

University of Tennessee Safety Guidelines

Program Subject: Hand and Power Tool Safety Guidance	Approval Date: 12/1/2016
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Contact Information: Program Owner: Environmental Health and Safety	

1.0 Purpose, Applicability and Scope

Introduction

Machine and woodworking shops are present in many locations and departments throughout the University. The equipment located within these shops is routinely used by employees and students to complete various tasks that have the potential to result in serious injury. It is the goal of University of Tennessee Knoxville campus to provide a safe working environment within all University machine and woodworking shops.

Purpose

University of Tennessee Knoxville campus desires to maintain a safe environment for its students, faculty, staff, and visitors. This guideline sets forth operating procedures and practices to operate machines and tools in shops throughout the University in a safe and compliant manner at all times. This document outlines safety guidelines for the use of various machines and tools that are most frequently used in a machine and woodworking shop on campus.

The information within this document has been developed in accordance with the following regulations and standards:

- 29 CFR 1910 Subpart J, “General Environmental Controls”
- 29 CFR 1910 Subpart O, “Machinery and Machine Guarding”
- 29 CFR 1910 Subpart P, “Hand and Portable Powered Tools and Other Hand-Held Equipment”
- “Safeguarding Equipment and Protecting Employees from Amputations” – OSHA publication 3170-02R
- “A Guide for Protecting Workers from Woodworking Hazards” – OSHA publication 3157
- “Hand and Power Tools” – OSHA publication 3080
- A variety of American National Standards Institute (ANSI) safety standards

Scope

University of Tennessee Knoxville campus shall provide all faculty, staff, student-employees, students, and volunteers training in safety and use of hand and power tools, equipment, and any other machinery required. Departments will provide personal protective equipment (PPE); the Environmental, Health & Safety (EHS) Department may provide consultation towards selection of proper PPE, as needed or requested.

2.0 Responsibility:

Shop Supervisors

- Be thoroughly informed of the contents of this program and how it relates to their areas of responsibility and authority.
- Ensure that all provisions of this program are implemented in the shop.
 - Including providing training and maintaining required documentation of training.
- Investigate and report all injuries and incidents within their shop.

Department of Environmental Health & Safety (EHS)

- Provide program oversight and assist departments in implementing the provisions of this program.
- Periodically audit machine shops.
- Update this program as needed.

Shop Users

- Comply with all provisions of this program, including the use of protective equipment and machine guarding.
- Attend all training required relative to this program.
- Promptly report any concerns related to shop equipment or shop safety issues to their immediate supervisor/faculty member.

3.0 Disclaimer

The information provided in this program is designed for educational use only and is not a substitute for specific training or experience.

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General Safety Rules for Machine and Woodworking Shops

General Safety Rules for Machine and Woodworking Shops

1. The faculty or staff member in charge of the shop will ensure that all appropriate safety rules are followed. EHS will assist in providing guidelines and recommendations as warranted. EHS will also perform periodic audits of campus shops to ensure compliance with established guidelines.
2. Only trained and approved persons will be permitted to use any piece of powered equipment.
 - a. For shops that are intended to be used by students:
 - i. Training is to be done and documented by the designated shop owner (faculty, staff member). Training should consist of both classroom instruction (including reading the Operator's Manual for each piece of equipment) and hands-on competency training.
 - ii. Training will be documented and record retention will be the responsibility of the department.
3. Shops are to be kept clean and orderly.
4. Shop safety rules are to be posted.
5. Horseplay is forbidden.
6. Machines are to be inspected prior to use.
 - a. Machines should NEVER be used if all guards are not in place.
 - b. Machines should be placed out of service if:
 - i. Guards are missing or damaged
 - ii. Machine is damaged or not operating properly
 - iii. Power cords are damaged or plug is not properly grounded
7. Use the right tool for the job. Do not force a tool or attachment to do a job for which it was not designed.
8. WEAR PROPER ATTIRE. Do not wear loose fitting, gloves, jewelry, watches, ties, ID badges or anything else dangling that might get caught in a piece of moving equipment. Long hair should be in a protective head covering such as a hair net.
 - a. Never wear open toe shoes - Use closed-toe shoes in the shop.
9. No student shall operate a powered piece of equipment in a shop alone. Use a buddy system in the shops.
10. Shops should have designated and posted operating hours.
11. Never use a powered machine when impaired.
 - a. This includes when you are sick, too tired, stressed or hurried to work carefully or on medication that could make you drowsy.
12. Never be shy about seeking help. Always ask if you're unsure about the safe operation of a tool or any aspect of a job. Have Shop Staff check the tool or work with which you are unfamiliar.
 - a. Exercise common sense and clarify before starting work
13. All injuries should be assessed and appropriate medical treatment or first aid administered immediately.

General Safety Rules for Machine and Woodworking Shops

- a. Never hesitate to activate emergency medical response as time may be critical depending on the injury.
- b. All incidents are to be reported to Shop staff and complete a UTK incident reporting form. <http://riskmanagement.tennessee.edu/Incident%20Report.pdf>

PERSONAL PROTECTIVE REQUIREMENTS FOR MACHINE AND WOODWORKING SHOPS

Personal Protective Equipment	Required	Recommended
Safety Glasses with side shields/safety goggles/face shields <i>(Needs to meet ANSI Z87.1)</i> <i>(Certain tasks may require use of both goggle and face shield. Refer to specific tool within this manual for more information)</i>		
Dust Masks <i>{Woodworking Shops Only}</i>		
Gloves <i>{Note that there are some specific tasks that may require gloves such as cleaning or changing blades. See Shop Supervisor for instruction.}</i>		
Ear plugs/Ear Muffs		
Closed-toe foot wear		
Protective Apron		

Angle Grinder (Portable Right-Angle Head Grinder)

Angle Grinder (Portable Right-Angle Head Grinder)

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.215 {Abrasive wheel machinery}
- 29 CFR 1910.242 {Hand and portable powered tools and equipment, general}
- 29 CFR 1910.243 {Guarding of portable power tools}

Potential Hazards

- The most common causes of injury are lacerations from attachments that break and become projectiles, and lacerations from angle grinder kickbacks.
- Being stuck by the workpiece.
- Working with a grinder near flammable or combustible materials can result in fire and burns to operators.
- Contact with the rotating grinding disc.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Electrical shock.

Key Controls

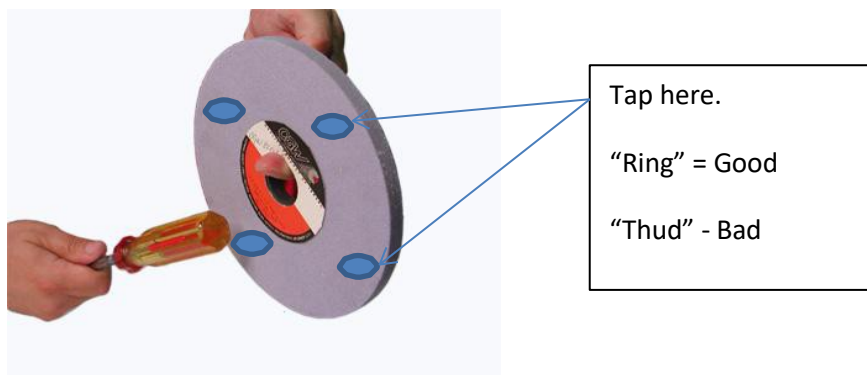
- Approved and authorized persons **ONLY** can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated **ONLY** with required guarding in place.
 - If any guards are damaged or missing, grinder is to be taken out of service.
 - **Closely inspect grinding disc.**
 - **Any grinding disc that has a visible crack, chip, or other damage should be disposed of immediately.**
 - Area clean and free of debris. A grinder should **NEVER** be used in an area where there are flammable liquids or combustible solids.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).

Angle Grinder (Portable Right-Angle Head Grinder)

- **Personal Protective Equipment:**
 - Approved safety goggles or safety glasses with side shields (meets ANSI Z87.1) are to be worn while operating angle grinder. It is also highly recommended to wear an ANSI approved face shield to protect the operator's face from flying projectiles.
 - Gloves are to be worn for protection of the hands.
 - Hearing protection is available and its use is highly encouraged (grinding and cutting operations are typically VERY loud). If grinding for extended periods of time, hearing protection may be required. See shop supervisor for more information.
- Instruct operators not to wear loose fitting clothing, or jewelry (including rings and watches).
- Instruct operators with long hair to secure in a cap or hair net.
- **PROPER SELECTION of disc is critical.**
 - Ensure the disc being used is the correct one for the job (cutting versus grinding).
 - Verify that the correct disc is being used for the class of material to be worked on.
 - Verify that the disc is of the correct speed rating for the grinder being used.
 - Verify that the disc size and arbor size are compatible for the grinder to be used.
- Follow proper lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.

Ring Test

- Prior to mounting an abrasive wheel, a "Ring Test" should be performed.
 - RING TEST PROCEDURE
 - Suspend abrasive disc as shown below:



- Tap abrasive wheel with a light, non-metallic instrument (such as a screw driver handle) about 45° from vertical centerline and about 1-2" from edge. Rotate wheel by 45° and repeat, working all the way around the wheel. An undamaged wheel will give a clear metallic ring, where a cracked wheel will sound dull or dead.
- Any wheel not passing the "Ring Test" (sounds dead) should be disposed of.

Angle Grinder (Portable Right-Angle Head Grinder)

Operating Precautions

- Always grasp the grinder firmly with TWO hands.
- When using a cutting disc, use the edge of the disc and not the face.
- When using a grinding disc, use the face of the disc and not the edge.
- Allow grinder to reach full speed before initiating grinding or cutting.
- Do not use excessive pressure as this can cause the disc to break.
- Do not place grinder on ground or bench while disc is still rotating. Do not walk around work area with a running grinder.
- Do not position your body directly behind the angle grinder as this will limit your ability to move out of the path of the grinder should it kickback.
- Ensure workpiece is appropriately supported and secured.

Guarding Guidelines



Grinder must have a guard for the grinding disc. The maximum exposure angle allowed is 180° and the guard shall be located so as to be between the operator and the wheel during use.

Band Saw - Horizontal

Band Saw - Horizontal

Applicable Standards

- 29 CFR 1910.132 {Personal protection equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Contact with the blade is the most common injury. Extreme caution is needed because the operator's hands may come close to the saw blade, and a saw blade cannot be completely guarded.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Contact with moving pulleys and belt.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings and recommended operating procedures given in the machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
 - If machine has any visible damage report to shop supervisor immediately and DO NOT use machine.
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are NOT to be worn when operating a band saw.
- Follow proper lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to

Band Saw - Horizontal

leave the machine before work is complete, proper LOTO procedures are to be followed.

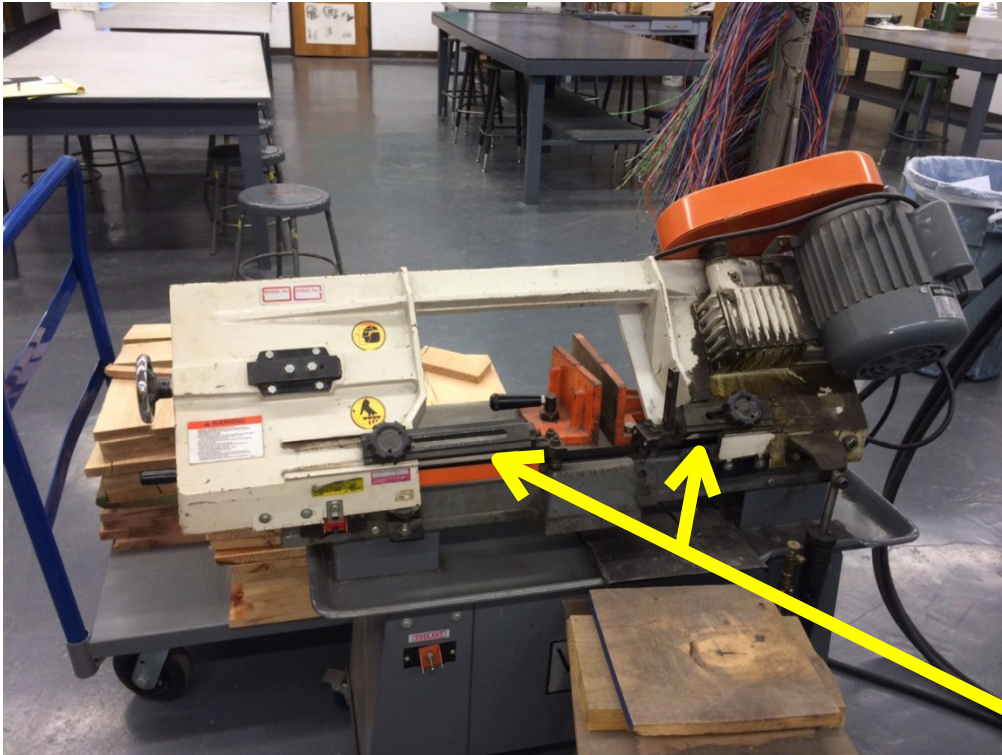
- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing, jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Use vacuum or brush to remove debris. DO NOT USE BARE HANDS.
- When changing saw blade, appropriate gloves are to be worn.

Operating Precautions

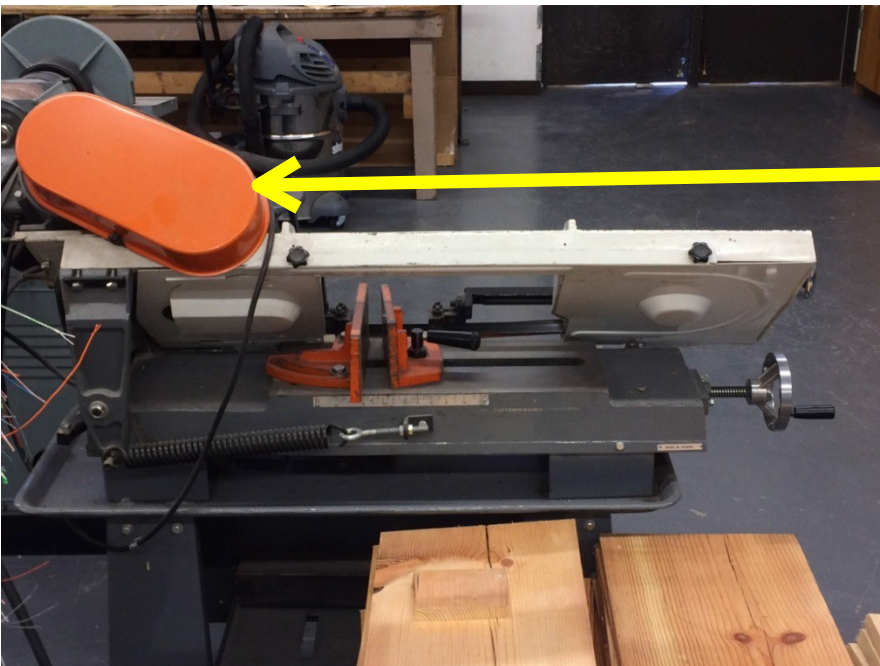
- Adjust blade guards to cover unused portions of blade.
- Ensure that blade speed, blade tension and blade tracking are properly adjusted.
 - A saw with a tension control device to indicate proper tension is desired.
- Use band saw blades that are sharp, properly set and otherwise suitable for the job (e.g., the right tooth pitch; tooth form; blade width).
- Stock should be held firmly in the saws vice. Keep hands away from point of operation.
- If the saw blade binds on a piece of stock, turn the saw off and wait until it comes to a complete stop before attempting to remove the blade from the stock.
- Keep the machine properly oiled and serviced.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the saw.

Band Saw - Horizontal

Guarding Guidelines



Adjust guards for saw blade so that unused portion of blade is covered.



Belt and pulleys to be guarded.

Band Saw - Vertical

Band Saw - Vertical

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Contact with the blade is the most common injury. Extreme caution is needed because the operator's hands may come close to the saw blade, and a saw blade cannot be completely guarded.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Contact with moving pulleys and belt.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings and recommended operating procedures given in the machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
 - If machine has any visible damage report to shop supervisor immediately and DO NOT use machine.
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are to be worn when operating a band saw.
- Follow proper lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to

Band Saw - Vertical

leave the machine before work is complete, proper LOTO procedures are to be followed.

- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Use vacuum or brush to remove debris. DO NOT USE BARE HANDS.
- When changing saw blade, appropriate gloves are to be worn.

Operating Precautions

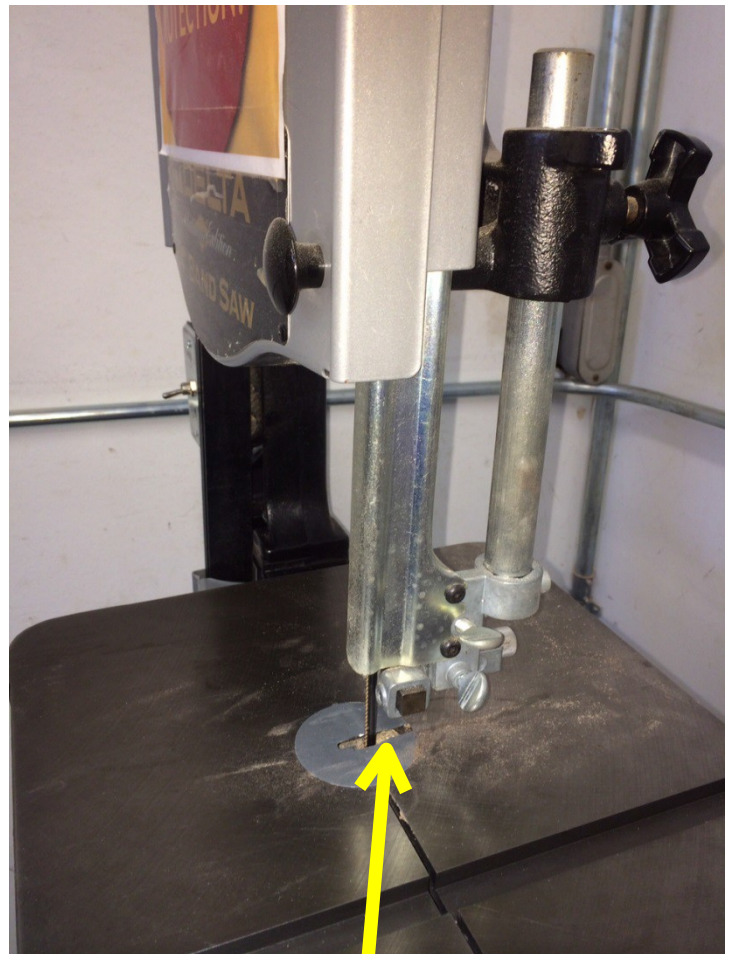
- Adjust blade guard height to about 1/8 inch above the top of the material being cut.
- Ensure the blade is tracking correctly and runs freely in and against the upper and lower guide rollers.
- Ensure the blade is under proper tension. A band saw equipped with automatic tension control is desirable.
- Use band saw blades that are sharp, properly set and otherwise suitable for the job (e.g., the right tooth pitch; tooth form; blade width).
- Hold stock firmly and flat on the table to prevent the stock from turning and drawing your fingers against the blade. Keep hands braced against the table.
- Use a push stick or jig to keep fingers at a safe distance from saw blade (at least 3 inches). Keep your hands on either side of the blade - not in line with the cutting line and the blade.
- Make release (relief) cuts before tight curves when doing intricate scroll-type work.
 - Plan saw cuts to avoid backing out of curves in the stock.
- If the blade comes out of the guides or breaks, stop the machine immediately by turning off the power. **Do not** open the access door to the machine until the wheels have come to a complete stop. Have the instructor reposition or install a new blade.
- If the saw blade binds on a piece of stock, turn the saw off and wait until it comes to a complete stop before attempting to remove the blade from the stock.
- Keep the machine properly oiled and serviced.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the saw.

Band Saw - Vertical

Guarding Guidelines



Covers need to be closed and secure before starting saw.



Adjustable guard should be 1/8" above top of material being cut.

Belt/Disc Combination Sander

Belt/Disc Combination Sander

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Contact with a moving abrasive belt or disc. Severe injury can result with contact with moving abrasive belt or disc.
- Having fingers or hands caught in a running nip point. There is a running nip point between the work table and disc and between the work table and belt.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
 - Check to see if the belt or sandpaper disc is torn. If there is visible damage, do not use machine and notify the shop supervisor.
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are NOT to be worn when operating a belt/disc sander.
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to

Belt/Disc Combination Sander

leave the machine before work is complete, proper LOTO procedures are to be followed.

- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.
- Install awareness devices (signage, barriers, etc.) around sander.
- Instruct operators not to wear loose fitting clothing, jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Use vacuum or brush to remove debris. DO NOT USE BARE HANDS.

Operating Precautions

- Keep hands away from sanding surface. Use a holding device or jig whenever possible.
 - Never attempt to sand small pieces by hand.
- On the disc sander, only use the portion of the sander that travels down.
- Work tables should be set as close as possible to disc or belt sander (1/16" max.).
- Keep work piece flat on work bench while sanding. Do not attempt hold it by hand higher up on the disc or belt.
- Do not use excessive force when sanding.
- Do not sand in one place. Keep work piece moving along surface of disc or belt sander.
- Wait for belt to reach full speed before sanding workpiece.
- Do not attempt to clean machine or make adjustments while machine is running.
- Never leave machine while it is running.
 - After machine is turned off, wait till belt/disc come to a complete stop before leaving machine. The disc/belt will coast for several seconds before coming to a complete stop.
- Keep the machine properly oiled and serviced.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the sander.

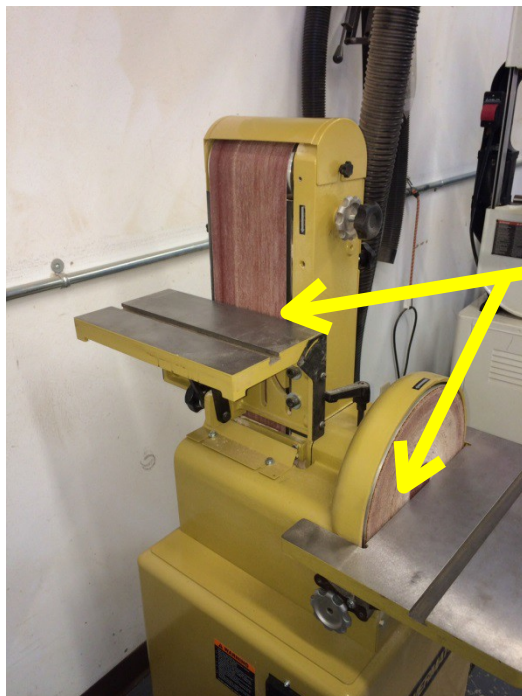
Belt/Disc Combination Sander

Guarding Guidelines



Top and sides of belt to be guarded. Perimeter and back of disc to be guarded.

Power transmission to be enclosed in cabinet.



Work bench to be set to 1/16" maximum from belt or disc.

Bench Grinder

Bench Grinder

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.215 {Abrasive wheel machinery}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}

Potential Hazards

- The most serious hazard comes from the potential of an abrasive wheel to explode. Fragments can travel at over 300 mph.
- Contact with the rotating wheel, flange, and spindle end.
- Being caught in the naturally occurring nip point between the wheel and rest plate.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Electrical shock.

Key Controls

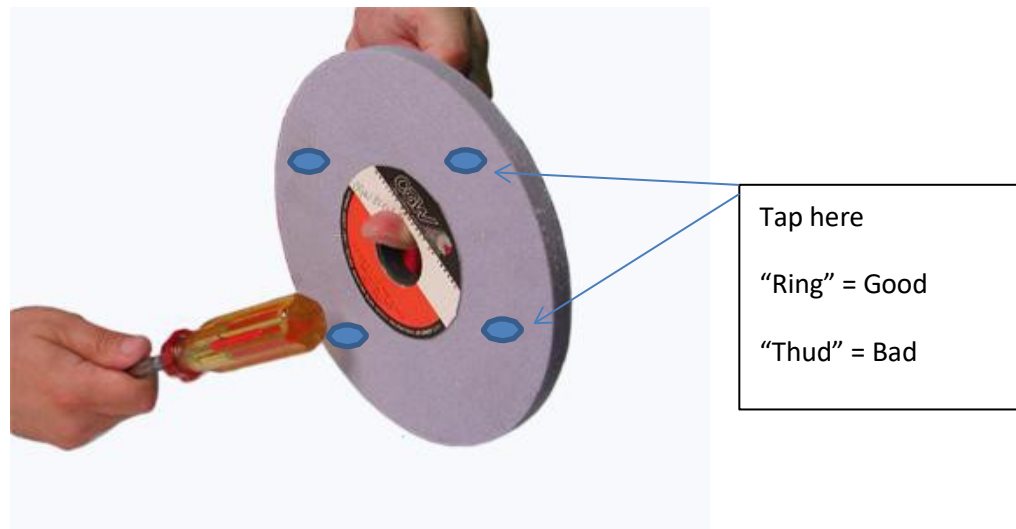
- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - If any guards are damaged or missing, grinder is to be taken out of service.
 - Make sure the work rest is as close to abrasive wheel as possible (1/8" maximum), and tongue guard is at 1/4" maximum clearance.
 - **Closely inspect wheel.**
 - **Any wheel that has a visible crack, chip, or other damage should be disposed of immediately.**
 - Area clean and free of debris.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves should be worn only if using a tool grip of adequate length to keep hands several inches from the face of the stone. Do not wear gloves while holding small pieces or using a wire wheel.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

Bench Grinder

- Follow proper lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around grinder.
- Instruct operators not to wear loose fitting clothing, jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Hearing protection is available and its use is encouraged.
- Wear disposable dust masks if needed (optional).

Ring Test

- Prior to mounting an abrasive wheel, a “Ring Test” should be performed.
 - RING TEST PROCEDURE
 - Suspend abrasive wheel as shown below:



- Tap abrasive wheel with a light, non-metallic instrument (such as a screw driver handle) about 45° from vertical centerline and about 1-2” from edge. Rotate wheel by 45° and repeat, working all the way around the wheel. An undamaged wheel will give a clear metallic ring, where a cracked wheel will sound dull or dead.
- Any wheel not passing the “Ring Test” (sounds dead) should be disposed of.
- Any wheel with visible cracks, chips, or other damage should be disposed of.

Bench Grinder

Operating Precautions

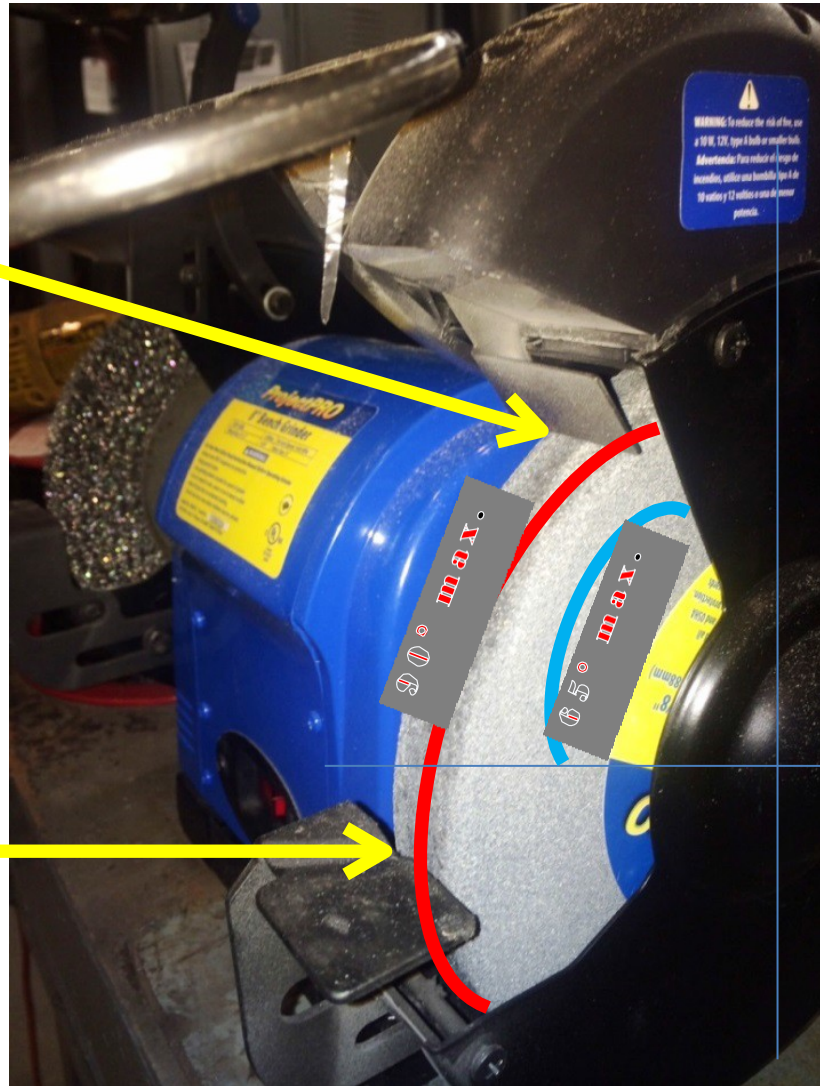
- Ensure wheel being mounted is rated for a speed compatible with the grinder. The recommended speed will be given on the side of the wheel.
- Stand to one side when turning on power. Allow grinder to reach full RPM before grinding.
- Keep fingers and hand clear of rotating abrasive wheel.
- When grinding, use the **face** of the abrasive wheel only. Never use the side of the wheel.
 - Move work back and forth across entire face of wheel to avoid creating grooves.
- When an operator has finished working on the grinder, and before leaving the grinder for any reason, the power must be shut off and the machine must come to a complete stop.
- Keep machine properly oiled and serviced.
 - **Wheels are to be dressed regularly.** Dressing a grinding wheel is the process by which the abrasive wheel is cleaned of any built up material and is made true across the grinding surface. It is a simple procedure utilizing a dressing tool. See your shop supervisor for specific procedures.
 - **NOTE: Remember to readjust the work bench (less than 1/8" inch) and the tongue guard (less than 1/4") after dressing the grinding wheel.**
- Ensure area is clean and uncluttered and sufficient space is given to operator using grinder.
- When an operator observes an unsafe condition on the grinder, or stock that is being worked on, they must report it immediately to the Supervisor.
 - Do not use a grinder whose wheel is vibrating.

Bench Grinder

Guarding Guidelines

Tongue guard must be adjusted to a **maximum** $\frac{1}{4}$ " to the abrasive wheel.

Bench rest must be adjusted to a **maximum** $\frac{1}{8}$ " to the abrasive wheel.



The opening of the wheel guard must not exceed 90° total, and the exposure shall begin at a point not more than 65° above the horizontal plane of the wheel spindle.

Chop Saw – Abrasive Wheel (Metal Cutting)

Chop Saw – Abrasive Wheel (Metal Cutting)

Applicable Standards

- 29 CFR 1910.132 {Personal protection equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.215 {Abrasive wheel machinery}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}

Potential Hazards

- Hands and fingers can be severely cut or amputated if contact is made with the rotating cutting blade.
- The abrasive wheel has the potential to crack, and then fly apart during use.
- Lacerations from sharp metal burrs.
- Burns from the workpiece.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - If any guards are damaged or missing, saw is to be taken out of service.
 - Ensure the correct abrasive wheel or blade is being used and that it is free from cracks or any other damage.
 - Area clean and free of debris. Key and any other tools removed from area of operation.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: The workpiece will become very hot when cut with an abrasive wheel chop saw. DO NOT handle workpiece by hand. Use leather work gloves to handle hot metal.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

Chop Saw – Abrasive Wheel (Metal Cutting)

- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around drill.
- Instruct operators not to wear loose fitting clothing, or jewelry (including rings and watches).
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

- **DO NOT** use an abrasive wheel chop saw for wood or wood products.
- Be sure to use the proper abrasive wheel for the saw you are using and the metal you are cutting.
- A cracked abrasive wheel has the potential to fly apart during use. Inspect saw blade and remove if there is any indication of a crack or other damage. When starting the machine, stand off to one side.
- Ease the abrasive disc into the workpiece. Do not use excessive force and this may cause the blade to crack and fail. Light pressure is all that is needed to get a good cut.
- Be careful to avoid coasting blades. Do not reach into cut area until blade has come to a complete stop.
- The workpiece will become extremely hot during the cutting process. Do not handle work piece with bare hands. Use leather work gloves to handle hot metal.
- Keep hands and fingers out of the line of fire.
- **ALWAYS USE THE VICE TO CLAMP THE WORKPIECE AND PROPERLY SUPPORT OVER-HANGING PORTION OF WORKPIECE LEVEL WITH THE BASE OF THE MACHINE.**
- Keep machine properly oiled and serviced.
- Ensure area is clean and uncluttered and sufficient space is given to operator using saw.

Chop Saw – Abrasive Wheel (Metal Cutting)

Guarding Guideline

Chop saw must have a self-adjusting guard. Guard should slide back into position.



Vice is to be used to secure the workpiece during the cutting operation,

Use the proper abrasive wheel based on size and RPM of the saw and the specific metal being cut.

Circular Saw (Portable)

Circular Saw (Portable)

Applicable Standards

- 29 CFR 1910.132 {Personal protection equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1920.213 {Woodworking machinery requirements}
- 29 CFR 1910.242 {Hand and portable powered tools and equipment, general}
- 29 CFR 1910.243 {Guarding of portable power tools}

Potential Hazards

- Contact with rotating saw blade.
- Struck by saw during kickback.
- Entanglement of loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - If any guards are damaged or missing, saw is to be taken out of service.
 - Area clean and free of debris.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- **Personal Protective Equipment (PPE)** shall be worn as detailed in table on page 6.
 - NOTE: Gloves are NOT to be worn while using a circular saw.
 - If sawing a large amount to wood, it is strongly encouraged to use hearing protection and to use a dust mask. See shop supervisor for more information.
- **Choose the right tool and blade.**
 - Do not use a saw that is too heavy for you to easily control.
 - Use clean, sharp blades with no missing teeth.
 - Use correct blade for job being performed.

Circular Saw (Portable)

- Ensure blade is rated for the speed (rpm) of the saw or higher.
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Instruct operators not to wear loose fitting clothing, jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

- Before cutting, check blade depth. The blade should extend 1/8" to 1/4" below the bottom of the piece of wood being cut.
- Ensure the power cord and extension cord is out of the path of the saw blade. Be sure there is enough cord to complete the entire cut.
- Workpiece should be properly supported and secured.
- Do not stand directly behind saw.
- Test trigger to ensure that it is properly working.
- Allow saw to reach full speed before initiating cut.
- Use two hands on the saw once the workpiece is secured.
 - NEVER hold workpiece in your hand or across your leg when sawing.
- NEVER overreach!
- Be alert to the possibility of kickback. Hold the saw firmly with two hands and position your arms to resist kickback.
- Avoid "knotty" wood. "Knotty" wood greatly increases the likelihood of a kickback.
- If performing a long rip cut, it is best to use a fence or guide board.
- After the cut is complete, turn off saw and let blade come to a complete stop before placing on bench or ground.

Circular Saw (Portable)

Guarding Guideline

Saw must have a constant pressure trigger to operate saw.



Saw must be equipped with guards both above and below the base plate. Lower guard must automatically retract when the saw is withdrawn from the workpiece.

Drill Press

Drill Press

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Entanglement with rotating drill bit.
- Contact with a rotating drill bit at point of operation. Drilling one's own finger.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Being hit by key left in drill chuck.
- Being hit by a piece of wood that is caught by the drill bit and begins to spin at same rate as the drill bit.
- Inhalation of dust and particles.
- Dropping objects on foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - If any guards are damaged or missing, drill is to be taken out of service.
 - Area clean and free of debris. Key and any other tools removed from area of operation.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are not to be worn when operating a drill press.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to

Drill Press

leave the machine before work is complete, proper LOTO procedures are to be followed.

- Install awareness devices (signage, barriers, etc.) around drill.
- Instruct operators not to wear loose fitting clothing, jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

- Do not make adjustments to the drill press (setting depth for example), secure material to the drill press bed or reposition material while drill bit is still rotating.
- Keep hands and fingers away from the point of operation.
- Material to be drilled should be secured to drill press bed using vise, clamps, or other appropriate device suitable for the piece being worked on.
 - If material slips in the vise or clamp, do not attempt to hold by hand. Shut down drill then retighten.
- Know the location of start and stop switches or buttons and keep the drill press table free of tools and other materials.
- Use only properly sharpened drill bits, sockets and chucks in good condition. Remove dull drill bits, battered tangs or sockets from service.
- Do not remove by hand metal or wood chips from the table or stock. Use brushes or other tools to properly remove chips.
- Use the correct speed and drill for the type of stock being drilled.
- The drill bit should be mounted the full depth and in the center of the chuck.
- Feed the bit smoothly into the work. If the hole being drilled is deep, withdraw the bit frequently to remove shaving on the bit.
- When an operator has finished working on the drill press, and before leaving the drill press for any reason, the power must be shut off and the machine must come to a complete stop.
- Keep machine properly oiled and serviced.
- Ensure area is clean and uncluttered and sufficient space is given to operator using drill.
- When an operator observes an unsafe condition on the drill press, or stock that is being worked on, they must report it immediately to the Supervisor and the press will be taken out of service until the problem has been corrected.

Drill Press

Guarding Guidelines

Guards for power transmission MUST be in place before use.

An adjustable guard to cover unused portion of chuck and drill bit can be installed to protect against flying debris and rotating parts.



Edge Sander

Edge Sander

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Contact with a moving abrasive belt can result in severe injury.
- Having fingers or hands caught in a running nip point.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
 - Check to see if the belt or sandpaper disc is torn. If there is visible damage, do not use machine and notify the shop supervisor.
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are NOT to be worn when operating an edge sander.
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.

Edge Sander

- Install awareness devices (signage, barriers, etc.) around sander.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Use vacuum or brush to remove debris. DO NOT USE BARE HANDS.

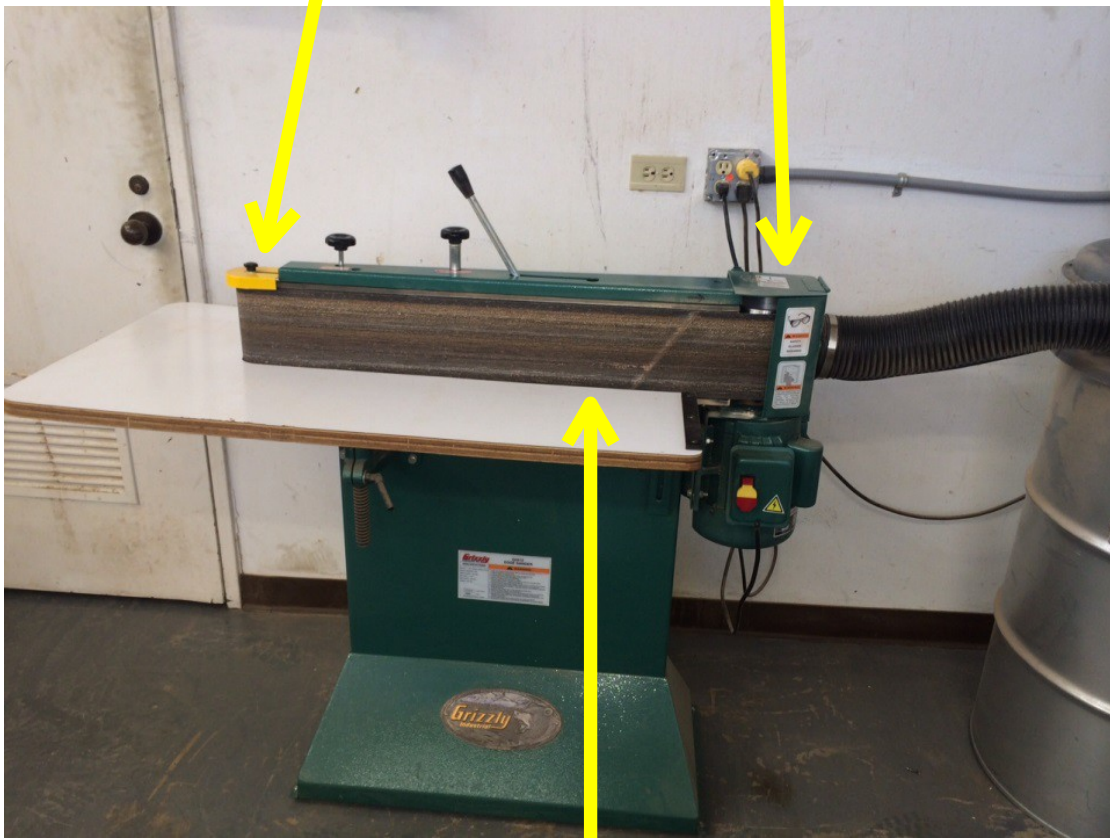
Operating Precautions

- Keep hands at least 6" away from sanding surface. Use a holding device or jig whenever possible.
 - Never attempt to sand small pieces by hand.
- Inspect stock to be sanded for nails, screws or other foreign matter that could pose a hazard during sanding.
- Work tables should be set as close as possible to disc or belt sander (approximately 1/8").
- Wait for belt to reach full speed before sanding workpiece.
- Do not apply excessive force when sanding.
- Do not attempt to clean machine or make adjustments while machine is running.
- Never leave machine while it is running.
- Keep the machine properly oiled and serviced.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the sander.

Edge Sander

Guarding Guidelines

In running nip points
must be guarded.



Edge of table as close
to belt as possible
(1/8").

Jointer

Jointer

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Woodworking tools}

Potential Hazards

- Contact with the blade is the most significant and dangerous hazard. **Hands and fingers can be amputated if they come into contact with moving blade.**
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Kick-backs – Stock is caught by the blade and thrown back at the operator.
- Inhalation of dust and particles.
- Dropping objects on foot.
- Electrical shock.

Key Controls

- Approved and authorized persons **ONLY** can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated **ONLY** with required guarding in place. There **MUST** be a self-adjusting or automatic guard over the cutting head. A guard must also be in place that will cover the portion of the cutting head that is back of the fence.
 - Ensure the 3 blades that make up the cutting head are tight and sharp and without defects.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are not to be worn while operating a jointer.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

Jointer

- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

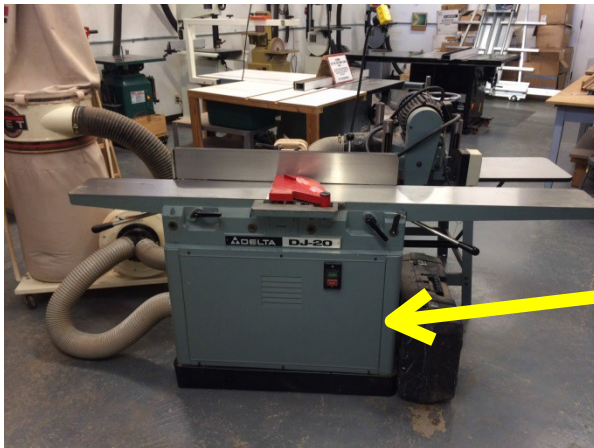
- Stock should be pushed through the machine using two push pads or a push pad on front of stock and a push stick on the rear of the stock.
- It is recommended NOT to use a jointer on the following:
 - The face of pieces of wood that are less than $\frac{1}{2}$ " thick as they can splinter and break.
 - The edges of pieces of wood that are $\frac{3}{4}$ " or less as they can vibrate split and cause a safety hazard.
 - Any piece of stock that is less than 12" long. The material must be long enough to bridge the jointer throat and have complete support on the bed or you could be injured.
- Adjust cutter head so that no more than $\frac{1}{8}$ " is removed at a single pass.
- Adjust the width of the table to match the width of the stock. You want to minimize the amount of exposed cutting blade to reduce risk of your hand coming into contact with the moving blade.
- Ensure the fence is locked down in the correct position.
- Stand on the left, beside the jointer, not behind or in line with your material. You will have more control over your material, will not have to reach so far, and will not be hit by the material if it is thrown from the machine.
- Do not start the machine with the wood contacting the cutting blades.
- To reduce risk of kick-backs:
 - Avoid use of very poor quality lumber. There should be no loose knots, splits, or structural defects. Also, there should be no nails, screws or other foreign objects in the stock.
 - Ensure blade height is correctly set and blades are in good condition.
 - Avoid deep cuts. Make multiple passes using a less aggressive cut to achieve desired surface,
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the machine.
- Keep the machine properly oiled and serviced.

Jointer

Guarding Guidelines



Self-adjusting guard that covers the rotating cutting head must be in place.



The power transmission system is located inside the cabinet. Cabinet is to be kept shut except when performing required maintenance and following required LOTO procedures.

Metal Lathe

Metal Lathe

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- ANSI B11.6-2001 {Safety Requirements for Manual Turning Machines with or without Automatic Control}

Key Hazards

- Contact with moving parts, such as drive gears, chucks, lead and feed screws, and the workpiece.
- Getting loose clothes, jewelry, or long hair caught in rotating parts.
 - **Entanglement is a serious hazard on a lathe.** Loose clothes or long hair can become entangled around the rotating parts of the lathe pulling the operator into the cutter or rotating stock resulting in significant injury or death.
- Being hit by loose objects on the lathe, such as chuck keys, tools or turnings.
- Being struck by a workpiece that has not been adequately secured in the lathe or is oversized.
- Dropping objects on foot.
- Electrical shock.

Key Controls

- Approved and authorized persons **ONLY** can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated **ONLY** with required guarding in place.
 - Remove chuck keys, adjusting wrenches and knockout bars. Form a habit of checking for these before turning on the lathe.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in below table on page 6.
 - NOTE: Gloves are not to be worn while operating a lathe.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to

Metal Lathe

leave the machine before work is complete, proper LOTO procedures are to be followed.

- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

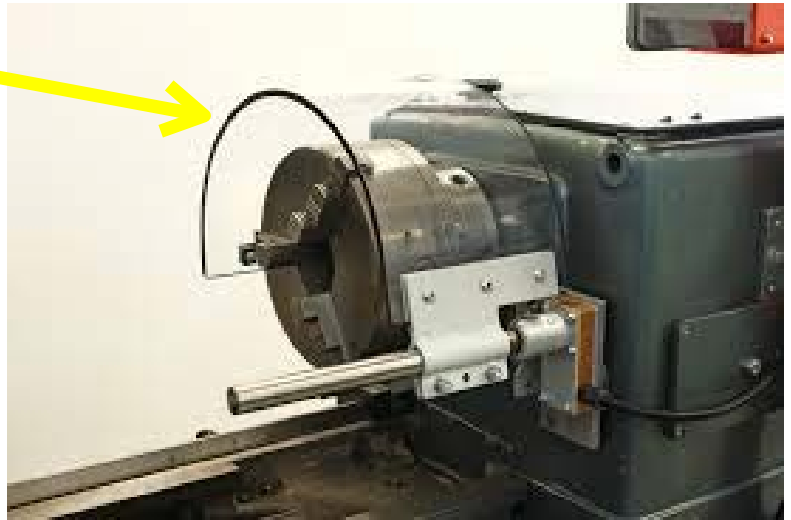
Operating Precautions

- Pay close attention to work pieces that have keyway slots or other surface profiles that may increase the risk of entanglement.
- Assess the need to manually polish (e.g., emery cloth) rotating material. If necessary, consider milling keyways or other profiles after polishing or use emery cloth with the aid of a tool or backing boards.
- Always use a brush or tool to remove chips. DO NOT USE BEAR HANDS.
- Make sure all work pieces and work-holding devices are secure and free from defects.
- Keep metal lathe cutting tools sharp. Do not use damaged or broken metal lathe cutting tools.
- Remove the chuck key from the chuck after securing the material.
 - A good rule is to never take your hand off the chuck key until you set it back onto a table. Consider using a spring-loaded or self-ejecting chuck key.
- Inspect tools prior to use and ensure worn or damaged tools are removed and not used.
- Turn the chuck or faceplate by hand to be sure there is no binding or danger of the work striking any part of the lathe.
- Don't run the machine faster than the proper cutting speed (consult speed and feed table to determine the best speed).
- Start lathe slowly and gradually increase rotational speed.
- Don't cut work completely through when turning between centers.
- Stop the machine before taking measurements or making adjustments.
- Remember that the chips are razor sharp. Do not attempt to remove chips with your fingers. Stop the machine and use pliers to remove them.
- Remove all burrs and sharp edges from the piece before removing it from the lathe.

Metal Lathe

Guarding Guidelines

Cover work-holding devices (chucks) with secured fixed or movable guards or shields.



Power transmission needs to be guarded.



NOTE: Guards or shields used to protect lathe operators from projected parts must either be from the manufacturer or, if fabricated in-house, meet or exceed the same impact-resistance specifications as the original manufactured part. Various materials (such as polycarbonates) may possess different and less effective impact-resistance characteristics than the original materials used by the manufacturer.

Milling Machine

Milling Machine

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- ANSI B11.6-2001 {Safety Requirements for Manual Turning Machines with or without Automatic Control}

Potential Hazards

- Contact with rotating cutter while:
 - Loading/unloading parts or calipering while cutter is rotating
 - Operating machine with guarding not in place
 - Performing servicing and maintenance such as:
 - Changing and lubricating parts
 - Clearing jams
 - Removing excess oil, chips turnings
- Contact with the gears while machine is in motion while performing:
 - Inspection of gearbox by removing gearbox cover
- Getting loose clothing or long hair caught in rotating cutter
- Being struck by a flying object coming off mill
- Electrical shock
- Dropping objects onto foot

Key Controls

- Approved and authorized persons **ONLY** can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated **ONLY** with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.

Milling Machine

- NOTE: Gloves are not to be worn while operating a Milling Machine.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.
- Machine should be equipped with an emergency stop control (usually red domed mushroom type head on yellow housing) located in an easily accessible location.
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

- Always use cutters which are sharp and in good condition.
- Work must be clamped securely in a vise and vise clamped tightly to the table, or, work must be clamped securely to the table.
- Ensure that the cutter is mounted securely before taking a cut.
- Keep working surface clear of scraps, tools and materials.
- Remove the collet tightening wrench immediately after using it.
- Before running machine the spindle should be rotated by hand to make sure it is clear for cutting.
- Never run machine faster than correct speed. See shop instructor if you have any question as to what speed to run cutter.
- Do not take measurements, make adjustments or reach into machine when the cutter is rotating.
- Use a vacuum, brush or rake to remove cuttings only after the cutters have stopped moving.
 - Do not use bare hands to remove cuttings.

Milling Machine

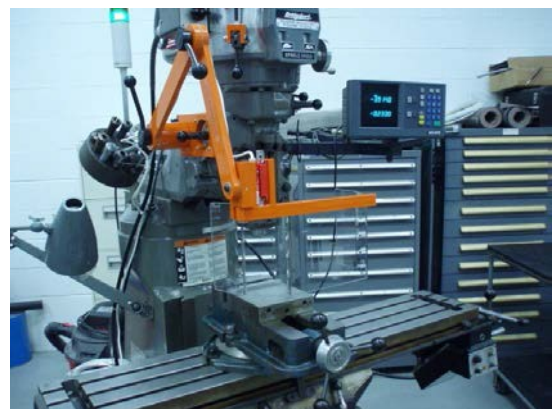
Guarding Guidelines

Vertical Milling Machines can be very dangerous. Contact or entanglement with rotating parts can result in serious injury.

*OSHA standard **29 CFR 1910.212(a)(iv)(e)** specifically references the point of operation of a milling machine as something that must be guarded.*

***NOTE:** Older Bridgeport Milling Machines did not come equipped with point of operation guarding. There are many types of guards available that will guard the point of operation. Contact EHS if assistance is needed.*

Each of the guards shown will protect the operator from contacting the point of operation, entanglement and from flying metal chips or oil.



Miter Saw

Miter Saw

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Contact with the blade is the most common injury. Extreme caution is needed because the operator's hands may come close to the saw blade, and a saw blade cannot be completely guarded.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings and recommended operating procedures given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
 - If machine has any visible damage report to shop supervisor immediately and DO NOT use machine.
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are not to be worn while operating a miter saw.
- Follow proper lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.

Miter Saw

- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Use vacuum or brush to remove debris. DO NOT USE BARE HANDS.
- When changing saw blade, appropriate gloves are to be worn.
- Wear disposable dust masks (optional).
- Hearing protection is available and its use is encouraged.

Operating Precautions

- Miter saws are to be used for cross cuts only. It is not recommended to use a miter saw for a rip cut.
- Do not exceed the maximum recommended cut for the machine.
- Ensure proper blade is on the saw and that the blade is sharp, undamaged, and that the arbor nut is tight.
- Use clamps to secure workpiece on the table before proceeding with the cut. Workpiece should be against the fence. **Do not cut free handed.**
- Do not start the saw with the blade touching the wood. Allow blade to reach full speed before beginning cut.
- Keep hands and fingers at a safe distance away from saw blade.
- Avoid reaching over the saw line. No cross armed cuts.
- Allow blade to come to a complete stop before lifting blade or removing workpiece.
- Keep the machine properly oiled and serviced.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the saw.

Miter Saw

Guarding Guidelines



Self-adjusting guard protects the operator from the portion of the blade that is above the table. This guard is to be in place and functioning properly before saw is to be used.

Oscillating Spindle Sander

Oscillating Spindle Sander

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Contact with the rotating and oscillating spindle can result in severe injury.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings and recommended operating procedures given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
 - If machine has any visible damage report to shop supervisor immediately and DO NOT use machine.
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are not to be worn while operating a spindle sander.
- Follow proper lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.

Oscillating Spindle Sander

- Install awareness devices (signage, barriers, etc.) around sander.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Use vacuum or brush to remove debris. DO NOT USE BARE HANDS.
- Do not operate sander without adequate dust collection system in place. Wear disposable dust masks if additional protection is desired (optional).
- Hearing protection is available and its use is encouraged.

Operating Precautions

- Remove any tools or other objects from table surface.
- Never jam a workpiece against the sanding surface. This can cause the workpiece to kickback.
- Firmly hold the workpiece and ease it into the spindle. Use light pressure when sanding. Always move the workpiece against the rotation of the sander. Never sand the workpiece while holding it off the table surface. This could cause the workpiece to be slammed to the table or propelled.
- Inspect stock for nails, staples or knots that could become dislodged and thrown from the machine during sanding.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the sander.

Oscillating Spindle Sander

Guarding Guidelines

The appropriate table insert needs to be in place. This will help prevent fingers from contacting the sanding spindle.



The cover for the power transmission needs to be closed and secure. The removable access panel is on the back of the machine.

Planer

Planer

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Woodworking tools}

Potential Hazards

- Point of operation – Contact with the cutter head may occur during blade adjustment or other maintenance activity.
 - Note: Automatic feeding systems make this machine less hazardous than other machines such as jointers and table saws.
- Loose clothes, jewelry, or long hair may be caught and pulled into automatic feed systems.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Kick-backs – Stock is caught by the blade and thrown back at the operator.
- Inhalation of dust and particles.
- Dropping objects on foot.
- Electrical shock.

Key Controls

- Approved and authorized persons **ONLY** can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Ensure all guarding is in place. Equipment to be operated **ONLY** with required guarding in place.
 - Ensure the 3 blades that make up the cutting head are tight and sharp and without defects.
 - Ensure anti-kickback fingers are in place on in feed side of planer.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

Planer

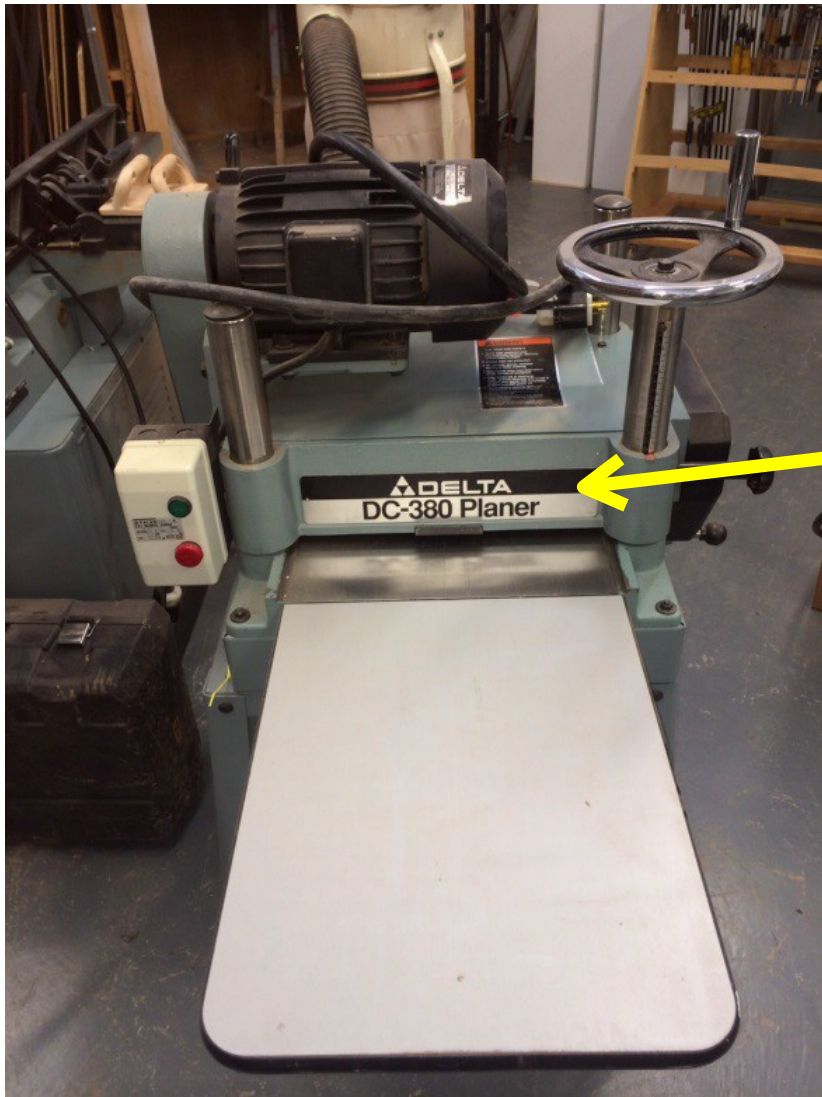
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

- Work piece will be fed automatically into planer. Do not reach into cutter head area while machine is running.
- Adjust cutter head so that no more than 1/8" is removed at a single pass.
- Make sure knives and infeed rollers are properly adjusted and set as per the instructions in the Machine's operating manual.
- Use different sections of the infeed when using planer in order to avoid uneven wear of cutting blades.
- Do not change speeds while planing.
- For best results, one face should be trued up on a jointer prior to planing and the side that has been trued up should be placed face down.
- Do not stand in line with the work piece.
- Do not start the machine with the wood contacting the cutting blades and allow cutting head to reach full speed before feeding in work piece.
- To reduce risk of kick-backs:
 - Avoid use of very poor quality lumber. There should be no loose knots, splits, or structural defects. Also, there should be no nails, screws or other foreign objects in the stock.
 - Ensure blade height is correctly set and blades are in good condition.
 - Avoid deep cuts. Make multiple passes using a less aggressive cut to achieve desired surface,
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the machine.
- Keep the machine properly oiled and serviced.

Planer

Guarding Guidelines



Cutter heads must be completely enclosed, except for the opening needed to feed the stock into the tool.

Radial Arm Saw

Radial Arm Saw

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Wood working tools}

Potential Hazards

- Contact with a moving blade is the most significant hazard. Extreme caution is needed because of the risk of severe cuts and amputations.
- Kick-back from the wood being caught in the blade or being fed the wrong direction.
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Inhalation of dust and particles.
- Dropping objects onto foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated ONLY with required guarding in place.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
 - Make sure blade is sharp and undamaged and that the arbor nut is tight.
 - Unit must have a return device. The front end of the unit must be slightly higher than the rear.
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are not to be worn while operating a radial arm saw.

Radial Arm Saw

- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.
- Use vacuum or brush to remove debris. DO NOT USE BARE HANDS.
- When changing saw blade, leather gloves recommended.
- Wear disposable dust masks (optional).
- Hearing protection is available and its use is encouraged.

Operating Precautions

- Ensure proper blade is on the saw and that the blade is sharp, undamaged, and that the arbor nut is tight.
- To reduce risk of kick-backs:
 - Avoid use of poor quality lumber.
 - Use proper blade for cut being performed.
 - Maintain and sharpen blade.
 - For ripping, use a spreader to prevent material from squeezing the saw or kicking back during ripping.
 - It is recommended to use a table saw for ripping, not a radial arm saw.
 - Use anti-kickback fingers to hold the stock down in the event that the saw kicks back the material.
- Hold workpiece securely against fence. Whenever possible, utilize clamps to assist in securing workpiece. **Do not cut free handed.**
- Do not start the saw with the blade touching the wood. Allow blade to reach full speed before beginning cut.
- Keep hands and fingers at a safe distance away from saw blade.
- Avoid reaching over the saw line. No cross armed cuts.
- Allow blade to come to a complete stop before removing workpiece or scrap.
- Keep the machine properly oiled and serviced.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the saw.

Radial Arm Saw

Guarding Guidelines



Both the upper and lower guards
MUST be in place before use.

Kick-back device to be used
whenever ripping.

Table Saw

Table Saw

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1926.304 {Woodworking tools}

Potential Hazards

- Contact with the blade is the most significant and dangerous hazard. **Hands and fingers can be amputated if they come into contact with moving blade.**
- Getting loose clothes, jewelry, or long hair caught in moving parts.
- Being hit, especially in the eyes, by debris flying from point of operation.
- Kick-backs – Stock is caught by the blade and thrown back at the operator.
- Inhalation of dust and particles.
- Dropping objects on foot.
- Electrical shock.

Key Controls

- Approved and authorized persons ONLY can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated **ONLY** with required guarding in place. This includes spreader (if performing a rip cut) and anti-kickback fingers.
 - The self-adjusting guard should adjust to the height of the wood and remain in contact with it. If it does not, remove saw from service and repair/replace guard.
 - Ensure blade is tight and sharp.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are not to be worn while operating a table saw.
- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

Table Saw

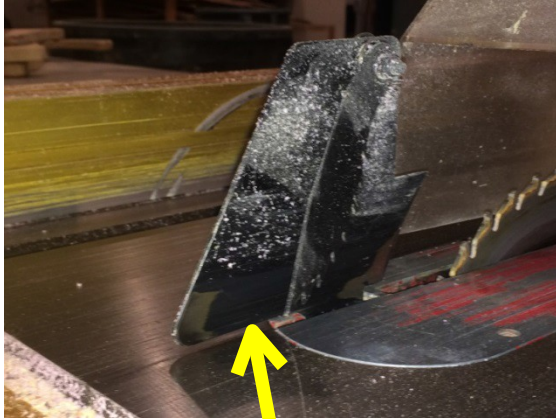
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

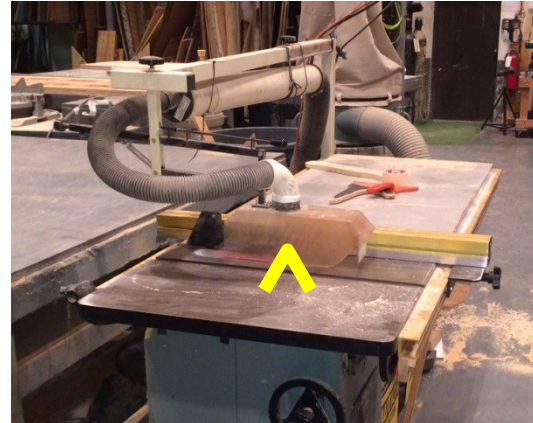
- Use a push stick for small pieces.
- Be careful to avoid coasting blades. Do not reach into cut area until blade has come to a complete stop.
- Blade height should be set so that the top of the teeth extend no more than 1/8 inch above the wood.
- Ensure proper blade is on the saw and that the blade is sharp, undamaged, and that the arbor nut is tight.
- Do not saw freehand. Always hold the stock firmly against the miter gauge or a rip fence to position and guide the cut.
- To reduce risk of kick-backs:
 - Avoid use of poor quality lumber.
 - Use proper blade for cut being performed.
 - Ensure blade height is correctly set.
 - Operate saw at speed recommended by MACHINE'S.
 - Maintain and sharpen blade.
 - Guide stock parallel to the rip fence.
 - For rip cuts, use a spreader to prevent material from squeezing the saw or kicking back during ripping.
 - Use anti-kickback fingers to hold the stock down in the event that the saw kicks back the material.
- Stand to side of blade in case a kick-back does occur.
- Ensure work area is clean and uncluttered and sufficient space is given to operator using the saw.
- Keep the machine properly oiled and serviced.

Table Saw

Guarding Guidelines

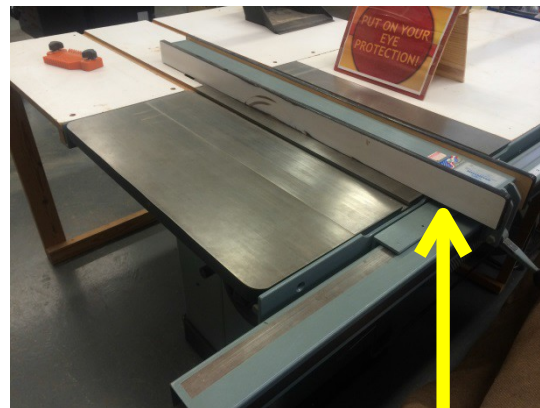


Spreader should be used when performing rip cuts. Anti-kickback pawls to be used to hold back wood in event saw kicks back wood.



Self-adjusting blade guard must be in place and in lowered position when prior to using saw.

Alternative anti-kickback device.



Saw blade should be lowered and under rip fence when not in use.

Wood Lathe

Wood Lathe

Applicable Standards

- 29 CFR 1910.132 {Personal Protection Equipment}
- 29 CFR 1910.147 {Control of hazardous energy}
- 29 CFR 1910.212 {General requirements for all machines}
- 29 CFR 1910.213 {Wood working machinery requirements}
- 29 CFR 1910.219 {Mechanical power-transmission apparatus}
- 29 CFR 1910.304 {Woodworking tools}
- ANSI B11.6-2001 {Safety Requirements for Manual Turning Machines with or without Automatic Control}

Key Hazards

- Point of operation – Contact with the tool or cutter head may occur.
- Contact with moving parts, such as the power transmission, chucks, spindles, and the workpiece.
- Getting loose clothes, jewelry, or long hair caught in rotating parts.
 - **Entanglement is a serious hazard on a lathe.** Loose clothes or long hair can become entangled around the rotating parts of the lathe pulling the operator into the cutter or rotating stock resulting in significant injury or death.
- Being struck by flying chips or wood splinters thrown by the cutting action.
- Being struck by a workpiece that has not been adequately secured in the lathe or is oversized.
- Inhalation of dust and particles.
- Dropping objects on foot.
- Electrical shock.

Key Controls

- Approved and authorized persons **ONLY** can operate equipment.
 - Training to be done and documented by designated competent instructor.
 - Appropriate department supervisor shall ensure unauthorized persons do not have access to machines.
 - Follow all safety warnings given in the Machine's Operating Manual.
- A visual pre-operation inspection should be done prior to use.
 - Equipment to be operated **ONLY** with required guarding in place.
 - Remove chuck keys, adjusting wrenches and knockout bars. Form a habit of checking for these before turning on the lathe.
 - Cord should be checked for cracks or worn areas. Remove from operation if cord is damaged or if plug does not have proper grounding (3-prong).
- Personal Protective Equipment (PPE) shall be worn as detailed in table on page 6.
 - NOTE: Gloves are not to be worn while using a wood lathe.

Wood Lathe

- Machines designed for a fixed location shall be securely anchored to prevent walking or moving.
- Follow proper Lock out procedures (CFR 1910.147).
 - NOTE: If device is plug in and plug is under exclusive control of the person performing the work, unplugging the machine will suffice. If person performing the work needs to leave the machine before work is complete, proper LOTO procedures are to be followed.
- Install awareness devices (signage, barriers, etc.) around saw.
- Instruct operators not to wear loose fitting clothing (short sleeves preferred), jewelry (including rings and watches) or gloves.
- Instruct operators with long hair to secure in a cap or hair net.

Operating Precautions

- Do not use stock that has splits, cracks, or knots.
- Allow glued joints to dry before working on stock.
- Hold tools firmly in both hands.
- Keep all cutting tools, blades and cutters sharp for the best performance.
- Make sure the tool rest is set close to the stock. Work only in the area covered by the tool rest; do not attempt to support the tool with your hands. Adjust the tool rest when the lathe is not running.
- Check that all locking devices on the tailstock and tool rest assembly (rest and base) are tight before operating the lathe.
- Make sure the blank is securely fastened.
- Rotate your workpiece by hand to make sure it clears the tool rest and bed before turning the lathe on. Be certain that the workpiece turns freely and is firmly mounted.
- ALWAYS CHECK THE SPEED OF THE LATHE BEFORE TURNING IT ON. Use slower speeds for larger diameters or rough pieces, and higher speeds for smaller diameters and pieces that are balanced.
- Always start a piece at a slower speed until the workpiece is balanced. If the lathe is shaking or vibrating, lower the speed. If the workpiece vibrates, always stop the machine to check the reason. As a starting point, consult your operator's manual for recommended speeds for a particular lathe. Make sure the lathe speed is compatible with the size of the blank.
- Never make any adjustments other than changing speed while the lathe is turning. Never adjust the tool rest or tailstock while the lathe is turning.

Wood Lathe

Guarding Guidelines

Cover lathes used for turning long stock with long curved guards extending over the top of the lathe.



Power transmission to be fully guarded.