UMBC Machine Guarding Reference Guide

The following is a general guide for machine guarding for the most common types of machines, tools, and equipment found in a shop environment. Contact Environmental Safety and Health (esh@umbc.edu or 5-2918) with specific questions regarding machine guarding requirements.

All Shop machinery, tools, and equipment must have the following points adequately guarded:

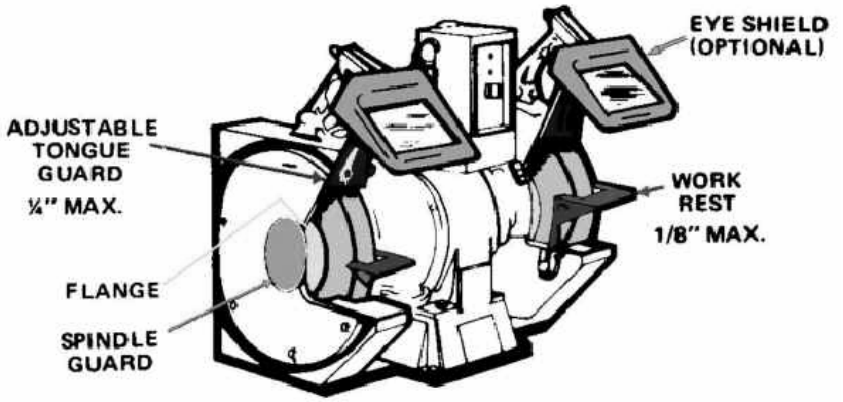
- **Point of Operation** - The area where the machine performs the work (i.e., where a saw blade meets the material being cut)
- **Power Transmission Devices** - The elements of a mechanical system that transmit energy, such as belts, chains, and pulleys.
- **Other moving parts** that move when the machine, tool, or equipment is in operation.

Unguarded ✘

Guarded ✅

Bench Grinders

- Side guards must cover the spindle, nut, flange, and 75 percent of the wheel diameter.
- The work rest must be adjusted to within ⅛ inch of the wheel.
- Adjustable tongue guards must be kept to within ¼ inch of the wheel.
- Face shields shall be worn if eye-shields are not installed on bench grinders.
- The maximum RPM rating of the grinding wheel shall be compatible with the RPM rating of the bench grinder motor.
- All grinding wheels shall be inspected, installed, and replaced by competent persons. An inspection shall consist of a visual inspection and a ring test prior to first use and periodically thereafter.
- Do not use a grinding wheel if it is cracked or if the ring test produces a dull or flat sound.



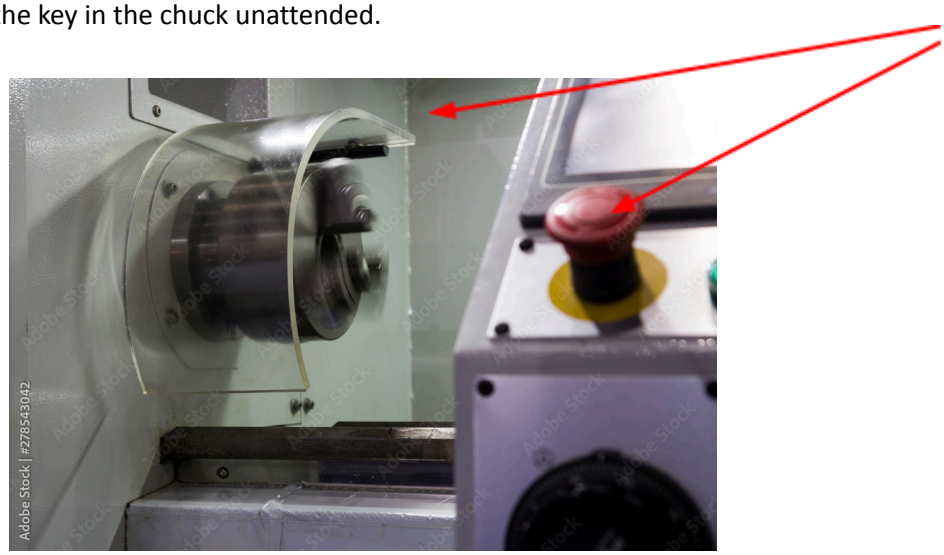
Angle Grinders

A fixed guard is required on the grinding wheel and must enclose one-half or 180 degrees of the grinding wheel.

An angle grinder with a fixed guard.

Metal and Wood Lathes

- Chucks shall be guarded to protect the user against pinch points, crushing, and entanglement. Lathes turning long stock must have a guard that covers the stock.
- Emergency stops should be equipped and be placed in easy to access locations that can be accessed within arms reach of the user.
- The machine shall be completely stopped prior to cleaning chips or measuring the workpiece.
- Do not leave the key in the chuck unattended.



A lathe with a clear chuck guard and emergency stop.

Band Saws

- Band saws shall have an adjustable guard set as close as possible to the stock.

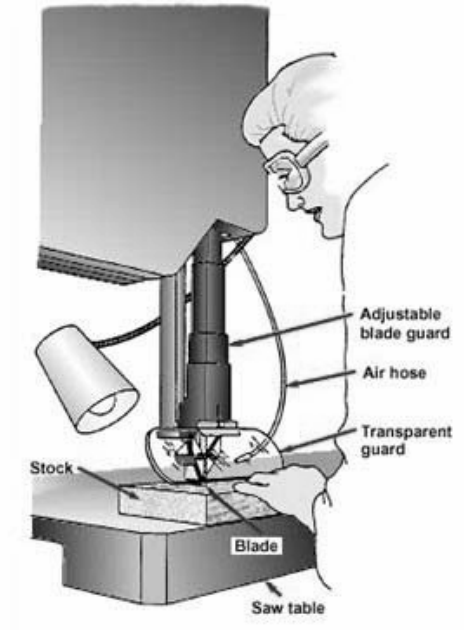
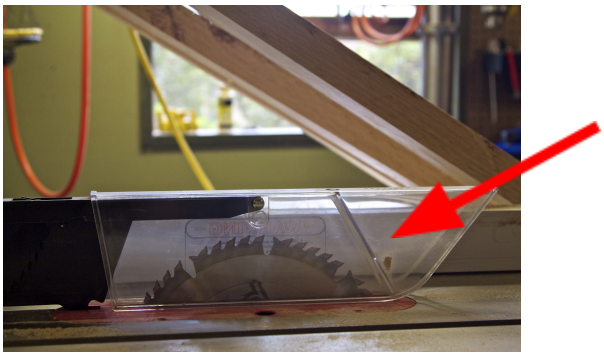
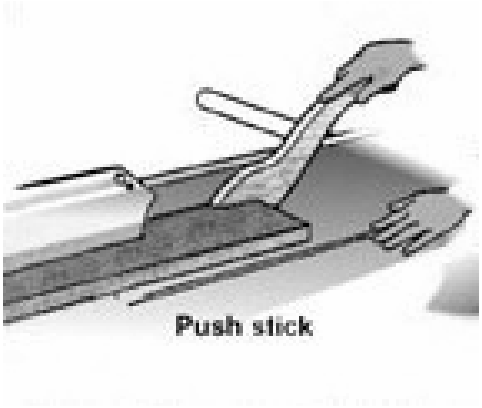


Table Saws

- Table saws shall have a wood spreader guard, a blade guard (self-adjusting) and an anti-kickback guard.
- Push sticks are to be used when cutting small material and for pushing material past the blade.
- Saw blade teeth may not extend ¼ of an inch above the material being cut.

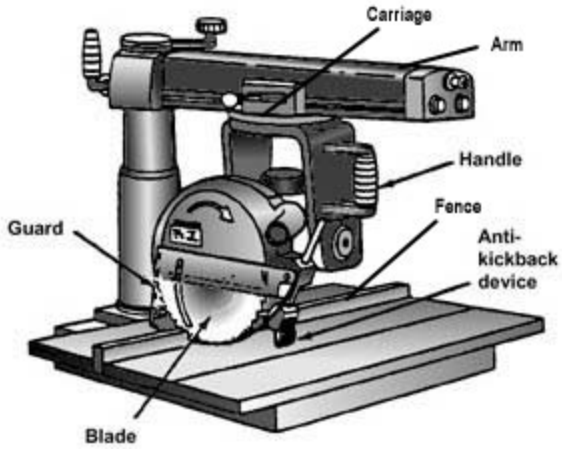




A table saw with a clear plastic blade guard.

Radial Arm Saws

- Radial arms saws must have a self-adjusting guard below the blade.
- Return the saw to its original position after finishing a cut.
- Radial arm saws configured for ripping (as opposed to cross-cutting) should have anti-kickback protection in place.



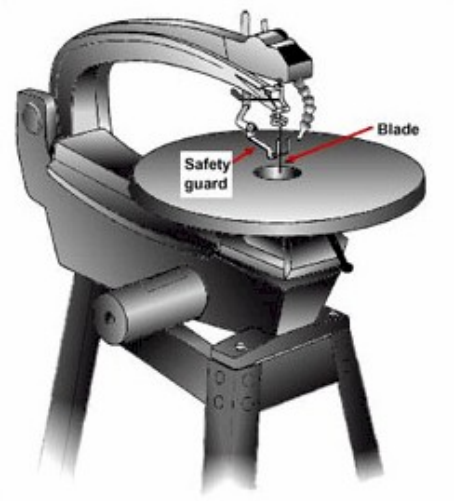
Circular Saw

- Circular saws must have a self-adjusting blade guard.
- Do not pull the saw out before the saw has come to a complete stop, otherwise kickback may occur.
- Turn the saw off before removing it if the cutting has not been completed.

Guarded blade on circular saw

Scroll Saw

- Scroll saws must have blade guards.



Routers

- Hand-held routers must have fixed guards.
- Benchtop routers must have self-adjusting guards above the cutting area.

Fixed guard on handheld router

Guarded benchtop router

Chop and Miter Saws

- Chop and Miter Saws must have self-adjusting blade guards.
- Use the appropriate blade based on size and RPM per manufacturer's specifications.

Reciprocating Saws

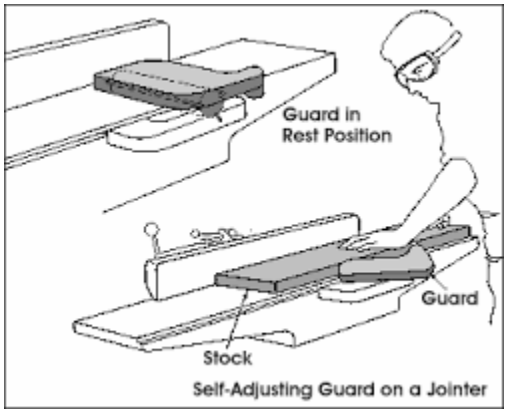
- Reciprocating saws (aka Saw Zalls) must have hand/finger guards.

Jig Saws

- Jig saws must have blade guards for the upper portion of the blade above the tool rest.

Jointers

- Jointers must have a self-adjusting blade guard.
- Use a push stick to feed small stock.



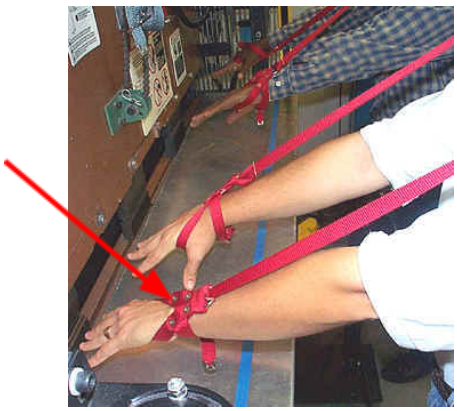
Planers/Moulders

- Cutter heads must be completely enclosed except for an opening to feed the stock into the equipment.

Cutter head is enclosed with a metal guard or a cage.

Power Press Brakes

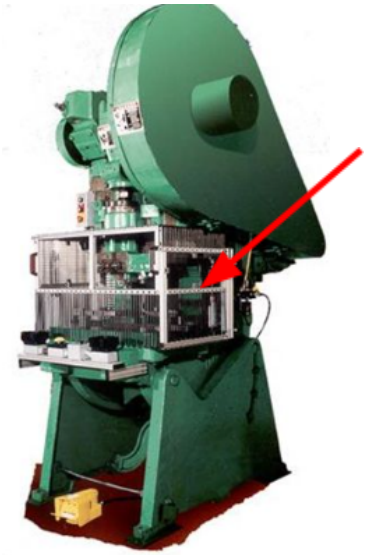
- Any of the following guarding methods shall be used for presses:
    - Presence-sensing device (such as safety light curtains)
    - Pullback device
    - Two-hand Trip/Control device
    - Restraint device
- Power transmission components and foot switches should be enclosed to prevent accidental operation.



Example of a pullback device

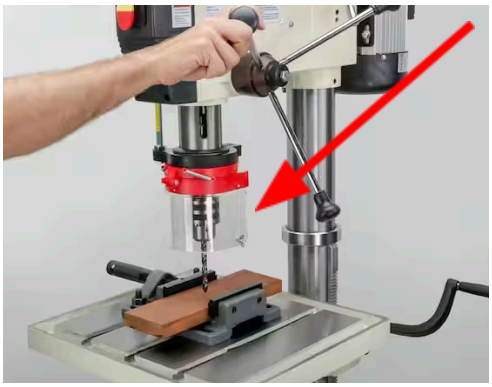
Safety light curtain and two-hand controls

Power Presses (Hydraulic and Mechanical)



- For mechanical and hydraulic power presses, as with Power Press Brakes, a variety of guarding methods can be used. The equipment manufacturer should be consulted for recommendations or specific requirements. The following are types of acceptable guarding methods:
    - Presence-sensing devices (such as safety light curtains)
    - Pullback devices
    - Two-hand Trip/Control device
    - Restraint devices
- Never place hands inside of the point of operation.
- Use special hand tools for removing work or scrap pieces from the die area.

Drill Presses



- Chuck guards are required on drill presses.
- Clamp any smaller material to prevent spinning.
- Drill presses must be secured to their work station.
- Do not leave chuck keys in drill presses.

Hot Work (Welding, Cutting, Brazing, etc.)

- Wear appropriate PPE and hot work attire (i.e., coat, pants, gloves, apron)
- Welding helmets or tinted face shields shall use the appropriate shade number depending on the type of torch or welding being used (see Shade Selection Guide below).
- Safety glasses are required if a face shield is worn.
- Oxygen and acetylene cylinders must be secured to a cart using a chain or webbing strap.
- Valve caps must be secured on all cylinders that are not connected to a regulator.
- Shield/distance any combustible or flammable materials.

1910.252(b)(2)(ii)(H) - OSHA Shade Selection Guide

Welding operation	Shade No.
Shielded metal-arc welding - 1⁄16-, 3⁄32-, ⅛-, 5⁄32-inch electrodes	10
Gas-shielded arc welding (nonferrous) - 1⁄16-, 3⁄32-, ⅛-, 5⁄32-inch electrodes	11
Gas-shielded arc welding (ferrous) - 1⁄16-, 3⁄32-, ⅛-, 5⁄32-inch electrodes	12
Shielded metal-arc welding:	
3⁄16-, 7⁄32-, ¼-inch electrodes	12
5⁄16-, ⅜-inch electrodes	14
Atomic hydrogen welding	10-14
Carbon arc welding	14
Soldering	2
Torch brazing	3 or 4
Light cutting, up to 1 inch	3 or 4
Medium cutting, 1 inch to 6 inches	4 or 5

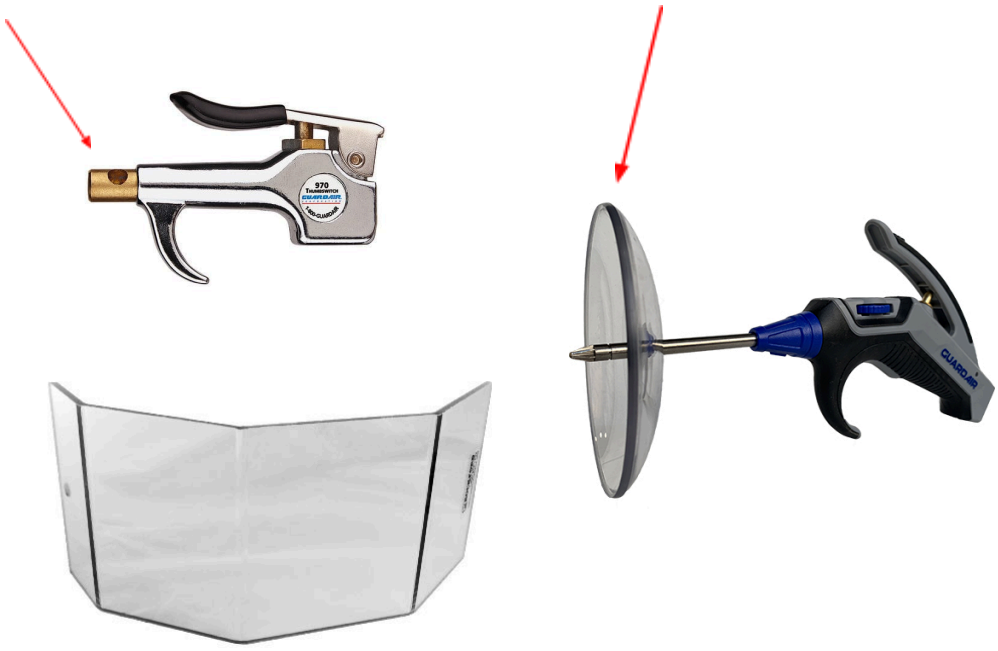
Heavy cutting, 6 inches and over	**5 or 6**
Gas welding (light) up to ⅛ inch	**4 or 5**
Gas welding (medium) ⅛ inch to ½ inch	**5 or 6**
Gas welding (heavy) ½ inch and over	**6 or 8**

Cranes and Hoists

- Cranes and hoists may only be operated by authorized individuals who have received training on crane and hoist operation.
- All cranes and hoists must have their load capacity clearly marked.
- Cranes have specific inspection requirements - refer to the UMBC Fall Protection and Working From Heights Program for additional information on crane inspections.

Compressed Air

- Do not use compressed air to clean off a person's body, hair, or clothing.
- Safety air nozzles shall be installed on compressed air hoses to relieve pressure to below 30 psi when "dead-ended", such as when the tip is placed against someone's skin. Typically these are ported to allow for air to escape. Air pressure may also be adjusted at the regulator to below 30 psi if feasible.
- Chip guarding must be in place (such as a plastic shield or protective air cone) to deflect any dirt, debris, or chips away from the operator. Chip guarding may also be separate from the air nozzle in the form of barriers or screens and may be necessary to ensure chips are not deflected onto any persons nearby.



Clockwise from top: A ported safety air nozzle, air nozzle with protective chip barrier, and a standalone chip guarding shield.