

# **General Shop Safety Orientation**

## **Introduction**

The USC Department of Environmental Health and Safety has prepared this handbook along with the accompanying machine shop usage agreement to familiarize machine shop users with the general safety concepts and requirements necessary to work safely in a machine shop environment.

A signed copy of the agreement for each student working in a machine shop will be maintained by the Viterbi School of Engineering.

Each machine shop user must review the first 5 pages of this document, the machine guides that apply to them (Pages 6–22), and then sign the agreement on the final page. The shop supervisor is responsible for ensuring that the training is complete and documented.

## **Guidelines**

### **After Reading this handbook, you should:**

- Be aware of the university's General Shop Safety Rules and Policies.
- Know how to report near-miss incidents and/or machine repair needs to the shop supervisors.
- Understand the limitations and hazards of using compressed air in the shop environment.
- Be aware of the proper selection of hand tools for machining operations.
- Understand the safety precautions that must be observed when working with magnesium or other fire-hazardous or toxic materials.
- Understand the process for selecting Personal Protective Equipment (PPE) for machining operations.
- Be aware of existing policies and procedures regarding lockout/tagout and use of lifting devices.
- Be familiar with information about controlling hazards for specific equipment in your shop area.

## **General Shop Safety Rules**

### ***General Requirements***

- Do not operate any machine unless qualified and authorized by the shop supervisor to use it.
- Only the shop supervisor/authorized operator is allowed to turn on a machine.
- No machine is to be started unless all guards are in place.
- Safe work procedures must be developed, posted, and enforced. Safe shop practices do not permit taking chances.
- Practical jokes, horseplay, wrestling, throwing objects, loud unnecessary noises, or unusual commotion is prohibited.
- Any slippery substance such as oil, grease, water, etc. spilled on the floor must be wiped up immediately.
- Never operate any machinery when tired.
- Always use the buddy system when working in the machine shop.
- Never bring anyone into the machine shop that has not completed the College/VSoE General Shop Safety Orientation.
- All accidents, no matter how minor, must be reported immediately to the shop supervisor.

### ***Setup/Preparations***

- Operators must not wear jewelry, loose-fitting clothing, neckties, or other apparel that may become caught in machinery.
- Confine long hair with a cap or held back in some way to prevent the possibility of hair being entangled in the machinery.
- Wearing an “iPod” or other device that interferes with hearing is not allowed.
- All machine adjustments and cleaning must be done with the machine is off and “locked-out”
- Before starting any machine, ensure the controls are set to run within safe specifications.
- Machine guards shall be adjusted to expose the minimum amount of cutting head or blade needed to complete the work.
- Cleanliness and housekeeping must be maintained to prevent creation of safety hazards.

### ***Operating Machine***

- Tools and equipment shall not be left unattended while parts are still in motion or machinery is in a "cocked" or mid-cycle status.
- When operating a power-driven machine, stop the machine after making the necessary cut. Never leave a machine while it is running.
- Keep fingers away from moving machine parts. Never reach over dangerous moving parts or lean over the work so that hair or clothing can become entangled in rotating parts.
- Do not bypass any machine guard when operating a machine.
- Use brushes, vacuum equipment, or special tools to remove chips and shavings from near a cutting tool. Never use hands or rags that can be caught by moving parts.
- Stop the machine when it is necessary to clean, oil, or adjust the equipment.
- Never attempt to stop a machine by using the hand or any part of the body as a brake.
- Only the proper hand tools should be used. Tools should be kept in their proper location (such as a tool rack or rest).
- Push sticks shall be used where appropriate (i.e. stripping, cutting small parts, etc.)
- It is expected that users will clean up after themselves each time they use the shop.

**Note: Never attempt to make electrical repairs. Request assistance from the shop supervisor.**

### **Compressed Air**

Use of compressed air for cleaning purposes, referred to as “blow-down or blow-off”, is discouraged where alternate means are feasible. Specifically cleaning with compressed air entrains dust into the air where it can be inhaled and can propel projectiles that have the potential to penetrate the skin or eyes. For these reasons, cleaning with compressed air should only be conducted when other methods, such as vacuuming and brushing, are impractical or ineffective. Additionally, use of compressed air for cleaning is expressly prohibited for specific toxic substances. If in doubt as to the appropriateness or necessity for cleaning with compressed air, check with your shop supervisor or Environmental Health and Safety.

- **Compressed air used for cleaning purposes shall be less than 30 psi (pounds per square inch) at the nozzle and effective chip guarding and personal protective equipment are required.**
- **Compressed air shall not be used for cleaning clothing while on a person, nor for cleaning a person.**

If you are unsure if your compressed air cleaning device meets the < 30 psi. requirement, check with your shop supervisor.

### **Hand Tools**

- Use the approved tool for the job. Makeshift arrangements such as the use of a screwdriver as a chisel, a pair of pliers as a wrench, a wrench as a hammer, or overloading a wrench by using a pipe extension (cheater bar) on the handle are not to be utilized.
- Use only tools that are in good condition and free from broken or splintered parts. Ensure that hammer heads are attached securely to the handles. In addition, files and similarly constructed tools should be equipped with handles
- Mushroomed heads on cold chisels, punches, hammers, etc. are to be ground down to avoid injury from flying particles.
- Use suitable shields to cover the dangerous parts of sharp-edged or pointed tools. Standard tool belts, grunt bags, pouches, or boxes should be used for carrying tools. The use of pockets for this purpose is discouraged.
- When working with hand tools, always secure the work in a mechanical vise or with clamps. Never use your hands in place of such equipment.

### **Magnesium & Pyroforic Materials**

The following safety precautions must be observed when using magnesium or other fire-hazardous or toxic materials.

- Because sparks can be produced, it is dangerous to use equipment that uses magnesium to grind other metals. Mark equipment for magnesium grinding “For Magnesium Only”.
- Good housekeeping is essential for safe handling of magnesium. Clean accumulations of magnesium from grinding or other processes often and place it in a special container marked “Magnesium”. Keep the container in an open area.
- Blowing chips is forbidden. This practice may lead to a fire-hazard.
- While machining magnesium, keep a fire extinguisher suitable for magnesium in the immediate area for instant use. Review directions on the extinguisher before beginning the machining operation.
- Machine magnesium **DRY. Never use moisture.** On occasion some oils may be used, check with your shop supervisor regarding these cases. In these cases, use only neutral mineral oils and greases for cooling and lubrication. Animal or vegetable oils, acid-containing mineral oils, or oil-water emulsions are potentially hazardous and should never be used with magnesium
- Never use a vacuum cleaner for chip removal from the machine. Have chips/shavings swept up and placed in a covered, plainly labeled container. Do not allow magnesium dust and shavings to be mixed with regular floor sweepings.

### **Personal Protective Equipment (PPE)**

All individuals in the machine shop areas must wear **eye protection**. **Safety goggles** complying with ANSI Z87.1, *Practice for Occupational and Educational Eye and Face Protection*, are excellent for operations that may generate flying objects. **Face shields** are not adequate if there are flying objects, but do help if there is dust. Face shields may be necessary *in addition* to goggles on some operations. **Safety glasses** that have side shields should be used whenever safety glasses are required. Consult with your shop supervisor in order to determine the best eye protection for your particular job.

**Safety shoes** must be worn in designated areas and while performing specific tasks where there is a high potential for injuring the top or other parts of the foot.

**Gloves** shall not be worn while operating machinery with rotating or reciprocating parts. This is because such machines and parts can catch on the glove and pull the user's hand towards dangerous moving parts. Gloves may be worn while loading and unloading parts and tooling.

### **Lifting**

Do not attempt to lift heavy work by yourself Obtain assistance or use hoists, shop lifts, or other lifting aids.

Use of overhead cranes is reserved only for employees trained and authorized to operate the specific crane being used. Among the necessary precautions, operators must check slings and other rigging equipment for defects. The loads need to be safely secured and affected personnel in the area must be warned and traffic through the area needs to be controlled or detained.

### **Lockout/Tagout**

In addition to the manufacturer-installed electrical controls on machine tools, each machine must have a disconnect switch that can be locked in the "Off" position to isolate the machine from the power source. No maintenance or repair on any machine should be conducted until the "disconnect" switch serving the equipment has been shut off, padlocked in the "Off" position, and tagged.

### **Emergency Response**

Always follow departmental policies and procedures in the event of an emergency. The following are recommended components of any action plan:

- Inform others in the area of the emergency.
- Evacuate the area.
- Become familiar with the building's posted evacuation routes.
- Do not move injured persons unless they are in immediate danger (such as from a fire).
- Report the nature and location of the emergency to the shop supervisor, EH&S, and the Department of Public Safety, as necessary.

### **Fire**

A fire can be prevented or its severity lessened if you are mindful of your actions at all times and develop good housekeeping habits. Good housekeeping habits entail prompt removal of accumulated waste from the machine shop; and, ensuring that aisles and exits are free of obstructions.

When a fire occurs, the following are recommended:

- Small vessel fires can usually be suffocated by covering the vessel.  
NOTE: Do not pick up the vessel. Do not cover it with combustible materials.
- If you are trained to use a fire extinguisher and confident in using it, fight the fire from a position that allows you a safe emergency exit.
- For fires burning over a large area, evacuate the area to a designated meeting area. Do not use elevators to leave the building; use the stairs.
- Notify co-workers and activate the fire alarm.
- Once outside the building, report to DPS and the responding fire fighters the nature of the fire i.e. whether it started from machinery, an electrical short, etc.

The **PASS** procedure is employed when operating a fire extinguisher. Remember that fire extinguishers generally only last around 30 seconds.



**NOTE:** Never attempt to use a fire extinguisher to extinguish a large or rapidly spreading fire. Never re-hang a spent fire extinguisher back on the wall.

### **Injuries from a Fire**

If a person's clothing is on fire, get them to **stop, drop, and roll** to extinguish the fire.

Once the fire is extinguished, clothing contaminated with possible hazardous materials should be removed. To prevent contamination of the eyes, use caution when removing clothing. However, do not attempt to remove clothing that has adhered to burn wounds.

### **Earthquake**

Whenever an earthquake occurs, it is important to stay calm and remember to **drop, cover, and hold on**.

Take shelter under a sturdy table or near an interior wall away from windows and heavy objects. Although it is a common practice to stand in a doorway, it is actually safer to stand next to an interior wall. Also, the door will swing during the shaking and strike you. If you are outside, move to an open area away from buildings.

### **Emergency Contact Information**

#### **Department of Public Safety (DPS)**

**(213) 740-4321 (do not call 911 if you are on campus, the response will be faster if you call DPS first because they can escort emergency services to the precise location, which may be difficult to locate for an outside agency).**

## Environmental Health & Safety

(213) 740-6448

### Machine Specific Hazards / Safety Controls / Inspection

Identify specific types of machines and their functions, understand the potential hazards associated with each machine, and learn to identify and eliminate hazards through your initial setup and preparation.

These guides describe minimum standards of regulatory agencies. Operations may require alternative methods of safeguarding, which must meet the minimum requirements of law.

Take the time to review the shop placards and guides for the equipment that is present in your shop area, especially those which you may be asked to operate. *Review operations not covered in this booklet with your immediate shop supervisor.*

### ABRASIVE CHOP SAW

#### Function

The abrasive chop saw cuts with a rotating circular blade that is lowered through the materials.

#### Hazards

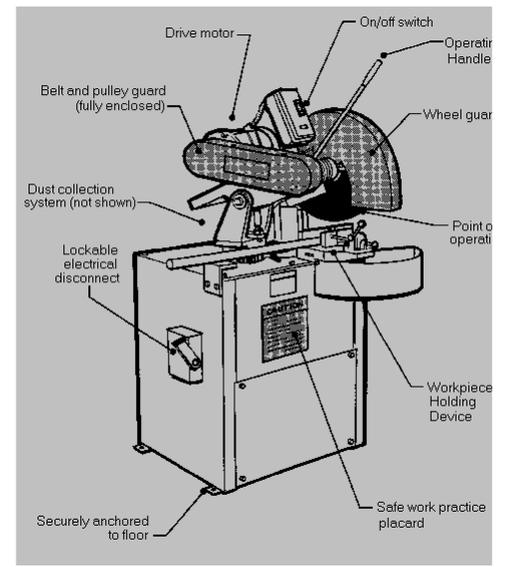
- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Noise during operation.
- Accidental contact with the rotating saw blade.
- Flying chips, sparks, or broken saw blade particles.
- Being struck by an unsecured workpiece.
- Exposure to airborne contaminants during unventilated cutting operations.

#### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the saw before each shift use.
- Operator and maintenance worker training in lockout/ tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice posting that includes warnings against mixing incompatible dusts, for example, "Aluminum Only" and "Do Not Grind Steel on This Machine."
- Personal protective equipment such as body aprons, faceshields, goggles, or respirators.
- Hearing protection during operation and in surrounding shop working areas.
- Dust collection system that is connected and functions properly.
- Negative exhaust ventilation systems that reduce particulate exposure levels.

#### Reference

American National Standards Institute (ANSI) B11.10, "Metal Sawing Machines"



## Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. The power is locked in the off position before a blade is changed or maintenance is performed.
8. Dull, cracked, or excessively dirty saw blades are taken out of service.
9. The proper blade for the material being cut is installed.
10. The workpiece is securely clamped before cutting.

## BANDSAW

### Function

The bandsaw cuts materials at various angles with a rotating band blade driven by two wheels.

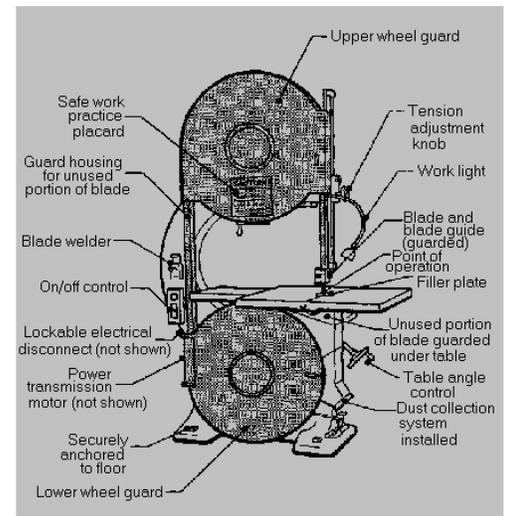
### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Accidental contact with the moving saw blade.
- Flying dust, chips, and broken saw blade particles.

### Safety Controls

- Operator training in safe work practices as described in the operator manual.
- Inspection of the bandsaw before each shift use.
- Operator and maintenance worker training in lockout/ tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission apparatus against contact.
- Push sticks to place material at the point of operation.
- Dust collection system that is connected and functions properly.
- The use of a brush rather than compressed air to remove dust and debris.
- Guards for upper and lower saw wheels, with latched access doors.
- Enclosure of the saw blade between the upper saw wheel and the saw table with a sliding fixture fastened to the guide that encloses all four sides.
- Enclosure of the unused portion of the saw blade, including the portion under the worktable.
- A clear shield that covers the part of the saw blade that runs through the roller guides to the bottom plane of the roller guides.
- Automatic wheel brakes for high-speed vertical friction sawing machines (6,000 to 15,000 f/min).

### Reference



**Inspection**

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. Access doors are latched to prevent exposure during operation.
8. The saw blade in use is the proper one for the material being cut.
9. The length of the exposed cutting blade is no more than 3/8 inch higher than the thickness of the material.
10. Saw blades with broken, dull, excessively gummed, or dirty saw teeth are taken out of service.
11. The openings in bandsaw filler plates that allow the blade to pass through the table top do not exceed 1/8 inch on either side of the blade.
12. Saw blades are adjusted to the proper tension. (The blade should run free against the guide rollers).
13. The shop area is at least 45 F. (The blade may break if the machine is started in colder temperatures.)

## **BELT/DISK SANDER**

### **Function**

The belt sander removes materials with the abrasive surface of the rotating disk or belt.

### **Hazards**

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Noise during operation.
- Mixing material dusts in the dust collection system (e.g., steel and aluminum, metal and wood).
- Contact with the rotating abrasive surface. The exposed portion of the sanding surface may expose the operator or passerby to a nip point or abrasion hazard.

### **Safety Controls**

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the sander before each shift use.
- Operator and maintenance worker training in lockout and tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice postings and guides that includes warnings against mixing incompatible dusts, for example, "Aluminum Only" and "Do Not Grind Steel on This Machine."
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Handling devices.
- Hearing protection during operation and in surrounding work areas.
- Guarding of power transmission apparatus against contact.
- Barrier guards for the portion of the abrasive disk below the worktable.
- Dust collection systems that are connected and function properly.
- The use of a brush rather than compressed air to remove dust and debris.

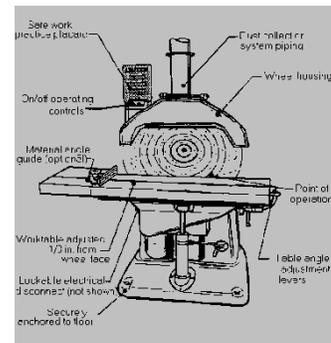
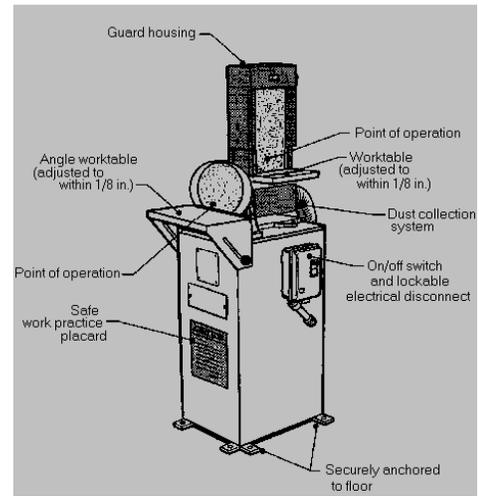
### **References**

ANSI 01.1, "Woodworking Machinery" and ANSI B11.9, "Grinding Machines"

### **Inspection**

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to a supervisor.)
5. The work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is with the machine.
7. Abrasive surface is free of rips, tears, or worn areas.
8. The proper type of abrasive belt is being used for the material being processed.



## BUFFING/POLISHING MACHINE

### Function

The buffing/polishing machine rubs either a cloth or a wire abrasive wheel against the work to change the surface finish.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Contact with the exposed portion of buffing wheels.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the machine before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission apparatus against contact.
- Wheel guards that cover both sides, spindle, end, nut, flange projection, and the periphery of the wheel, leaving not more than 180-deg exposure.
- Dust collection system that is connected and functions properly.
- The use of a brush rather than compressed air to remove dust and debris.

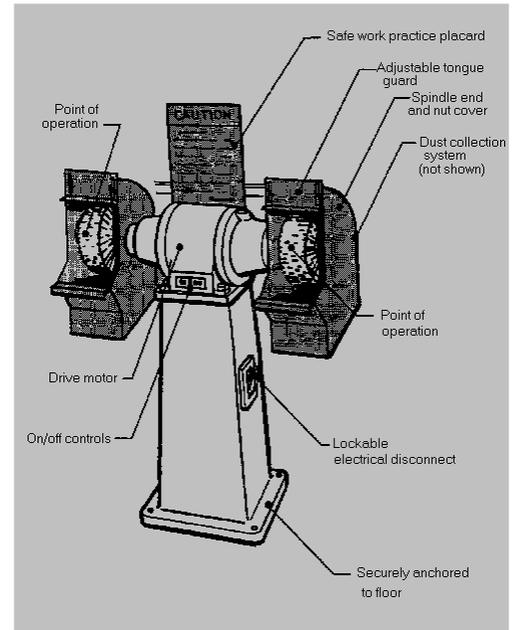
### Reference

ANSI B11.9, "Grinding Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to a supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. The proper type of polishing wheel is being used for the material being processed.



## DRILL PRESS

### Function

There are three general classes of drill presses: vertical or upright, multiple, and radial spindle. All three drill holes in material by lowering a rotating cutter onto materials such as wood, ferrous and nonferrous metals, and composites.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Contact with moving machine parts or tools.
- Flying chips, coolant, chuck keys, broken tooling, and broken bits longer than jobber size bits.
- Material falling on the fingers or toes.
- Being struck by work that has seized up on the tool and has pulled free of the work holder.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the press before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission apparatus.
- Adjustable chip/coolant shields when required.
- Spring-loaded chuck keys.
- Workpiece clamps and vices.
- The use of a brush rather than compressed air to remove dust and debris.

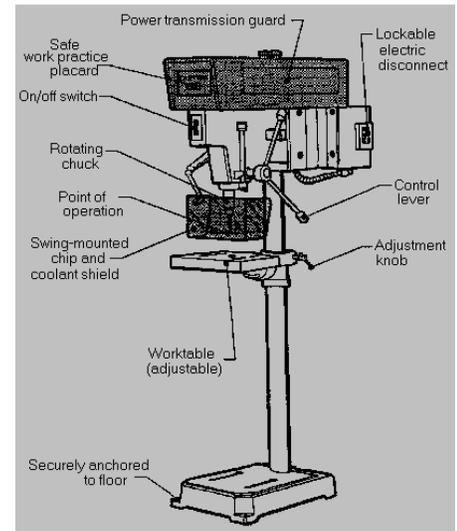
### Reference

ANSI B11.8, "Drilling, Milling, and Boring Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. Drill bits are properly sharpened and drills with battered tangs, slots, or burrs are taken out of service.



## DRUM/SPINDLE SANDER

### Function

The drum/spindle sander removes various materials with the abrasive surface of the rotating drum/spindle.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Noise during operation.
- Mixing material dusts in the dust collection system (e.g., steel and aluminum, metal and wood).
- Contact with the rotating abrasive surface.

### Safety Controls

- Operator training in safe work practices as described in the operator manual.
- Inspection of the sander before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice posting that includes warnings against mixing incompatible dusts, for example, "Aluminum Only" and "Do Not Grind Steel on This Machine."
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Hearing protection during operation and in surrounding work areas.
- Guards against contact with power transmission apparatus.
- Adjustable barrier guards for the unused portion of the sanding drum/spindle below the worktable and above the table to cover the rotating spindle and nut on the top.
- Dust collection system that is connected and functions properly.
- The use of a brush rather than compressed air to remove dust and debris.

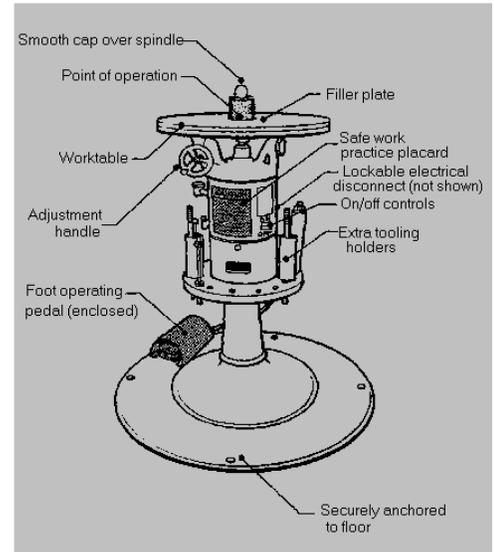
### References

ANSI 01.1, "Woodworking Machinery" and ANSI B11.9, "Grinding Machines"

### Inspection

Check to ensure that—

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. The proper type of abrasive drum/spindle is being used for the material being processed.
8. Abrasive surface is free of rips, tears, or worn areas or taken out of service if these conditions are noted.
9. The filler plate in the center of the table through which the spindle passes is the correct size for the drum/spindle chosen. The opening between the filler plate and the drum/spindle does not exceed 1/8 inch.



## ELECTRIC MITER SAW

### Function

The electric miter saw cuts angularly by lowering a rotating circular saw blade through the material from top to bottom.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Noise during operation.
- Contact with the rotating saw blade.
- Being struck by an unsecured workpiece, flying chips, sparks, or broken saw teeth.

### Safety Controls

- Operator training in safe work practices as described in the operator manual.
- Inspection of the saw before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard that includes warnings against mixing incompatible dusts, for example, "Aluminum Only" and "Do Not Grind Steel on This Machine".
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Hearing protection during operation and in surrounding work areas.
- The use of a brush rather than compressed air to remove dust and debris.

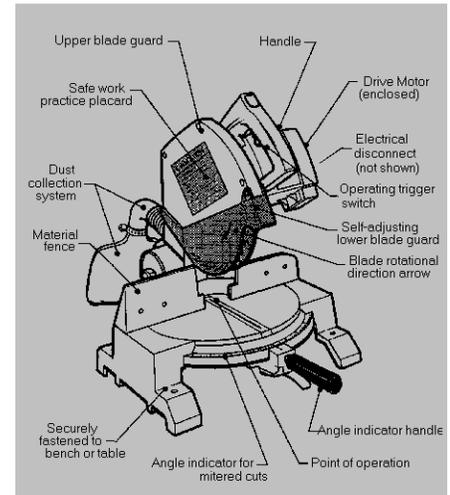
### References

ANSI 01.1, "Woodworking Machinery" and ANSI B11.10, "Metal Sawing Machines"

### Inspection

Check to ensure that—

1. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
2. Operational controls are legibly marked to indicate their purpose.
3. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
4. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
5. The owner-operator manual is on site and with the machine.
6. The manufacturer-provided saw blade guard is in place and in good working condition. (Never clamp or wedge the guard in the open position.)
7. The saw is securely mounted to prevent movement.
8. The proper blade for the material being cut is being used.
9. Dull, cracked, or excessively dirty saw blades are taken out of service.
10. The miter angle guide rotates smoothly without binding.
11. The spring-loaded trigger switch is in proper functional condition.
12. The workpiece is securely clamped.
13. Electric cords are disconnected before blades are changed or adjusted. Disconnect electrical cords by grasping the plug and pulling straight out; never jerk cords from a receptacle.



## HORIZONTAL MILLING MACHINE

### Function

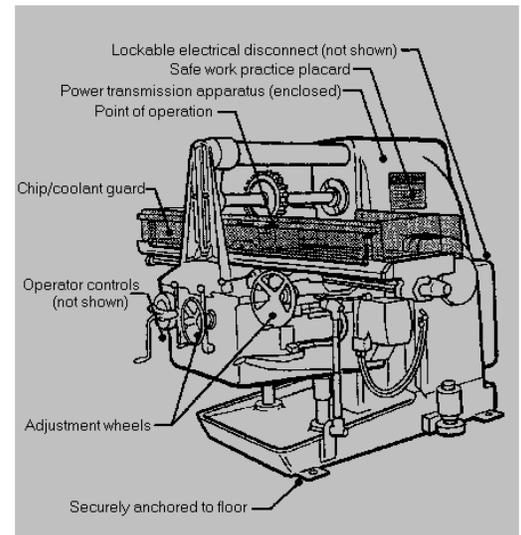
The horizontal milling machine uses a horizontally mounted multiple-cutting-edged rotating tool to remove metal. The machine has a stationary tool and the work is fed into the cutter. Horizontal milling machines are often used for gear cutting.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Being struck by operating control handles (that are not spring-loaded) that rotate when the worktable is moved by power.
- Being struck by flying chips and coolant.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the machine before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission apparatus.
- Chip and coolant guarding.
- "Spring-loaded" operational handles that disengage when not hand operated, on machines that have power-fed tables where the handles do not disengage and rotate at high speed.
- The use of a brush rather than compressed air to remove dust and debris.



### Reference

ANSI B11.8, "Drilling, Milling, and Boring Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.

## "KNEE MILL" MILLING MACHINE

### Function

The knee mill is a metal-cutting machine that uses a vertically mounted multiple-cutting-edged rotating tool to remove metal. Its capabilities include boring, slotting, end milling, or external surface preparation work; it can be used on piece parts with plain or irregular surfaces.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Being struck by flying chips and coolant.
- Being struck by operational handles.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the knee mill before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission apparatus against contact.
- Chip and coolant shielding when required.
- Spring-loaded operating handles that disengage when not hand operated for worktables that are power fed.
- Barrier guards for "fly cutting" operations.
- The use of a brush rather than compressed air to remove dust and debris.

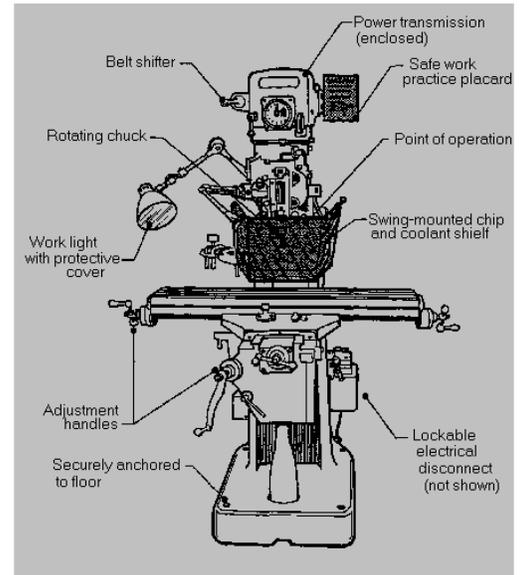
### Reference

ANSI B11.8, "Drilling, Milling, and Boring Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. The proper cutters are used for the work being processed
8. Recommended tool cutting speeds are followed.
9. Cutters not in use are properly stored in storage racks and capped to guard against accidental contact with sharp edges.



## METAL-CUTTING (HORIZONTAL) BANDSAW

### Function

The metal-cutting bandsaw cuts a wide variety of substances, including steel and its alloys, "exotic" alloys, cast iron, copper, plastic, laminated plastics, composites, brass, aluminum, and hard rubber. It uses a rigid, heavy blade with cutting teeth on one edge. Abrasive disks, large toothless (friction) cutoff saws, and various hot metal saws are not included.

### Hazards

1. Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
2. Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
3. Poor housekeeping.
4. Contact with the moving saw blade or sharp edges of cut material.
5. Skin irritation from coolants.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the bandsaw before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard that includes warnings against mixing incompatible dusts, for example, "Aluminum Only" and "Do Not Grind Steel on This Machine".
- Personal protective equipment such as body aprons, faceshields, goggles, and approved safety shoes.
- Guarding of power transmission apparatus against contact.
- Guards for both saw wheels, with latched access doors.
- Guards for the unused portions of the saw blade.
- Clamps to prevent workpiece movement during operation.
- The use of a brush rather than compressed air to remove dust and debris.

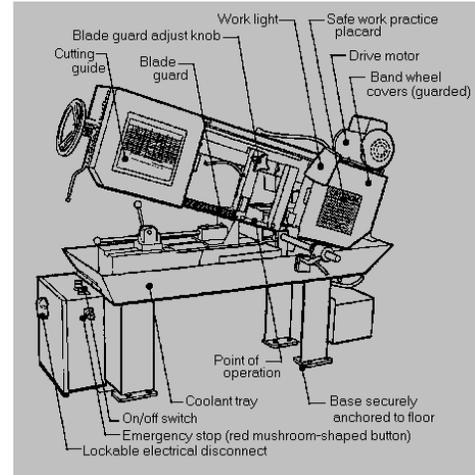
### Reference

ANSI B11.10, "Metal Sawing Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The working surface is free from scrap and unneeded tools and materials.
7. The owner-operator manual is on site and with the machine.
8. Dull, cracked, or excessively dirty saw blades are taken out of service immediately.
9. The saw blade in use is the proper one for the material being cut.
10. The blade tension is properly adjusted.



## METALWORKING LATHE

### Function

The metalworking lathe is a cutting machine that rotates stock against an adjustable tool or tools to change its shape. There are at least 12 different types of metalworking lathes, however, over 50% of those in use are engine lathes (illustrated).

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Contact with lead screw may result in nip or pinch point.
- Poor housekeeping.
- Being struck by improperly clamped workpieces.
- Flying metal chips or chuck wrenches left in the chuck before startup.
- Lifting heavy workpieces.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the lathe before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring, including devices such as rubber feet, tar paper, or a nonskid mat.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission and lead screw against contact.
- Chip and coolant shielding.
- Lifting devices for the loading and unloading of heavy workpieces.
- The use of a brush rather than compressed air to remove dust and debris.

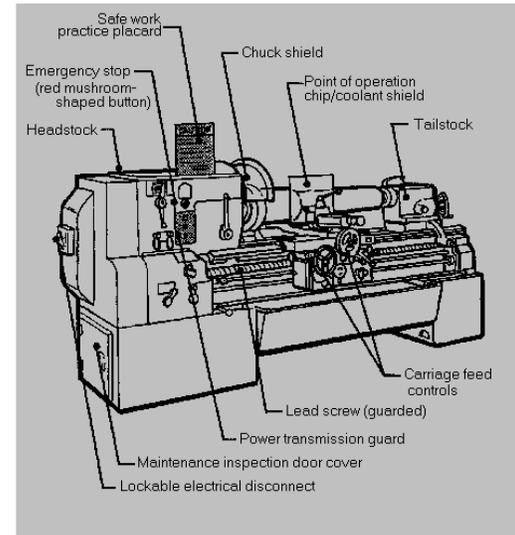
### Reference

ANSI B11.6, "Lathes"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. The machine is never stopped by hand braking.
8. The work is not calipered or gauged while the machine is in motion.
9. Wrenches are spring-loaded to prevent them from being left in the chuck.
10. The workpiece is properly clamped to prevent dislodging during operation.
11. Tools are sharp.



12. Tools are stored in storage racks, not left on the lathe.

## PEDESTAL GRINDER

### Function

The pedestal grinder removes material burrs and rough edges from metal with a rotating abrasive or wire wheel.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Poor housekeeping.
- Noise during operation.
- Mixing material dusts in the dust collection system (e.g., steel and aluminum, metal, and wood).
- Contact with the exposed portion of abrasive or wire wheels.
- Being struck by broken pieces of abrasive or wire wheels.
- Exposure to airborne contaminants during unventilated grinding operations.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the pedestal grinder before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard that includes warnings against mixing incompatible dusts, for example, "Aluminum Only" and "Do Not Grind Steel on This Machine."
- Personal protective equipment such as body aprons, faceshields, goggles, or eye shields.
- Hearing protection during operation and in surrounding work areas.
- Wheel guards that cover both sides, spindle, end, nut, flange projection, and periphery of the wheel, leaving not more than 90 deg exposure.
- Dust collection system that is connected and functions properly.
- The use of a brush rather than compressed air to remove dust and debris.
- Lockout and deenergizing of the motor-drive system before work rests and tongue guards are adjusted.

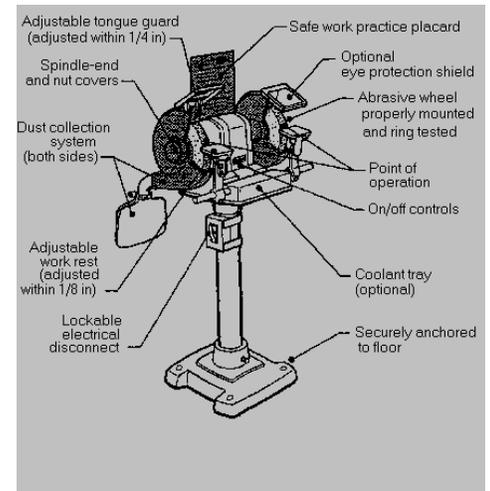
### References

ANSI B7.1, "Abrasive Wheels" and ANSI B11.9, "Grinding Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact.
5. The work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. Abrasive wheels are inspected before each use and cracked or fouled wheels are taken out of service.
8. The rated speed of the grinding machine does not exceed the rated speed of the abrasive wheel.
9. New wheels are not cracked.
10. The proper abrasive wheel is used for the material being processed.
11. Work rests are adjusted within 1/8 inch of the face of the constantly decreasing abrasive wheel as necessary.
12. Work rests are free from cracks, broken pieces, and modifications of any kind (e.g., slots cut to accept drill bits at angles).



13. Tongue guards are adjusted to within 1/4 inch of the face of the constantly decreasing abrasive wheel as necessary.
14. Wheel sides are not used for grinding, unless they are specifically designed for this purpose. (Most wheels used on pedestal and bench grinders are Type 1, designed for peripheral grinding).
15. Wheels are stored in a clean, dry place and protected from damage.

### PRECISION HONING MACHINE

#### Function

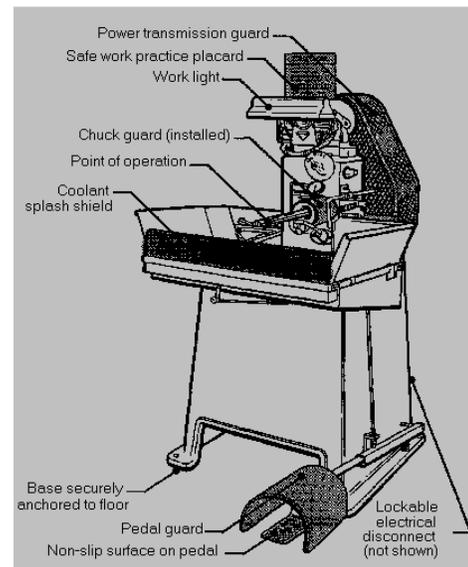
The precision honing machine improves surface finish, usually on bored holes. Honing is a low-velocity abrading process that uses an abrasive stick or stone to remove metal. The tool is rotated and fed into the work, which is given a slow reciprocating motion.

#### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Contact with the rotating chuck.

#### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the precision honing machine before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission apparatus against contact.
- The use of a brush rather than compressed air to remove dust and debris.
- A shield that protects against contact with the rotating chuck.



#### Reference

ANSI B11.9, "Grinding Machines"

#### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)
5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.

## RADIAL ARM SAW

### Function

The radial arm saw cuts wood, reconstituted products, and plastics by pulling a rotating saw wheel through a stationary workpiece toward the operator. This type of saw is commonly used for cutoff and crosscutting. The cutting head can be rotated 90 deg in either direction to a rip position with the saw blade parallel to the fence.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Noise during operation.
- Accidental contact with the rotating saw blade.
- Being struck by flying chips and broken saw teeth.
- Being struck by an unclamped workpiece.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the saw before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard warns "Do not rip or plough from this end".
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Hearing protection during operation and in surrounding work areas.
- Guards on both sides of the saw blades.
- Guarding of power transmission apparatus against contact.
- Dust collection system that is connected and functions properly.
- Note: Consult the saw manufacturer for special requirements for cutting ferrous and nonferrous metals.

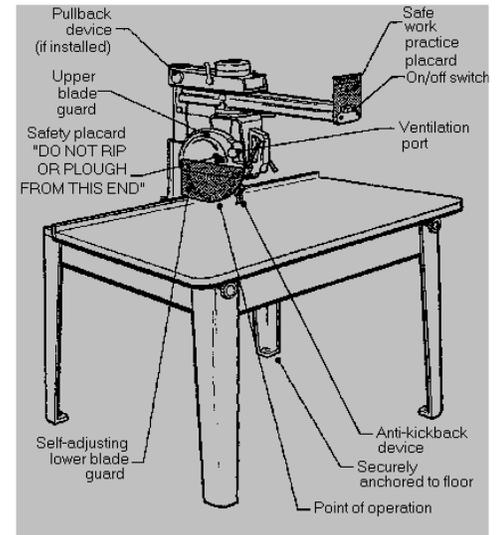
### Reference

ANSI 01.1, "Woodworking Machinery"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Operational controls are legibly marked to indicate their purpose.
3. Electrical wiring is undamaged and live electrical components are guarded against accidental contact.
4. The work area is clean and free from scrap material, dust, and other material that may cause poor footing.
5. The owner-operator manual is on site and with the machine.
6. The proper saw blade is used for the material being cut.
7. Dull, cracked, or excessively dirty saw blades are taken out of service.
8. Abrasive, cutoff, or wire wheels are not used on radial arm saws.
9. The forward-travel stop is properly adjusted and all other travel stops are set before operation.
10. Saw blade does not travel beyond the working edge of the table.
11. The rated speed (r/min) of the saw blade is never exceeded.



12. On/off switches are located at the front of the machine.
13. The saw returns gently to the starting position when released.
14. Workpiece clamps are used to prevent "kickback" hazards.

## TABLE SAW

### Function

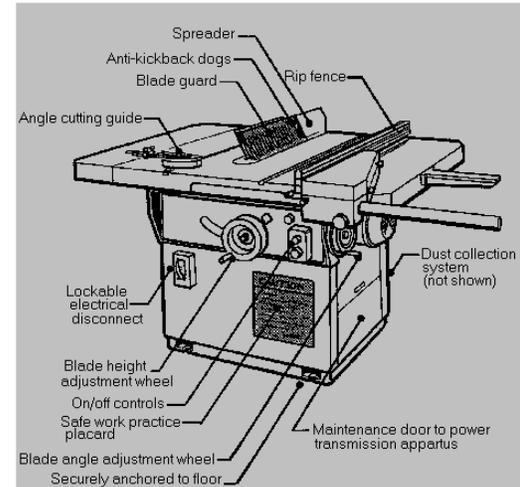
This machine saws wood, plastic, composition board. With the proper blades installed, it will also saw nonferrous metal, brick, and stone.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Noise during operation.
- Accidental contact with the rotating saw blade.
- Being struck by flying chips and broken saw teeth.
- Being struck by a workpiece that is "kicked back".

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the saw before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Hearing protection during operation and in surrounding work areas.
- Guarding of all power transmission apparatus against contact.
- Standing to the side during operation, never directly behind the blade.
- Self-adjusting saw blade guards that remain in contact with the material, completely covering the blade before and after the material has passed under it.
- Note: Combs or jigs must be used when standing guards cannot be used, for example, in dadoing, grooving, jointing, or rabbeting.
- "Spreader" and "antikickback dogs" to prevent kickbacks when cutting wood.
- The use of push blocks.
- Exhaust collection system.
- Note: Consult the manufacturer for special requirements for cutting metals.



### References

ANSI 01.1, "Woodworking Machinery" and ANSI B11.10, "Metal Sawing Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)

5. The work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. Blade adjustment wheel works smoothly and locks the blade firmly in place.
8. Rip fence adjusts properly in grooves and locks in place smoothly.
9. Angle cutting guide moves smoothly along the table slot and locks firmly in place.
10. Antikickback dogs are properly positioned when cutting wood.
11. Maintenance inspection door cover under the worktable is in place and secured.
12. Blade height is properly adjusted above the material.
13. The proper saw blade for the material is used.
14. Dull, cracked, or excessively dirty saw blades and blades with broken teeth are taken out of service.
15. Electrical control switches are in good repair, safely located, and labeled.
16. Table is cleaned of debris before and after use. Never leave loose tools on the table during operation.

## VERTICAL MILLING MACHINE

### Function

The vertical milling machine is a metal-cutting machine that uses a vertically mounted multiple-cutting-edged rotating tool.

### Hazards

- Entanglement of loose clothing; long, unrestrained hair; jewelry; and gloves.
- Electrical shock from damaged electrical wiring or contact with unguarded power transmission apparatus.
- Poor housekeeping.
- Being struck by flying chips and coolant.
- Being struck by operational handles.

### Safety Controls

- Operator training in safe work practices as described in the owner-operator manual.
- Inspection of the machine before each shift use.
- Operator and maintenance worker training in lockout/tagout procedures.
- Preventive maintenance according to the manufacturer's recommendations.
- Adequate lighting.
- An undercurrent protection device that, in the event of interrupted electrical power (power loss, fluctuation), requires the operator to manually restart the machine when power is restored.
- Electrical disconnect that can be locked in the off position.
- Safeguards that protect operational controls from accidental activation.
- Operational controls placed so that the operator does not have to reach over machinery to access them.
- Machine anchoring that prevents movement and excessive vibration during operation.
- Visible and legible machine safe-work-practice placard.
- Personal protective equipment such as body aprons, faceshields, or goggles.
- Guarding of power transmission apparatus against contact.
- Adjustable or fixed guarding of chips and coolant as required.
- Barrier guards for fly cutting operations.
- Spring-loaded operating handles that disengage when not hand-operated for power-fed worktables.
- The use of a brush rather than compressed air to remove dust and debris.

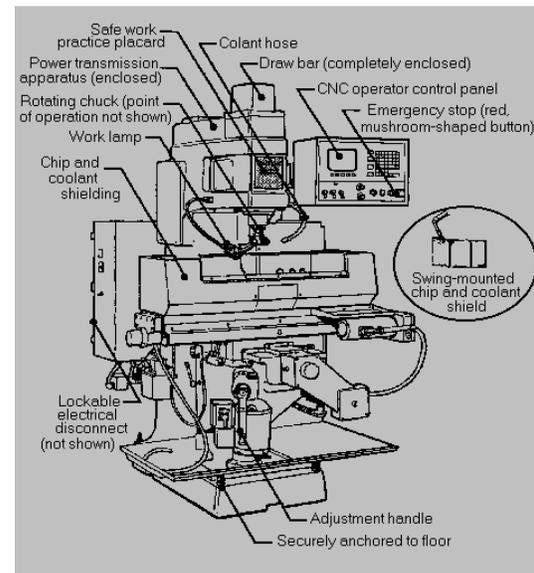
### Reference

ANSI B11.8, "Drilling, Milling, and Boring Machines"

### Inspection

Check to ensure that-

1. Guards are in place and properly adjusted before the machine is started.
2. Belts, pulleys, chains, sprockets, and other dangerous moving machinery parts are guarded to prevent access or accidental contact.
3. Operational controls are legibly marked to indicate their purpose.
4. Electrical wiring is undamaged and live electrical components are guarded against accidental contact. (Report electrical hazards immediately to the shop supervisor.)



5. The surrounding work area is clean and free from scrap material, dust, and other material that may cause poor footing.
6. The owner-operator manual is on site and with the machine.
7. Unused cutting tools are properly stored and covered.

## Student Machine Shop Usage Agreement

I, \_\_\_\_\_, have completed the College/Viterbi School (VSoE) General Machine Shop Safety Orientation, and understand them as they apply to my work in the shop.

1. I agree to abide by the rules and accept personal responsibility for my work in the machine shop.
2. I am aware that violation of the safety requirements may result in my loss of privileges in the machine shop.
3. I will not eat, drink or wear devices that can interfere with hearing.
4. I understand the requirements for selecting the appropriate Personal Protective Equipment for machine operations and will not enter the shop unless properly dressed \_\_\_\_\_ (Initial).
5. I promise not to attempt to use any machinery that I do not have written permission to use \_\_\_\_\_ (Initial).
6. I am responsible to clean and maintain all equipment, floors, and stations to its original condition.
7. I will report all accidents, no matter how minor, and malfunctioned equipment to the shop supervisor immediately.

I agree to abide by all university regulations and shop policies at all times in the machine shop. This acknowledges that I have received training in the safe operation of the machines checked below:

_____ Band Saw	_____ Instructor	_____ Lathe	_____ Instructor
_____ Drill Press	_____ Instructor	_____ Mill	_____ Instructor
_____ Grinder	_____ Instructor	_____ Table Saw	_____ Instructor
_____ Other: _____	_____ Instructor		

USC College/  
VSoE Instructor: \_\_\_\_\_ Date: \_\_\_\_\_  
Name/Title

Shop Equipment User: \_\_\_\_\_ Date: \_\_\_\_\_  
Name & USC ID#

\_\_\_\_\_  
Signature