece and the precision of the cut will be impaired.
- Use straight wood of even thickness as the wood facing.
- Use screws to attach the wood facing to the guide fence. The screws should be installed so that the screw heads are below the surface of the wood facing.
- When the wood facing is attached, do not turn the turn base with the handle lowered. The blade and/or the wood facing will be damaged.

NOTE:

- Use of the holder-rod assembly (optional accessory) allows cutting repetitive lengths up to 2,200 mm (7.2 ft.) approximately.

CAUTION:

- Always secure all moving portions before carrying the tool.
- Stopper pin is for carrying and storage purposes only and not for any cutting operations.

MAINTENANCE

CAUTION:

- Always be sure that the tool is switched off and unplugged before attempting to perform inspection or maintenance.

WARNING:

- Always be sure that the blade is sharp and clean for the best and safest performance.

Tool Safety

Plasma Cutter

Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.

WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.

GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following: Antimony Chromium Mercury Arsenic Cobalt Nickel Barium Copper Selenium Beryllium Lead Silver Cadmium Manganese Vanadium
- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.
- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Sec. 25249.5 et seq.)

ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically “live” or “hot.”
- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.
- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.

FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.

NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.

PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infrared light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

Minimum Protective Suggested

Arc Current Shade No. Shade No.

Less Than 300* 8 9

300 - 400* 9 12

400 - 800* 10 14

* These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the work piece.

Tool Safety

Portable Drill

SPECIFIC SAFETY RULES

DO NOT let comfort or familiarity with product (gained from repeated use) replace strict adherence to drill safety rules. If you use this tool unsafely or incorrectly, you can suffer serious personal injury.

1. Wear eye protection.
2. Obtain permission from instructor before using the drill.
3. Select proper drill (be sure it is sharp), have coolant handy and use it.
4. Remove chuck key immediately after using it.
5. Make sure power switch is off.
6. Plug in electrical cord.
7. Hold tool by insulated gripping surfaces when performing an operation where the cutting tools may contact hidden wiring or its own cord. Contact with a "live" wire will make exposed metal parts of the tool "live" and shock the operator.
8. Always be sure you have a firm footing. Be sure no one is below when using the tool in high locations.
9. Hold the tool firmly.
10. Keep hands away from rotating parts.
11. Do not leave the tool running. Operate the tool only when hand-held.
12. Do not touch the drill bit or the work piece immediately after operation; they may be extremely hot and could burn your skin.
13. Some material contains chemicals which may be toxic. Take caution to prevent dust inhalation and skin contact. Follow material supplier safety data.
14. Disconnect electrical cord. Clean and return machine to designated place.

Tool Safety

Recipro Saw

1. Do not force the power tool. Use the correct power tool for your application. The correct power tool will do the job better and safer at the rate for which it was designed.
2. Do not use the power tool if the switch does not turn it on and off. Any power tool that cannot be controlled with the switch is dangerous and must be repaired.
3. Disconnect the plug from the power source and/or the battery pack from the power tool before making any adjustments, changing accessories, or storing power tools. Such preventive safety measures reduce the risk of starting the power tool accidentally.
4. Store idle power tools out of the reach of children and do not allow persons unfamiliar with the power tool or these instructions to operate the power tool. Power tools are dangerous in the hands of untrained users.
5. Maintain power tools. Check for misalignment or binding of moving parts, breakage of parts and any other condition that may affect the power tools operation. If damaged, have the power tool repaired before use. Many accidents are caused by poorly maintained power tools.
6. Keep cutting tools sharp and clean. Properly maintained cutting tools with sharp cutting edges are less likely to bind and are easier to control.
7. Use the power tool, accessories and tool bits etc. in accordance with these instructions and in the manner intended for the particular type of power tool, taking into account the working conditions and the work to be performed. Use of the power tool for operations different from those intended could result in a hazardous situation.

ADDITIONAL SAFETY RULES FOR TOOL

DO NOT let comfort or familiarity with product (gained from repeated use) replace strict adherence to reciprocating saw safety rules. If you use this tool unsafely or incorrectly, you can suffer serious personal injury.

1. Hold power tool by insulated gripping surfaces when performing an operation where the cutting tool may contact hidden wiring or its own cord. Contact with a "live" wire will make exposed metal parts of the tool "live" and shock the operator.
2. Use clamps or another practical way to secure and support the work piece to a stable platform. Holding the work by hand or against your body leaves it unstable and may lead to loss of control.
3. Always use safety glasses or goggles. Ordinary eye or sun glasses are NOT safety glasses.
4. Avoid cutting nails. Inspect work piece for any nails and remove them before operation.
5. Do not cut oversized work piece.
6. Check for the proper clearance beyond the work piece before cutting so that the blade will not strike the floor, workbench, etc.
7. Hold the tool firmly.
8. Make sure the blade is not contacting the work piece before the switch is turned on.
9. Keep hands away from moving parts.
10. Do not leave the tool running. Operate the tool only when hand-held.
11. Always switch off and wait for the blade to come to a complete stop before removing the blade from the work piece.

12. Do not touch the blade or the work piece immediately after operation; they may be extremely hot and could burn your skin.
13. Do not operate the tool at no-load unnecessarily.
14. Always use the correct dust mask/respirator for the material and application you are working with.
15. Some material contains chemicals which may be toxic. Take caution to prevent dust inhalation and skin contact. Follow material supplier safety data.

CAUTION:

- Always be sure that the tool is switched off and unplugged before adjusting or checking function on the tool.

Adjusting the shoe

When the blade loses its cutting efficiency in one place along its cutting edge, reposition the shoe to utilize a sharp, unused portion of its cutting edge. This will help to lengthen the life of the blade. To reposition the shoe, push the shoe button in the "A" direction with a click and reposition as shown in the figure which allows you to make five-way adjustment. To secure the shoe, push the shoe button in the "B" direction with a click.

Switch action

CAUTION:

- Before plugging in the tool, always check to see that the switch trigger actuates properly and returns to the "OFF" position when released.
- Switch can be locked in "ON" position for ease of operator comfort during extended use. Apply caution when locking tool in "ON" position and maintain firm grasp on tool. To start the tool, simply pull the switch trigger. Tool speed is increased by increasing pressure on the switch trigger. Release the switch trigger to stop. For continuous operation, pull the switch trigger and then push in the lock button. To stop the tool from the locked position, pull the switch trigger fully, then release it.

ASSEMBLY CAUTION:

Always be sure that the tool is switched off and unplugged before carrying out any work on the tool.

Installing or removing the saw blade

CAUTION:

- Always clean out all chips or foreign matter adhering to the blade, blade clamp and/or slider. Failure to do so may cause insufficient tightening of the blade, resulting in a serious injury. To install the saw blade, always make sure that the blade clamp sleeve is in released position before inserting the saw blade. If the blade clamp sleeve is in fixed position, rotate the blade clamp sleeve in the direction of the arrow so that it can be locked at the released position.
- To install the saw blade, always make sure that the blade clamp sleeve is in released position before inserting the saw blade. If the blade clamp sleeve is in fixed position, rotate the blade clamp sleeve in the direction of the arrow so that it can be locked at the released position. Insert the saw blade into the blade clamp as far as it will go. The blade clamp sleeve rotates and the saw blade is fixed. Make sure that the saw blade cannot be extracted even though you try to pull it out.

NOTE:

If you do not insert the saw blade deep enough, the saw blade may be ejected unexpectedly during operation. This can be extremely dangerous. To remove the saw blade, rotate the blade clamp sleeve in

the direction of the arrow fully. The saw blade is removed and the blade clamp sleeve is fixed at the released position.

If you remove the saw blade without rotating the blade clamp sleeve fully, the sleeve may not be locked of the released position. In this case, rotate the blade clamp sleeve fully again, then make sure that the blade clamp sleeve locked at the released position.

CAUTION:

- Always press the shoe firmly against the work piece during operation. If the shoe is held away from the work piece during operation, strong vibration and/or twisting will be produced, causing the blade to snap dangerously.
- Always wear gloves to protect your hands from hot flying chips when cutting metal.
- Be sure to always wear suitable eye protection which conforms with current national standards.
- Always use a suitable coolant (cutting oil) when cutting metal. Failure to do so will cause premature blade wear. Press the shoe firmly against the work piece. Do not allow the tool to bounce. Bring the blade into light contact with the work piece. First, make a pilot groove using a slower speed. Then use a faster speed to continue cutting.

Safety Rules for Working with Solvents and Resins

1. Avoid skin contact. Wear latex or nitrile gloves. Check for chemical to glove compatibility first!
2. Work in a well-ventilated area. When respirators are necessary ask the Shop Manager for assistance.
3. Avoid using solvents around hot metal surfaces and flames.
4. Do not smoke or light flames in areas where solvents are used and stored.
5. Report and clean up any spills immediately. Let the Shop Manager know immediately.
6. Do not work with solvents in confined, unventilated areas.
7. Do not drink alcoholic beverages or take medications containing alcohol before or during working with solvents. Alcohol in the bloodstream sometimes causes synergistic reactions with various solvents that can lead to loss of consciousness, and even possibly, death.
8. Report any ill effects and skin disorders to the Shop Manager.
9. Develop and maintain good personal hygiene habits. Remove protective equipment and wash thoroughly after contact with solvents.
10. Fumes from paints, solvents, adhesives, and the abrasive cut-off saw used on the patio can drift into the shop.
11. Mix resins in small batches and in correct containers.