

Miami University  
Department of Architecture and Interior Design

# Workshop



# Safety Manual

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## General Information

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Department of Architecture and Interior Design Workshop  
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(513) 529-7009 (Fax)

<http://www.fna.muohio.edu/woodshop/woodshop.html>

The woodshop is located in the basement of Alumni Hall. It is available for students and staff of the department. This complete machine and assembly shop, one of the finest in any U.S. architecture school contains over 4,500 square feet of high-bay space and is open days, evenings, and weekends. The facility is supplied with full woodworking capabilities, welding equipment and a large variety of hand tools. Ted Wong is the manager and director of the shop facilities.

## Shop Mission

The mission of the Alumni Hall Workshop and staff is to provide a safe and reliable work environment for the exploration and study of building materials and the tools and techniques used to shape them.

## Shop Mottos

- It can be fixed.
- Watch'yer fingers.

## Shop access

- All Students, faculty and alumni of the Department of Architecture and Interior Design that have fulfilled the requirements of shop certification.

## Safety

Safety in the workshop is of utmost concern for shop staff and shop users. Accidents in the shop may result in serious bodily harm or death. Following proper safety procedures and conforming to shop policy as outlined in this workshop safety manual will greatly reduce any chance of injury.



## Guests and Visitors

Any person who has completed the Shop Orientation, Shop Test and signed a Shop User Safety Agreement may accompany shop guests and visitors. He or she is responsible for that guest/visitor. Guests and visitors are not permitted to use any machines or tools and are not allowed in any machine use areas. Visits should be as brief as possible.



# Policies and Procedures

## 1. Eye Protection

- 1.1 Eye protection must be worn at all times in the shop facilities.  
(safety glasses are supplied by the shop)
- 1.2 Consistent failure to wear eye protection will result in loss of shop access:
  - First offense: Warning.
  - Second offense: Loss of shop access for 48 hours.
  - Third offense: Loss of shop access until meeting with department chair and shop manager.

## 2. Shop Orientation, Test Requirements and Shop Certification

- 2.1 All Shop Users must be Shop Certified.
- 2.2 Shop Certification consists of: attendance at Shop Orientation session, successful completion of Workshop Policy Quiz, Table saw Safety Quiz, Jointer Safety Quiz, demonstration of equipment proficiency and a signed copy of the Shop User Safety Agreement Form.
- 2.3 All requirements of shop certification must be completed within the same semester.
- 2.4 Shop users must have on file with the shop manager a signed and dated copy of the Shop Users Safety Agreement form.
- 2.5 Individuals must receive additional instruction for machines not included in the standard orientation.
- 2.6 Shop Certification is good for four years from date of signed Shop User Safety Agreement Form.

## 3. Injury – Causing Accidents

In the event of an injury-causing accident, the following procedures must be followed:

- 3.1 Notify the shop supervisor immediately! Shop personnel will follow established first-aid procedures.
- 3.2 All injury-causing accidents requiring outside medical attention requires a meeting with and the shop manager to determine the cause of the accident and as a preventative measure against similar accidents in the future before shop access may resume.

## 4. Non-injury Accidents

In the event of accidents resulting in machine damage, material "kick-backs," jamming, or other unsafe events, the following procedure must be followed:

- 4.1 If gross negligence is determined to be involved in the course of a non-injury causing accident a meeting is required between the user(s) involved in the accident and the shop manager before shop access may resume.

## 5. Shop Occupancy Limits

In order to maintain a safe work environment strict user limits are enforced. Therefore faculty should always schedule their shop related projects with the shop manager. The following are capacity limits:

- 0 to 12 students\*: Requires one shop supervisor.
- 13 to 20 students\*: Requires two shop supervisory personnel.
- 21 to 25 students\*: Requires three shop supervisory personnel.

\* These are only guidelines; the supervisor may restrict access at his or her discretion.

More than 26 students are not allowed in the shop at any one time. The shop manager may waive this limit if prior arrangements have been made.



## 6. Spray room Policy

- 6.1 All spraying must be done within the confines of the spray booth equipment.
- 6.2 Spray Booth is to be used with aerosolized paint spray material only do not use spray booth to apply brush finishes, pour concrete, etc.
- 6.3 All solvent soaked rags or materials must be disposed of in red fireproof receptacle.
- 6.4 All empty spray cans must be discarded in regular trash receptacle.
- 6.5 Failure to comply with spray room policy may result in closure for extended periods of time for cleaning.

## 7. Cleaning of Shop Facilities

The shop facility is under the control of the department and is not cleaned by Miami's janitorial staff. Shop users are responsible for cleaning up after using the shop.

- 7.1 Each student is personally responsible for clean up and tool return.
- 7.2 Each machine and work area should be cleaned immediately after use.
- 7.3 **The last person to use a machine is responsible for cleaning the machine and surrounding work area.**
- 7.4 Students consistently failing in their clean-up responsibilities may be denied shop access.
  - First offense: Warning.
  - Second offense: Loss of shop access for 48 hours.
  - Third offense: Loss of shop access until meeting with department chair and shop manager.

## 8. Materials and Project Storage

A limited number of lockers are available for materials/project storage. The following procedures apply for items that will not fit in lockers:

- 8.1 Special arrangements may be made for large materials storage. Such storage is only allowed for limited periods of time and requires a specific removal date. All materials stored beyond the removal dates will be subject to discard.
- 8.2 Projects may be left on workbenches for a specified period of time after consulting with shop staff.
- 8.3 Lockers will be emptied one week after the end of each spring semester. Any contents not immediately claimed will become property of the shop.

## 9. General Shop Hours

### 9.1 Workshop Hours of Operation

Monday	9:00am – 10:00pm
Tuesday	9:00am – 10:00pm
Wednesday	9:00am – 10:00pm
Thursday	9:00am – 10:00pm
Friday	9:00am – 5:00pm
Saturday	10:00am – 5:00pm
Sunday	1:00pm – 10:00pm

The shop is closed  
12:00pm – 1:15pm  
Monday – Saturday  
And  
5:00pm – 6:00pm  
Monday – Thursday,  
Sunday

- 9.2 At the discretion of the shop manager the shop may be closed for lack of use.
- 9.3 At the discretion of the shop manager the shop may be reserved for specific courses taught in the shop.
- 9.4 If the university is closed, so is the shop.
- 9.5 Spray facility is accessible 24/7.

## 10. Personal Projects

Department faculty, staff and currently registered department students may use the workshop during regularly scheduled hours for non-course related projects under the following conditions:

- 10.1 All standing policies and procedures are followed. Users are department faculty or enrolled students and have met the requirements for Shop Certification.
- 10.2 The use does not interfere with other users performing course-related work in any way.
- 10.3 No consumable shop supplies are used (glue, abrasives, hardware, etc.).
- 10.4 If commercial, professional or financial gain is to be made by any shop user as a result of the use of the Department Workshop, a fee of \$40.00/hr. shall be paid to Miami University.
- 10.5 Department students not taking summer courses must pay a \$10.00/hr fee to use the Department Workshop over the summer.
- 10.6 Shop Attendants on duty have the authority and responsibility to determine whether any such work is permitted on a case-by-case basis.

## 11. Alumni and Former Students

Alumni and Former Students of The Department of Architecture and Interior Design at Miami University may use the shop provided the following:

- 11.1 Former Students and Alumni that have been shop certified within the last two years may have access to the department workshop. Alumni and former students that have not been shop certified within the last two years must renew shop certification.
- 11.2 A current signed copy of the Shop Safety Agreement form is on file with the shop office.
- 11.3 A fee has been paid that is commensurate with the scope of the work as determined by the shop manager.
- 11.4 The use does not interfere with other users performing course-related work in any way.

## 12. Materials

### **Wood**

Used wood and wood based materials may be processed in the shop as long as the material is clean, free of dirt, grit, grime or abrasive materials. Material that is excessively contaminated with dirt or grime should not be processed on any of the workshop equipment (ex. material previously used for concrete formwork). Material should also be free of paint or finishes (ex. varnish, enamel) and free of metallic objects (ex. nails, screws, staples). All used material should be analyzed with a metal detector before attempting any machining procedures using the shops tools or equipment. **Shop users using used materials may be found liable for damage to the shops tools and equipment caused by those materials.**

### **Metal**

Metal should be processed on specific equipment or machines for metal. Follow guidelines for each specific tool or machine regarding materials as outlined in the shop manual.

### **Plastic**

Plastic should be processed on specific equipment or machines for Plastic. Follow guidelines for each specific tool or machine regarding materials as outlined in the shop manual.

### **Plaster or cement**

Cement or plaster may not be processed on any of the equipment or machines in the shop. Grinding tools with specific attachments may be used to work cement or concrete on the outdoor concrete slab.

# General Shop Safety Rules

1. Shop is open during posted hours or by appointment. Check for schedule changes during finals period and holidays.
2. **Do not enter the shop while under the influence of mind-altering drugs or alcohol.**
3. Every person is required to wear eye protection in the shop as required by OSHA.
4. Tie back long hair when operating machinery.
5. Remove all rings, wristwatches and necklaces before operating machinery.
6. Do not wear sandals or open toe shoes while working in the shop.
7. Loose clothing should be restrained - tuck in shirttails, etc.
8. All accidents, even if very small, must be reported to your instructor/shop manager or the staff person on duty.
  
9. A safe attitude will protect you and others. Think - practice and develop good, safe working habits.
10. Respect the rights and property of other students. Be thoughtful and helpful towards others in the shop.
11. Horseplay, running, yelling and/or fighting are absolutely forbidden in the shop.
  
12. Do not use stationary equipment work surfaces for sanding, project assembly, layout, applying finishes, etc. or for uses other than their intended purpose.
13. Make sure machines are in the “**off**” position and motion has stopped, before leaving them after use.
14. All safety guards must be kept in place while operating equipment. If a guard or safety device is an impediment to safe operation of a machine seek help.
15. Use equipment for its intended use. If in doubt, ask for help.
16. Do not use equipment until you have received proper and safe instruction and feel comfortable with its operation.
17. If you have made an adjustment on a piece of equipment, return it to its normal position after you are done.
18. **Never make an adjustment to knobs or handles marked with red tape.**
19. Do not use broken or damaged equipment; report immediately to manager.
20. Do not attempt repairs to any equipment that is broken. Notify shop manager or student assistants for help.
21. Make sure machine's work surface is unobstructed and clean before use.
  
22. Always be aware of the proximity of moving parts to body parts (ex. fingers).
23. Never talk to someone operating a machine.
24. Avoid talking or other distractions while operating tools and equipment.
  
25. **Clean up your mess!** Wipe up all spilled liquids. Pick up your materials. Put away tools. Sweep up any loose debris.
26. Return all tools to their proper storage place after using.
27. **Absolutely no tools out of the shop.**
28. Ask for Shop Managers approval before storing materials or projects in shop.

29. All used lumber must be inspected by shop staff.
30. Do not use previously painted or finished wood in the shop.
31. Do not use pressure treated (green treated) lumber in the shop.
32. Do not use plaster or any cementitious material on any power machines.
33. Ask for assistance when disposing solvents, finishes, chemicals, and other hazardous materials.
34. Do not pour solvent or oil-based chemicals in sink.
35. Do not wash brushes containing solvent or oil-based chemicals in sink.
  
36. Office access is restricted. Ask shop attendant for assistance.
37. Headphones are prohibited in the shop.
38. Alumni Hall and the immediate surrounds are smoke-free areas.
39. These rules are meant to insure a safe and orderly work environment; please respect them.
  
40. The mission of the shop is to provide a safe and reliable facility for the pursuit of higher understanding as it applies to the nature of materials and the possibilities and limitations of the tools and techniques used to shape them.



# Handheld Portable Power Tools

Random Orbit Sanders

Belt sander

Compact Belt Sander

½” Electric Drill

½” Hammer Drill

3/8” Cordless Drill

3/8” Cordless Right Angle Drill

Routers

Jigsaws

Circular Saws

Reciprocating Saw

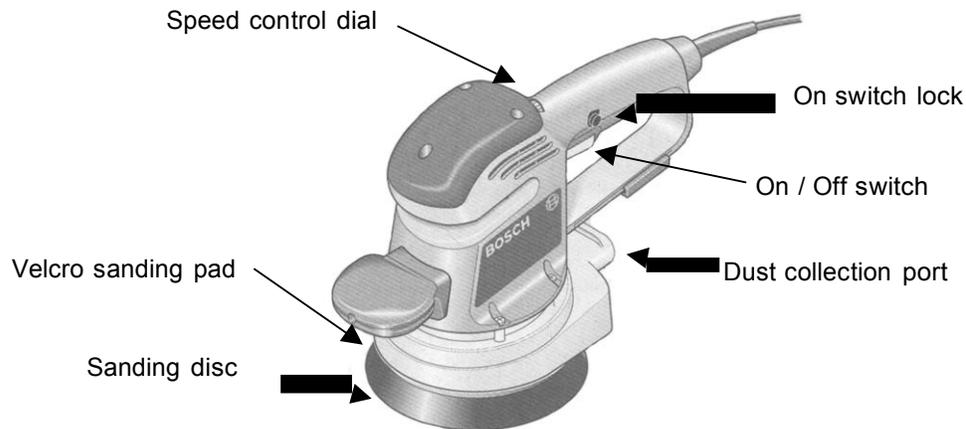
Biscuit Joiner

Flexible Shaft Rotary Tool

Pneumatic Nailers

## General Safety for Handheld power tools.

- **Eye protection is required when using these tools.**
- **Stay focused on the tool and the work being performed.**
- Keep work area clear of other tools and materials.
- Use the right tool for the job.
- Seek help if you are unsure of tool operating procedures.
- Keep hands and fingers clear of tool's blade or bit and cutting path.
- Secure work to bench when using electric hand tools.
- Do not over-reach with electric hand tools.
- Make all adjustments on the tool with the power cord unplugged.
- Do not carry plugged in tools with finger on power switch.
- Use only grounded extension cords.
- Always keep tool guards in place.
- Let the tool's bits and the blades do the work. Do not force tools into the material.
- Unplug, clean and put away tools when finished working.

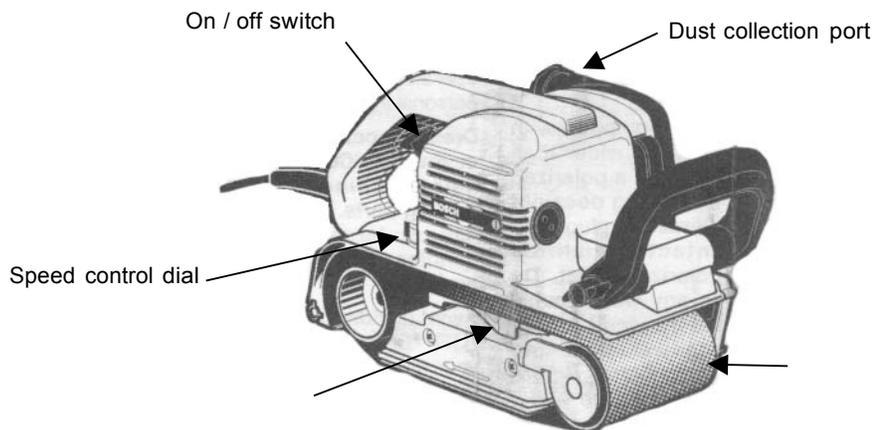


## Random Orbit Sander

Electric Random Orbit Sanders are used for final finish sanding and may be used on wood or wood composite material and some plastic materials. Random Orbit Sanders use disposable sandpaper discs that are available for purchase in the shop.

### Safety and Use

- **Eye protection is required when using Random Orbit Sanders.**
- **Stay focused on the tool and the work being performed.**
- **All sanding should be performed on downdraft tables.**
- **Sandpaper disc must be attached to bottom of sander before using Random Orbit Sander.**
- **Be sure switch is in "OFF" position before plugging in.**
- Only use discs available for purchase from shop supply room. Ask Shop staff for assistance.
- The use of a dust mask is encouraged when using this tool.
- Connect vacuum to dust collection port.
- Start sander on material to be sanded.
- Hold handle firmly.
- Sander should "float" on top of material. **Do not bear down on sander or push sander into material.**
- When pausing or stopping sanding operation lift sander off material and hold away from any surfaces until disc coasts to a complete stop.
- Do not place spinning or coasting sander directly on downdraft table.

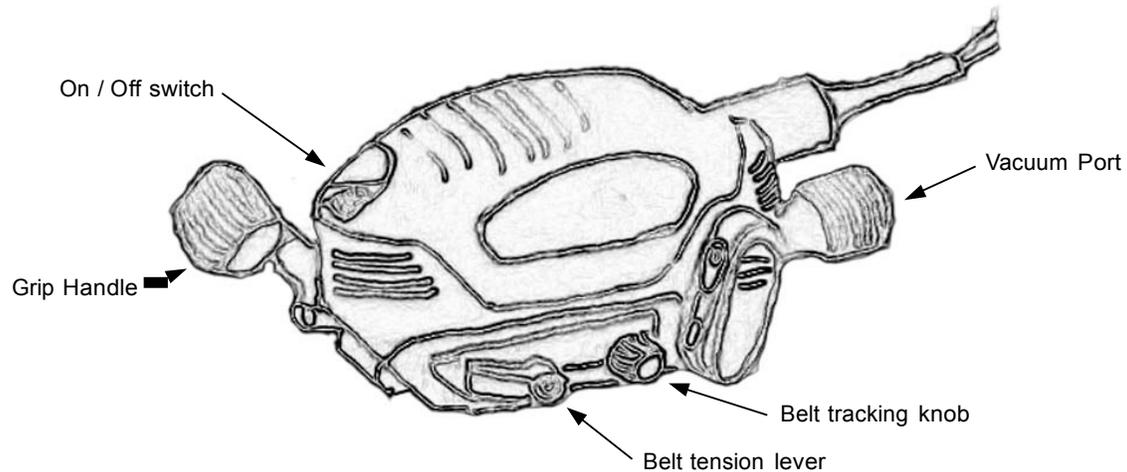


## 4" x 24" Belt Sander

The 4" Electric Portable Belt Sander is used for flattening and smoothing flat material in preparation of final sanding. With the appropriate belts it will quickly remove large amounts of material or smooth a surface in preparation for final finish sanding with other sanders.

### Safety and use

- **Eye protection is required when using this tool.**
- **Stay focused on the tool and the work being performed.**
- The use of a dust mask is encouraged when using this tool.
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- All sanding with belt sanders should be performed on downdraft tables or outside on the concrete pad
- Use appropriate sandpaper belt for sander and for work to be performed ask attendant for assistance if you are not sure which belt to use.
- Attach vacuum to dust collection port.
- Belt Tension Lever must be retracted before using.
- **Be sure switch is "OFF" before plugging in.**
- Always keep finger or exposed flesh away from sanding belt.
- Hold handles firmly before starting sander.
- Start sander on material to be sanded.
- When pausing or stopping sanding operation allow sander to decelerate by slowly releasing trigger switch, wait for sander to come to a complete stop.
- Do not place running or coasting sander directly on downdraft table.
- Sander should "float" on top of material. **Do not bear down on sander or push sander into material.**

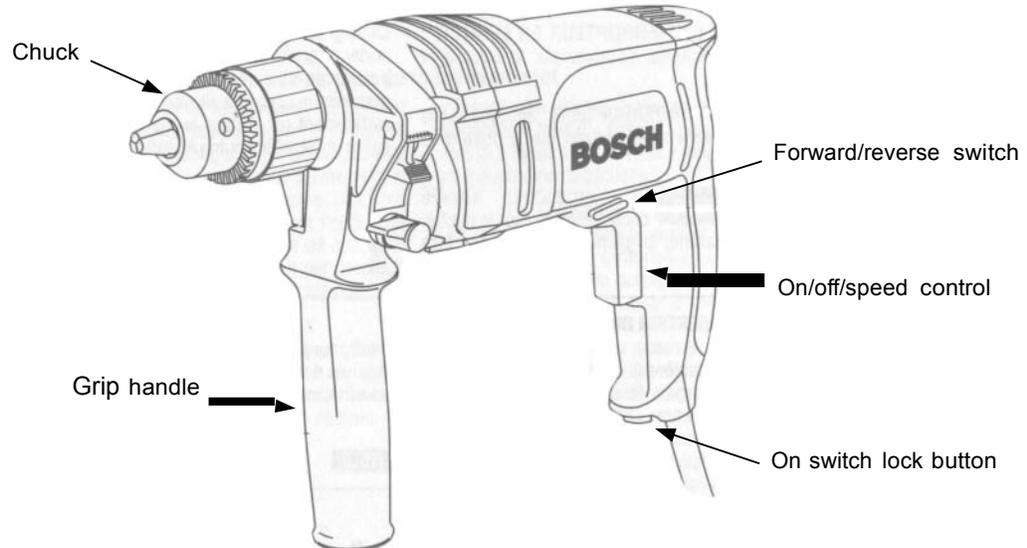


## 2 ¼" x 14" Compact Belt Sander

The Compact Belt Sander is an easily maneuverable lightweight sander that is ideal for sanding items with small surface areas. It is used for sanding moderate amounts of material off edges of boards as well as the face. The sander has a small area of contact and can easily follow moderate to shallow curves.

### Safety and use

- **Eye protection is required when using this tool.**
- **Stay focused on the tool and the work being performed.**
- The use of a dust mask is encouraged when using this tool.
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- All sanding with belt sanders should be performed on downdraft tables or outside on the concrete pad
- Use appropriate sandpaper belt for sander and for work to be performed ask attendant for assistance if you are not sure which belt to use.
- Attach vacuum to dust collection port.
- Belt Tension Lever must be retracted before using.
- **Be sure switch is "OFF" before plugging in.**
- Always keep finger or exposed flesh away from sanding belt.
- Hold handles firmly before starting sander.
- Do not place running or coasting sander directly on downdraft table.
- Sander should "float" on top of material. **Do not bear down on sander or push sander into material.**

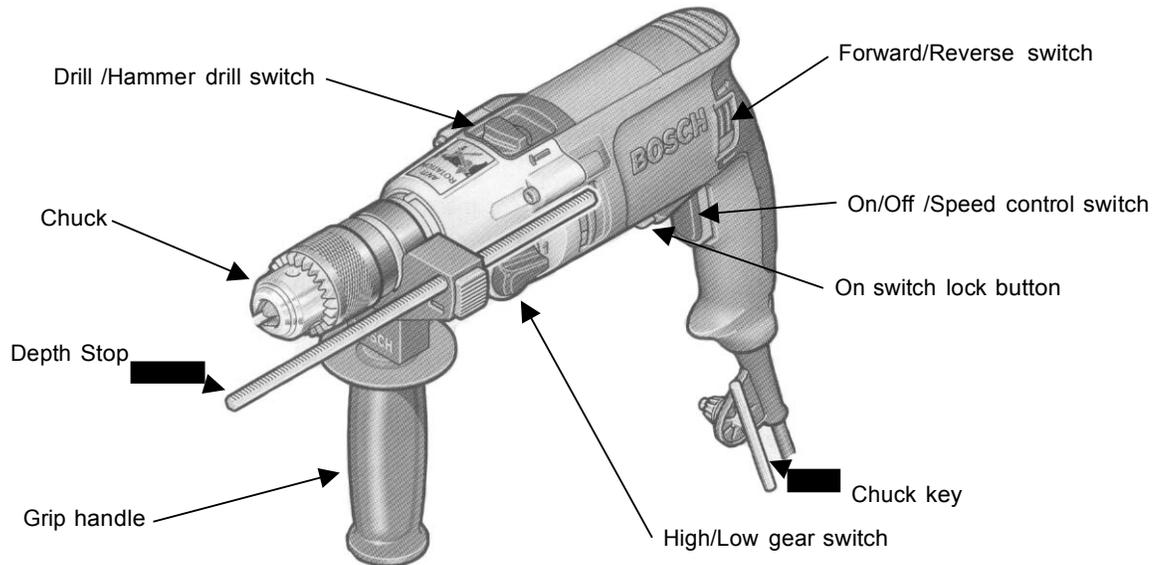


## 1/2" Electric Drill

The 1/2" Electric Drill is a powerful traditional corded drill that offers greater torque than cordless drills. It can be used to drill holes and with a wide range of accessories it can be used to sand, grind or polish.

### Safety and Use

- **Eye protection is required when using these tool.**
- **Stay focused on the tool and the work being performed.**
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Use appropriate drill bit or accessory for work to be performed.  
ask attendant for assistance if you are not sure which bit or accessory to use.
- Check forward/reverse switch before starting Switch should be in forward position for drilling or reverse for backing out stuck bits.
- Use chuck key to secure bits in chuck. Tighten all three holes.
- **This is a high torque drill, use accessory handle for greater leverage when using bits larger than 1".**
- Always keep finger or exposed flesh away from drill bit or accessory.

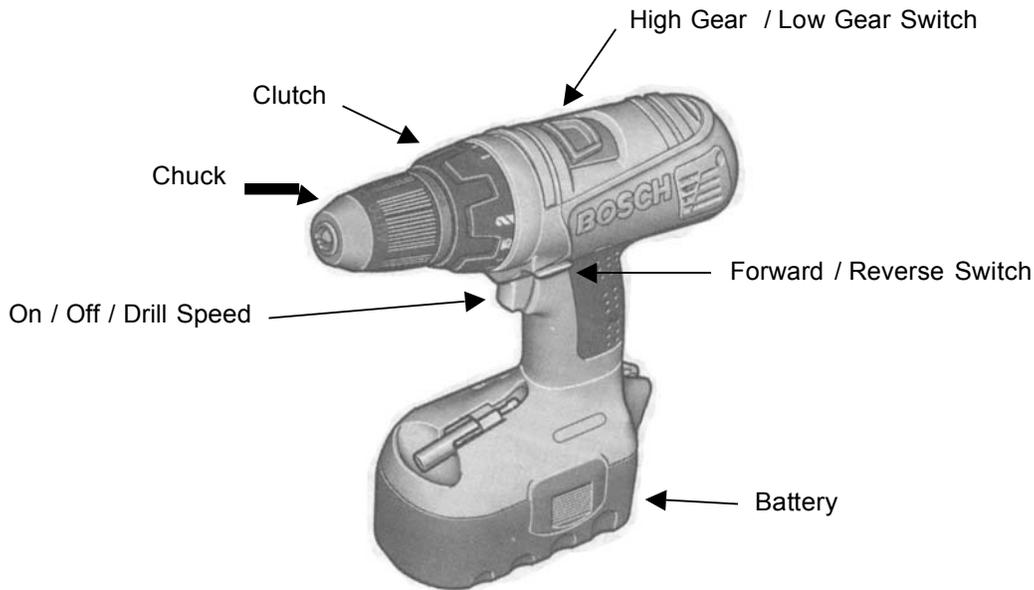


## 1/2" Electric Hammer Drill

The 1/2" Electric Hammer Drill is a powerful traditional corded drill that offers greater torque than cordless drills. With the hammer feature it can be used to quickly drill into concrete or masonry.

### Safety and Use

- **Eye protection is required when using these tool.**
- **Do not talk with observers while operating these tools.**
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Use appropriate drill bit or accessory for work to be performed.  
ask attendant for assistance if you are not sure which bit or accessory to use.
- Check forward/reverse switch before starting Switch should be in forward position for drilling or reverse for backing out stuck bits.
- Use chuck key to secure bits in chuck. Tighten all three holes.
- Return chuck key to holder after securing/releasing bits.
- **Use only masonry bits when using drill in hammer mode.**
- **Do not shift between high/low gear or forward/reverse when chuck is still spinning.**
- **This is a high torque drill, use grip handle for greater leverage when using bits larger than 1".**
- Always keep finger or exposed flesh away from drill bit or accessory.

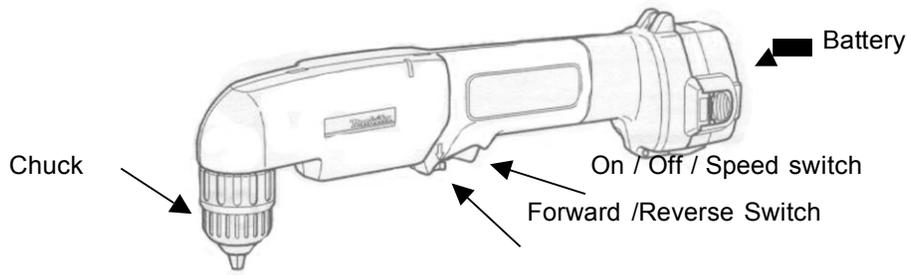


## 3/8” Cordless Drill

Cordless drills have a variety of uses; drilling holes, driving screws and fasteners, sanding with abrasive accessories, etc. They are very versatile because of the large number of accessories available and also because they are not bound by the limits of electrical cords.

### Safety and Use

- **Eye protection is required when using these tool.**
- **Stay focused on the tool and the work being performed.**
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Use appropriate drill bit or accessory for work to be performed.  
ask attendant for assistance if you are not sure which bit or accessory to use.
- Set gear switch to high or low. Generally, use low speed to drive screws and high speed to drill holes.
- Check forward/reverse switch before drilling or driving screws. Switch should be in forward position for drilling or driving screws, reverse for removing screws.
- Adjust clutch to appropriate setting for work being performed. Ask for assistance if you are not sure which setting to use.
- Always keep finger or exposed flesh away from drill bit or accessory.
- Avoid dropping or bumping drill of tables and ledges. Be mindful and keep drill away from the edge of work benches or elevated surfaces.
- Ask for assistance with discharged battery.
- When drilling holes use a piece of scrap under material being drilled to protect workbenches and to minimize tear out on material.



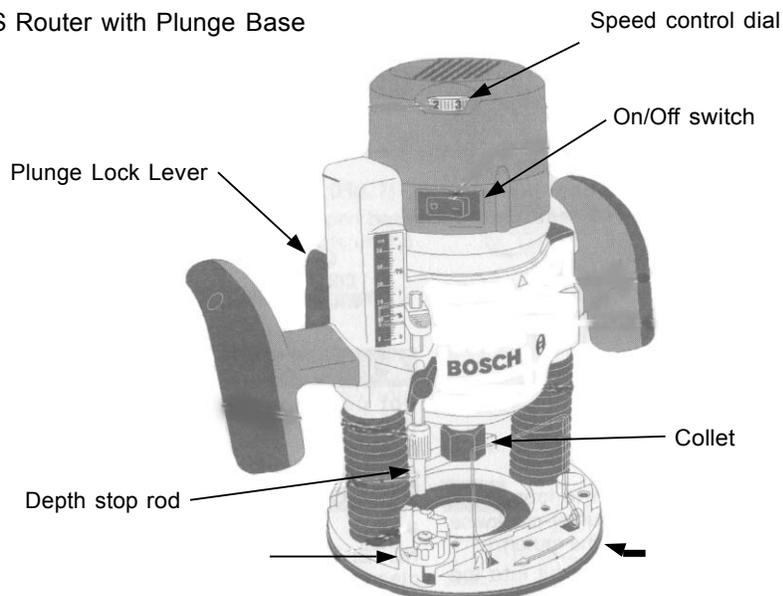
## 3/8” Right Angle Cordless Drill

Cordless drills have a variety of uses; drilling holes, driving screws and fasteners, sanding with abrasive accessories, etc. They are very versatile because of the large number of accessories available and also because they are not bound by the limits of electrical cords.

## Safety and Use

- **Eye protection is required when using these tool.**
- **Stay focused on the tool and the work being performed.**
- Restrain or tuck back hair and loose clothing.
- Use appropriate drill bit or accessory for work to be performed.  
ask attendant for assistance if you are not sure which bit or accessory to use.
- Check forward/reverse switch before drilling or driving screws. Switch should be in forward position for drilling or driving screws, reverse for removing screws.
- Always keep finger or exposed flesh away from drill bit or accessory.
- Avoid dropping or bumping drill of tables and ledges. Be mindful and keep drill away from the edge of work benches or elevated surfaces.
- Ask for assistance with discharged battery.
- When drilling holes use a piece of scrap under material being drilled to protect workbenches and to minimize tear out on material.

1617 EVS Router with Plunge Base



## Routers

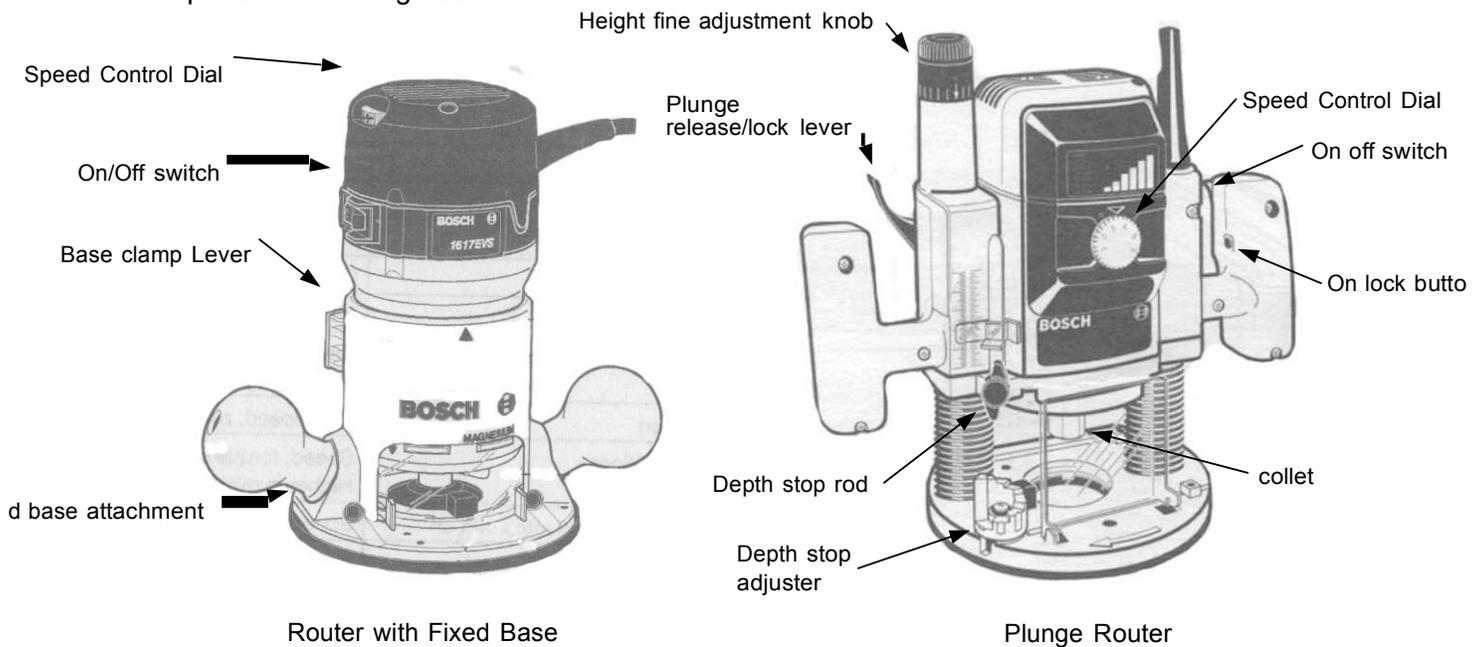
Routers are one of the most versatile tools in the woodworking field. Different cutters called bits, may be used to provide a variety of cutting and shaping operations such as; slotting, mortising, grooving, rabbeting, corner-rounding, beading, dovetailing, veining, inlay work, etc.

## Safety

- **Eye protection is required when using these tools.**
- **Stay focused on the tool and the work being performed.**
- The use of hearing protection is encouraged when using this tool.
- The use of a dust mask is encouraged when using this tool.
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Select proper bit for work to be done.
- Always be sure the collet nut is securely tightened to prevent the router bit from slipping during use.
- Use appropriate dust collection device and adapter if practical.
- Make certain that the work piece is rigidly held in desired position and free of obstructions and always hold the router firmly and against the work, using both hands.
- Remove material in increments (successive passes) if cut will exceed 1/8" in width or depth of cut. **Keep cutting pressure constant. Do not force tool into cut.**
- **Never adjust depth of cut while motor is running.**
- Be sure cord is free and will not "hang up" during routing operations.
- Keep hands clear of cutter when motor is running to prevent personal injury.
- **Be sure switch is "OFF" before plugging in.**
- Maintain firm grip on router when starting motor to resist starting torque. Allow motor to come to full speed before contacting work piece.
- Be sure motor has completely stopped before setting machine down.

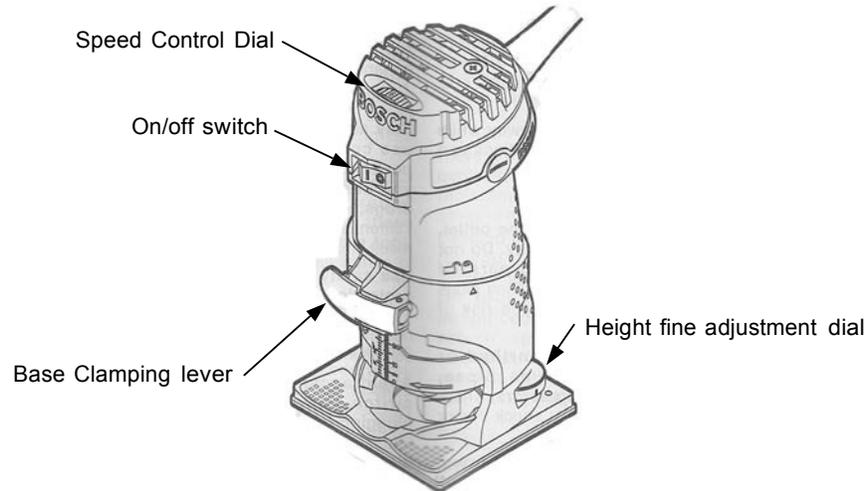
## Typical procedure for using router

Before using the router, consider the kind and total amount of material to be removed. Depending on the material, it will likely be necessary to make more than one cut for best results and to avoid overloading the motor. Before beginning the cut on the actual work piece, it is advisable to make a sample cut on a piece of scrap lumber. This will show exactly how the cut will look as well as enable you to check dimensions. Always be sure the work is rigidly clamped or otherwise secured before making a cut. Generally speaking, when working on a bench, the work piece should be held on the bench by wood clamps. When routing edges, the router should be held firmly down and against the work by both guiding knobs. Since the cutter rotates clockwise (when viewing router from top), more efficient cutting will be obtained if the router is moved from left to right as you stand facing the work. When working on the inside of a template, move router in a clockwise direction. When working on the outside of a template, move the router in a counter clockwise direction. The speed and depth of cut will depend largely on the type of material being worked upon. Keep the cutting pressure constant, but do not force the router through the material so the motor speed slows excessively. When making cuts on all four edges of the work piece, it is advisable to make the first cut on the end of the piece across the grain. Thus, if chipping occurs at the end of a cut, it will be removed when making the next cut parallel with the grain.



The shop has two different types of routers. **Plunge Routers** allow the user to make cuts on the interior area of a material. (i.e. cutting a circle out of the middle of a board). With a spring loaded mechanism the user is able to “plunge” the router bit into the material when it is placed in the interior portions of the material.

**Fixed Base Routers** on the other hand must be started from the outside edges of the material. They can be used for profiling the edges of material and can also be used to cut from grooves from one edge of the material to the other.

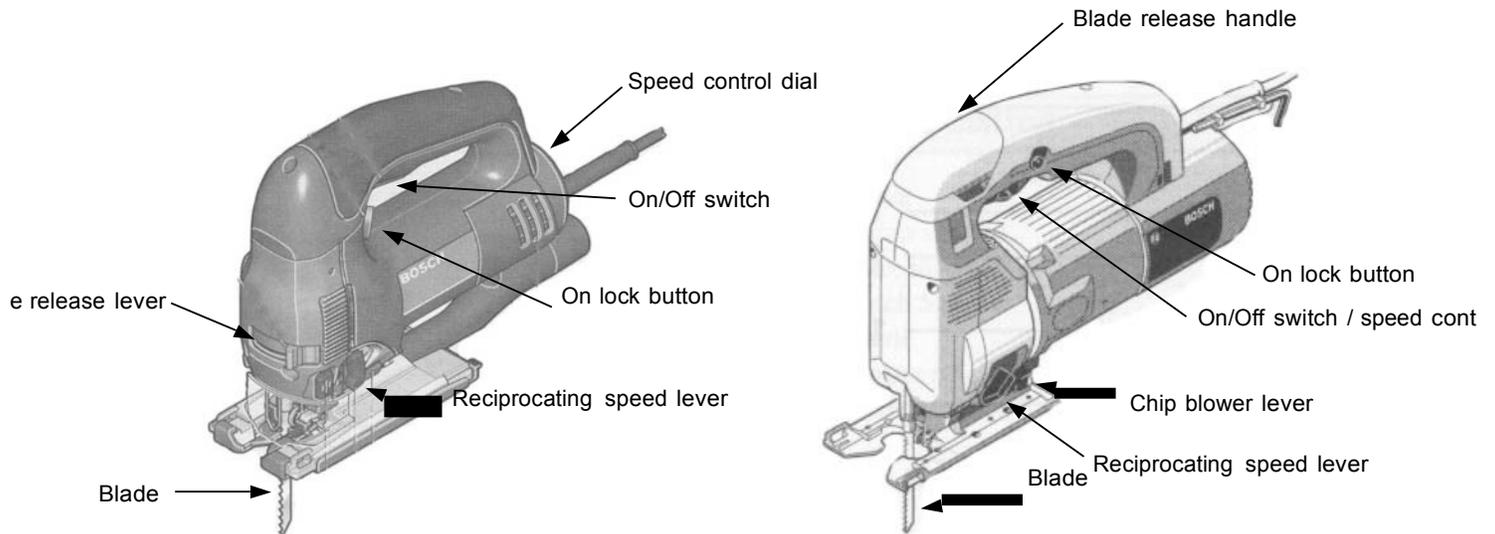


## Palm Router

The Palm router is a compact fixed base router. It can perform many of the functions of a regular sized router but is designed for smaller scale work where a larger router would be cumbersome to operate. Its smaller size and profile make it ideally suited for routing work in tight spaces or in situations where maneuverability may be an issue.

## Safety

- **Eye protection is required when using these tools.**
- **Stay focused on the tool and the work being performed.**
- The use of hearing protection is encouraged when using this tool.
- The use of a dust mask is encouraged when using this tool.
- Loose clothing, hair and or jewelry should be removed, tucked back and or restrained.
- Select proper bit for work to be done.
- Always be sure the collet nut is securely tightened to prevent the router bit from slipping during use.
- Use appropriate dust collection device and adapter if practical.
- Make certain that the work piece is rigidly held in desired position and free of obstructions and always hold the router firmly and against the work, using both hands.
- Remove material in increments (successive passes) if cut will exceed 1/8" in width or depth of cut. **Keep cutting pressure constant. Do not force tool into cut.**
- **Never adjust depth of cut while motor is running.**
- Be sure cord is free and will not "hang up" during routing operations.
- Keep hands clear of cutter when motor is running to prevent personal injury.
- **Be sure switch is "OFF" before plugging in.**
- Maintain firm grip on router when starting motor to resist starting torque. Allow motor to come to full speed before contacting workpiece.
- Be sure motor has completely stopped before setting tool down.



## Jigsaw

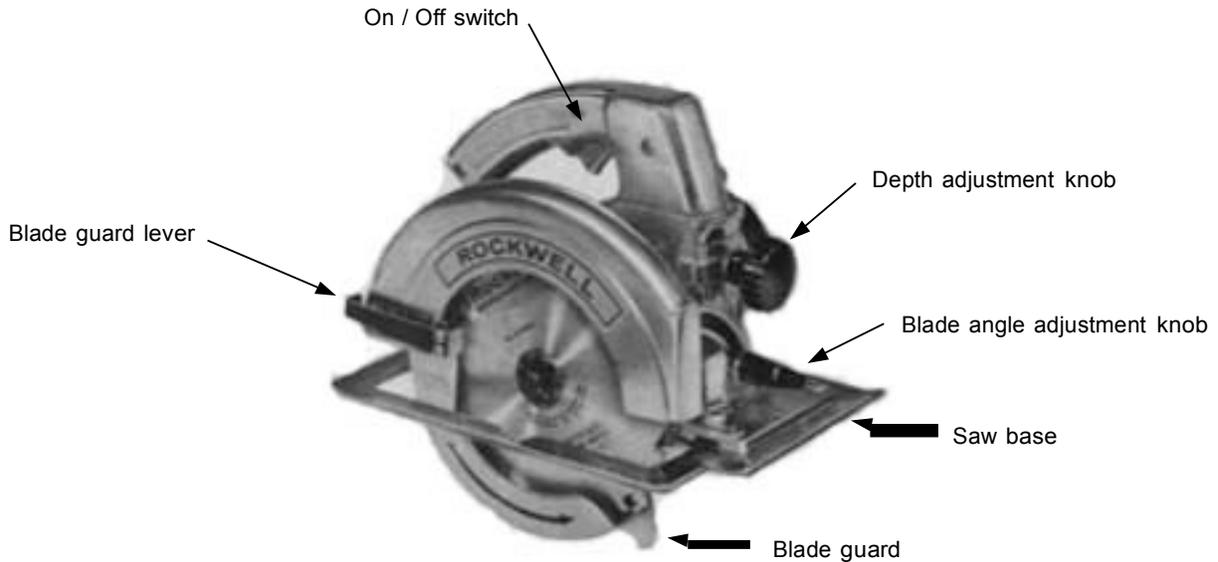
This tool is generally used for pattern cutting into materials with the maximum thickness of 2" wood and 1 1/4" plastic and fiberglass, refer to manual for metal thickness.

## Safety

- **Eye protection is required at all times when using this tool.**
- **Stay focused on the tool and the work being performed.**
- Restrain loose clothing, tie back long hair, remove or restrain loose jewelry.
- Keep fingers away from line of cut
- Always securely clamp or hold material in position.

## Procedure for using Jigsaw.

1. Use appropriate blade for material to be cut. Ask for help from shop staff.
2. Do not attempt to change blade or blade settings.
3. Find a clear area to work with this tool and secure the material. Line of cut should be supported within 1/2".
4. When cutting on material on bench-tops be aware of where bench surface is underneath. Avoid cutting bench-top.
5. Area underneath line of cut should be free of any obstructions.
6. Line up front edge of blade with line of cut.
7. Back Jigsaw away from material slightly (about 1/2")
8. Never start Jigsaw with front edge of blade pressed up against material.
9. Keep jigsaw base flat on material when in use.
10. Never use a bent blade.



## Portable Circular Saw

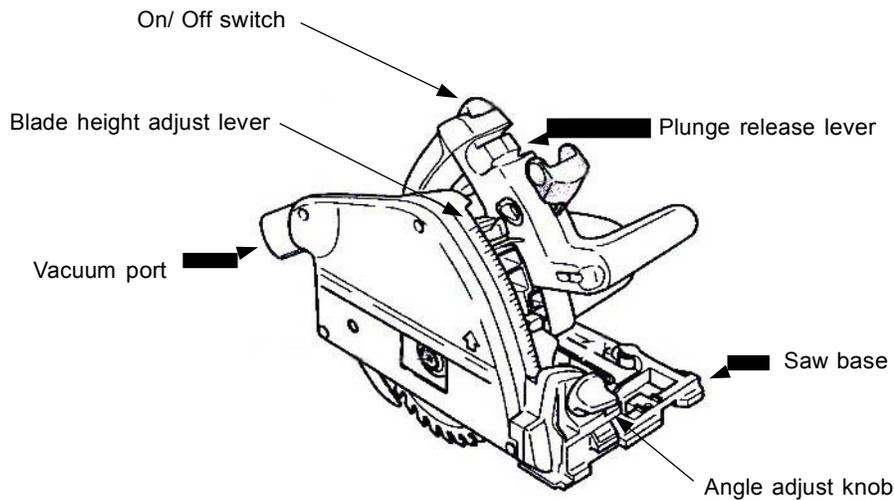
The Portable Circular Saw is used to make straight cuts when the material is too large or awkward to cut on other stationary equipment. With the appropriate blade various materials may be cut such as: wood and wood composites, paper or fiber based materials, plastics and masonry type materials.

## Safety

- **Eye protection is required at all times when using this tool.**
- **Stay focused on the tool and the work being performed.**
- The use of a dust mask is encouraged when using this tool.
- The use of hearing protection is encouraged when using this tool.
- **Keep fingers away from line of cut in front of and in back of saw.**

## Procedure for using Circular Saw

1. Ask for staff assistance if tool adjustments are needed.
2. Find a clear area to work with this tool and secure the material with clamps if needed.
3. Avoid binding the blade in line of cut by supporting work properly using either method:
  - a) Material should be fully supported on both sides of cut line (large pieces).
  - b) Material may be supported on only one side of cut with waste falling away (shorter pieces)
4. Area underneath line of cut should be free of any obstructions. Do not cut into bench-top.
5. Line up front edge of blade with line of cut.
6. Back circular saw away from material slightly (about 1/2").
7. Squeeze trigger switch and push saw through material with only moderate force.
8. Never start saw with front edge of blade pressed up against material.
9. Keep saw base flat on material when in use.



## Plunge Circular Saw

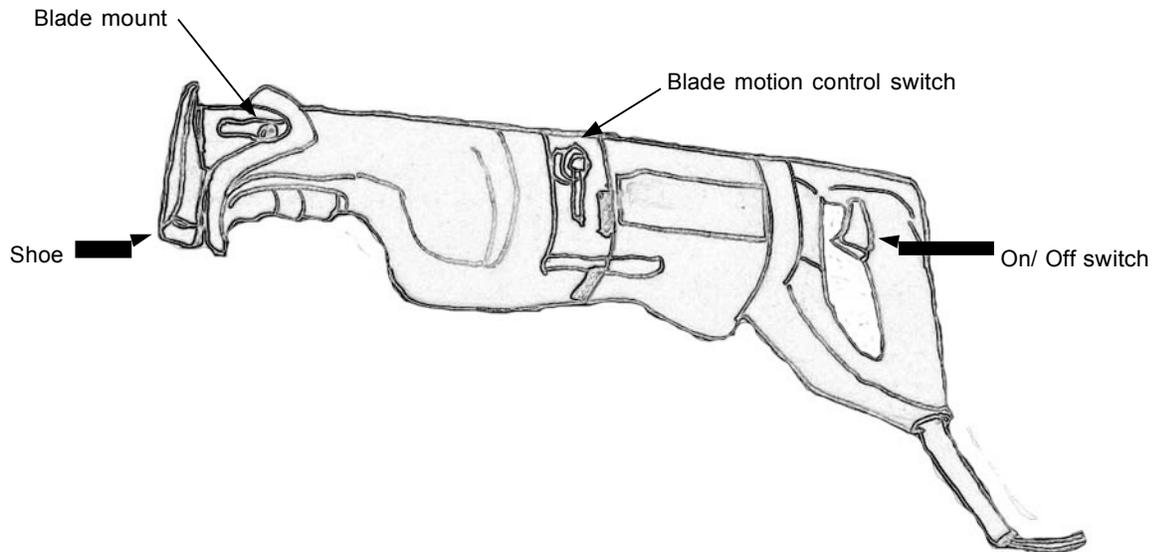
The Plunge Circular Saw is used to make straight cut in material that is too large to process on any of the stationary equipment. With various blades and a specially designed work table or straight edges this saw can make straight and miter cuts in a variety of materials. This saw also has the added feature that allows cuts to be made within the interior areas of a work-piece.

### Safety

- **Eye protection is required at all times when using this tool.**
- **Stay focused on the tool and the work being performed.**
- The use of a dust mask is encouraged when using this tool.
- The use of hearing protection is encouraged when using this tool.
- **Keep fingers away from line of cut in front of and in back of saw.**

### Procedure for using Circular Saw

1. Ask for staff assistance if tool adjustments are needed.
2. Find a clear area to work with this tool or use the specially designated work-table or straight edges and secure the material with clamps if needed.
3. Avoid binding the blade in line of cut by supporting work properly using either method:
  - a) Material should be fully supported on both sides of cut line (large pieces).
  - b) Material may be supported on only one side of cut with waste falling away (shorter pieces)
4. Area underneath line of cut should be free of any obstructions. Adjust blade height if needed. Do not cut into bench-top.
5. If using special straight edge, place saw in position on straight edge.
6. Line up front edge of blade with line of cut.
7. Back circular saw away from material slightly (about 1/2").
8. Squeeze trigger switch and push saw through material with only moderate force.
9. Never start saw with front edge of blade pressed up against material.
10. Keep saw base flat on material when in use.



## Reciprocating Saw

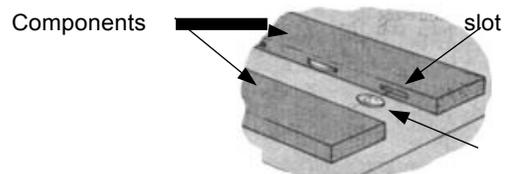
The Reciprocating Saw utilizes an oscillating blade to make rough cuts where a high degree of precision is not needed. It is primarily a power tool used in the construction industries. And with a wide array of blades available it can be used to cut through wood, metal, plastic, rubber, plaster, etc.

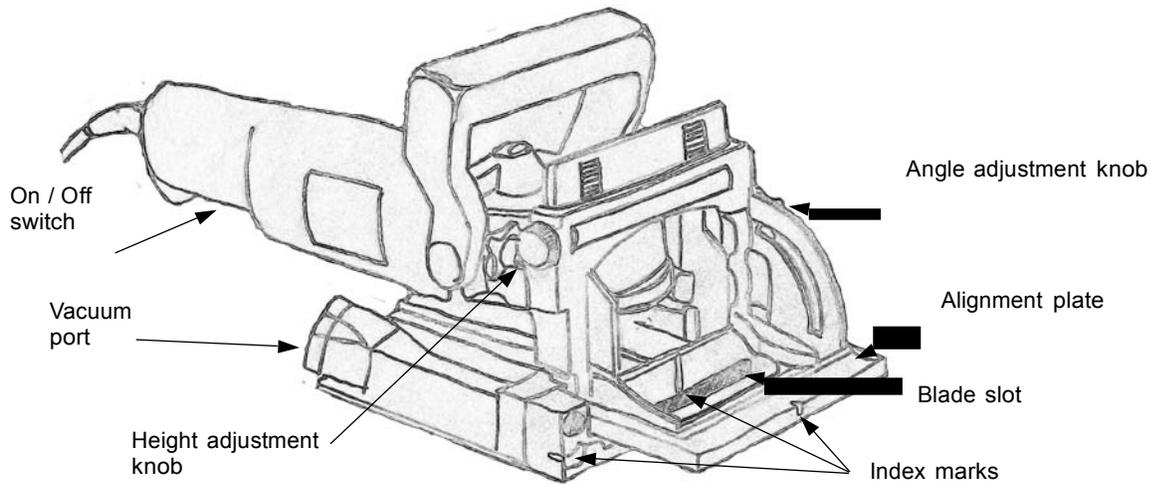
## Safety

- **Eye protection is required at all times when using this tool.**
- **Stay focused on the tool and the work being performed.**
- Restrain loose clothing, tie back long hair, remove or restrain loose jewelry.
- Keep fingers away from blade and line of cut.
- Always securely clamp or hold material in position.

## Procedure for using reciprocating saw.

1. Use appropriate blade for material to be cut. Ask for help from shop staff.
2. Do not attempt to change blade or blade settings.
3. When cutting material on bench-tops be aware of where bench surface is underneath. Securely clamp material down. Avoid cutting into bench-top.
4. Blade motion control switch should be horizontal for cutting wood and vertical for use in metal.
5. Line up blade and place shoe firmly against material to be cut.
6. Start saw with blade and shoe pressed up against material.
7. Apply moderate pressure while cutting.
8. Never use a bent blade.





## Plate Joiner (Biscuit Joiner)

The Plate Joiner is used to facilitate the joining of wood components. It cuts an arc shaped slot in the material in preparation for the insertion of a football shaped plate (biscuit). Before the plate is inserted glue is applied in the slot. Once the plate is inserted into the slot containing the glue it becomes an integral part of the material then another piece of material with similarly cut slots can be glued and attached to the first piece of material (see drawing above).

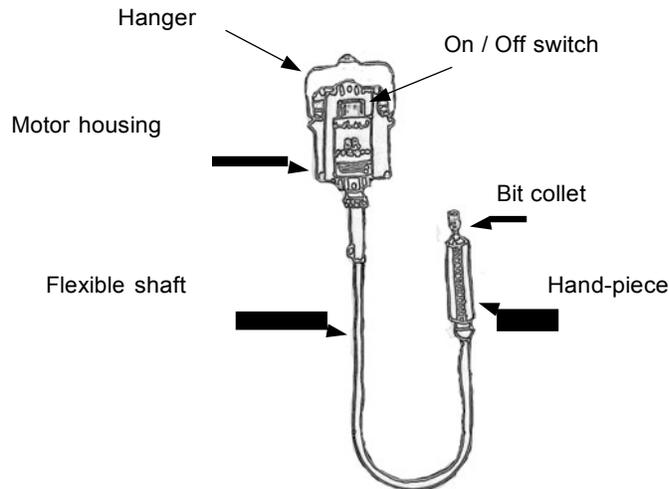
## Safety

- **Eye protection is required at all times when using this tool.**
- **Stay focused on the tool and the work being performed.**
- Restrain loose clothing, tie back long hair, remove or restrain loose jewelry.
- Keep fingers away from blade and line of cut.
- Always securely clamp or hold material in position.
- Keep fingers away from blade slot.
- Hold tool firmly in place.

## Procedure for using Plate Joiner.

1. Select appropriate plate size for material being joined (Ask for assistance if needed).
2. Mark desired location of slot on each component to be joined.

3. Line up index marks on Plate Joiner to location mark on first component.
4. Hold Plate Joiner alignment plate firmly against material surface.
5. With Plate Joiner firmly pressed against material engage start switch and push handle of Plate Joiner towards material.
6. When Plate Joiner cannot be pushed any further release pressure and allow tool to “spring back” to starting position
7. Turn off Plate Joiner.
8. Repeat procedure for other component.



## Flexible Shaft Rotary Tool

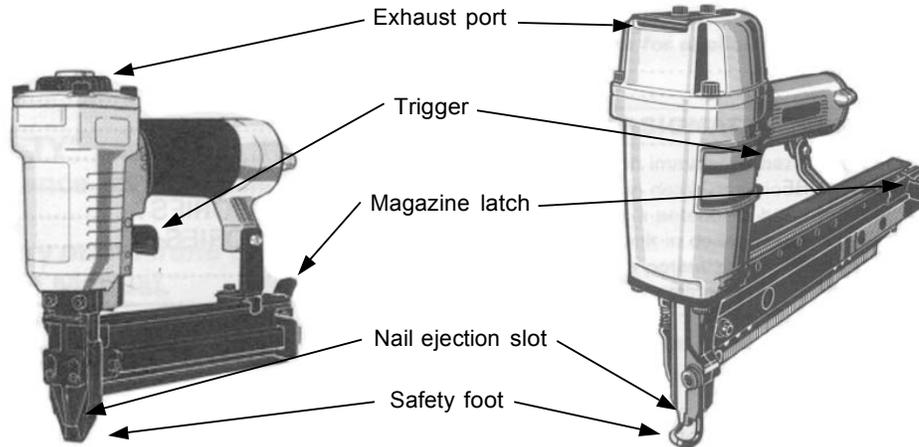
The Flexible Shaft Rotary tool is very versatile. With a wide range of accessories it can be used to cut, grind, carve, polish and drill a wide variety of materials. With the proper bit or accessory wood, metal, ceramics, plastic, stone and concrete can be worked. The compact size and maneuverability of the tool lends itself well to intricate work where larger tools would be too cumbersome to use.

## Safety

- **Eye protection is required when using this tool.**
- **Stay focused on the tool and the work being performed.**
- **Restrain loose clothing, tie back long hair, remove or restrain loose jewelry.**
- **The use of a work apron is encouraged when using this tool.**
- **The use of a dust mask is encouraged when using this tool.**
  
- **Use tool outside if abrasive media on tool causes sparking.**
  
- When using tool for the first time, ask for assistance when changing bits.
- Use appropriate accessories for work to be performed. Ask for assistance if you are not sure what accessory to use.
- Start tool before making contact with material. Do not start on surface of material.
- Do not force tool into material. Allow abrasive media to lightly contact work.
- Clean surrounding area when finished.

18 Gauge Pin Nailer

16 Gauge Brad Nailer



## Pneumatic Nailers

Pneumatic nailers or nail guns allow users to quickly and neatly assemble various wood components. The shop has two different sized the largest nailer shoots 16 gauge finish nails and is used for nailing thicker materials used for cabinet boxes and carpentry millwork. The smaller gun shoots 18 gauge brad nails and is used for assembling thinner materials used in projects such as picture frames, small boxes and delicate millwork.

## Safety

- **Eye protection is required at all times when using these tools.**
- **Stay focused on the tool and the work being performed.**
- **The use of hearing protection is recommended when using these tools.**
- **Never point nail ejection slot at self or others.**
- **Keep hands and other body points out of the line of fire.**
- **Keep eyes and face away from air exhaust slot.**
- **The use of a dust mask is recommended when working in dusty or confined areas.**

## Procedure for Using Pneumatic Nailers

- 1) If you have never used a nailer before it is suggested you follow the steps below on some scrap material in order to “get a feel” for these tools.
- 2) Select appropriate nailer for work to be performed (Ask Workshop supervisor for assistance if needed).
- 3) Select appropriate nail for material (Ask Workshop supervisor for assistance if needed).
- 4) Secure and hold material to be fastened.
- 5) Locate desired area for nail and place tip of nailer on desired location.
- 6) Push nailer down firmly (but do not bear down with full body weight) until safety foot is fully retracted.
- 7) Squeeze trigger and release after nail is shot.

## Stationary Woodworking Machines

15" Band Saw

18" Band Saw

36" Band Saw

10" Table Saw

10" Table Saw w/ Crosscut Box

4" Model Table Saw

6" Jointer

8" Jointer

20" Jointer

12" Planer

13" Planer

24" Planer

12" Disc Sander

6" Edge Sander

6" Oscillating Spindle Sander

24" Wide Belt Sander

15" Drill Press

32" Radial drill Press

12" Sliding Compound Miter Saw

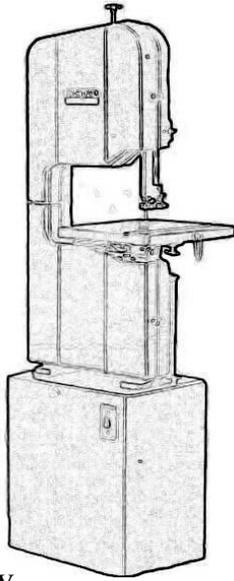
Hollow Chisel Mortiser

Lion Miter Trimmer

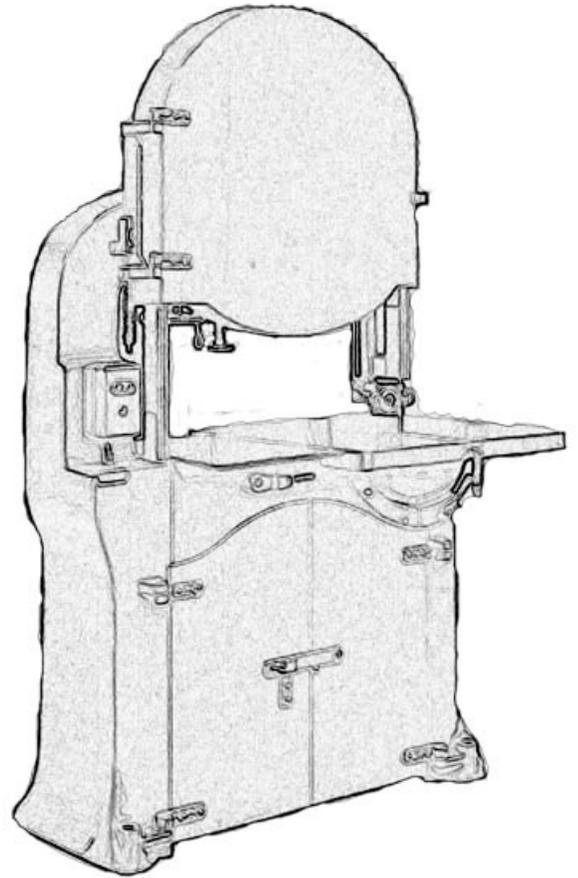
10" Lathe

Router Table

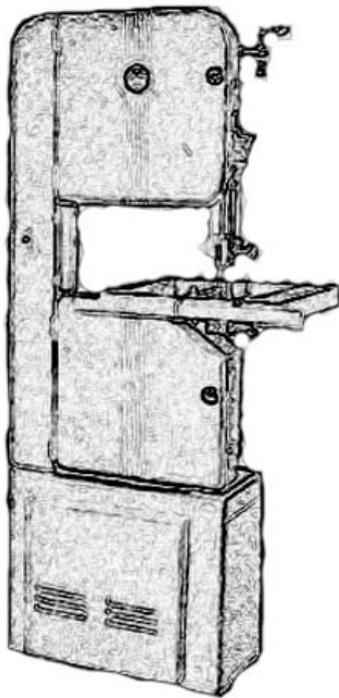
Horizontal Boring Machines



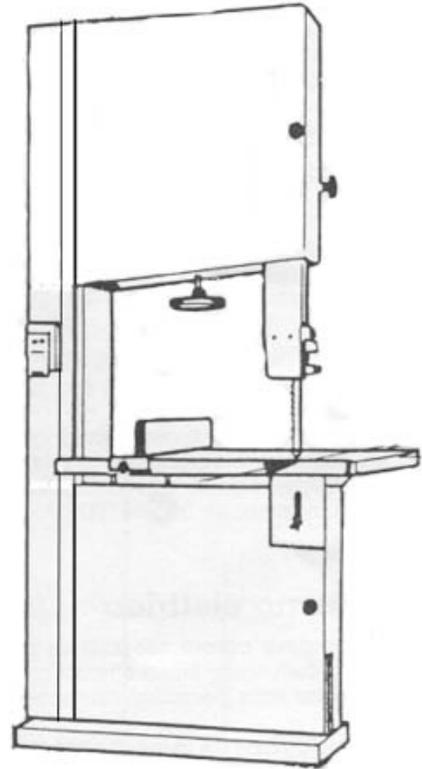
15" Band Saw



36" Band Saw



16" Band Saw



18" Band Saw

## Wood Cutting Band Saws

Band Saws can be used to cut straight cut and freehand curves in all kinds of wood and some types of plastics. Before using these pieces of equipment please read and make sure you understand the following safety rules. With the various size Band Saws in the shop and the variety of blade sizes large planks of lumber can be cut as well as delicate scale model materials.

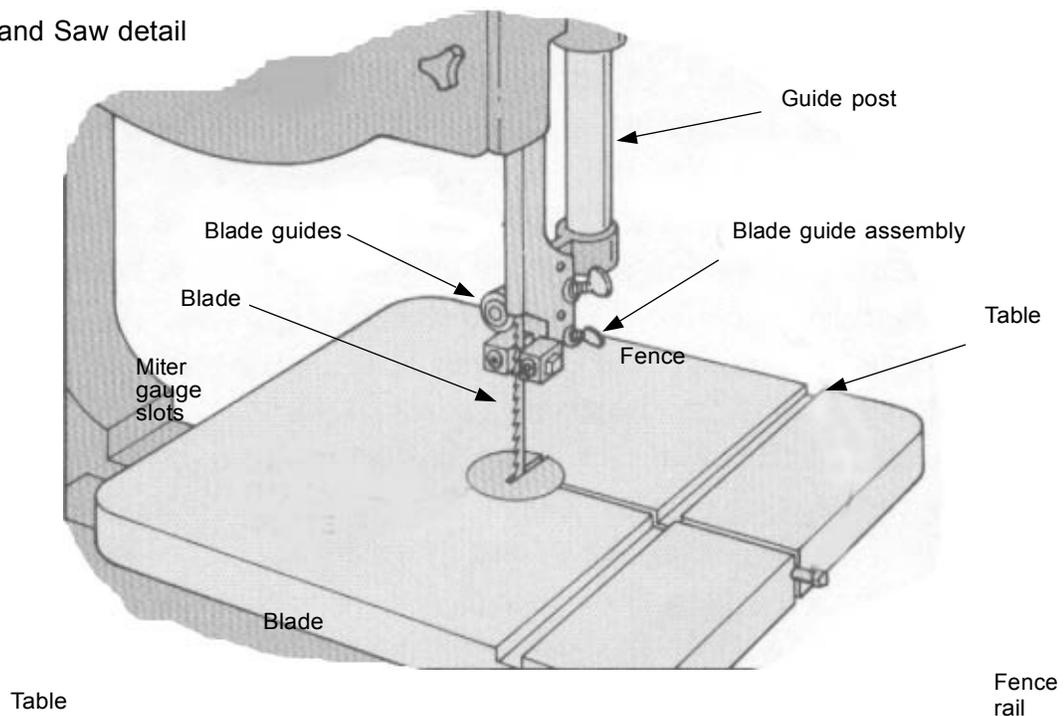
### Safety

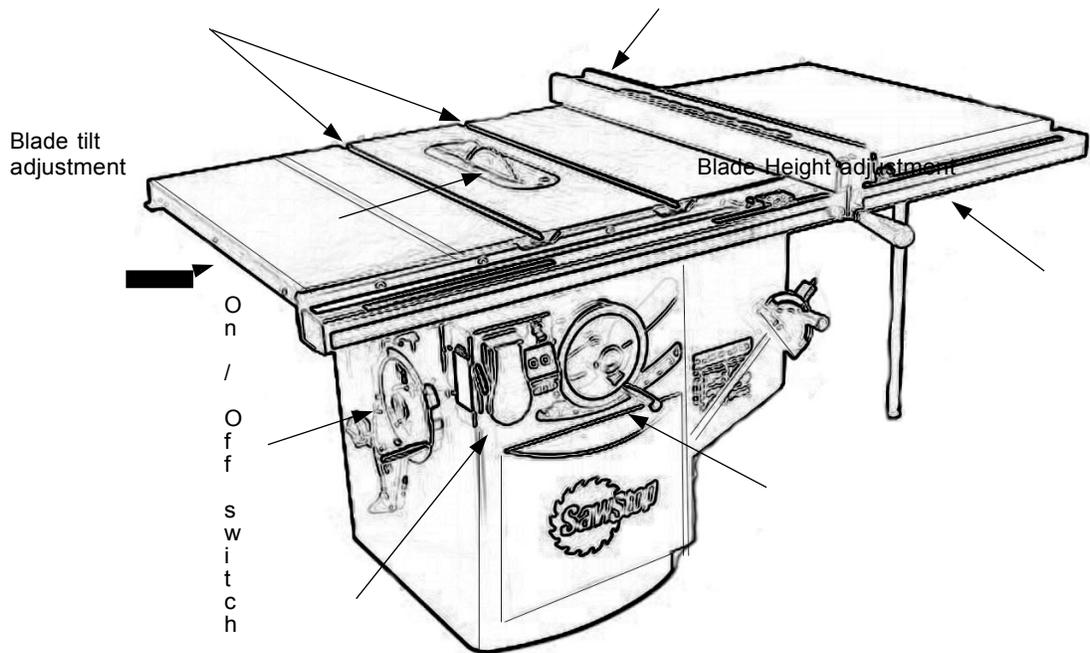
- **Eye protection is required when using these machines.**
- **Stay focused on the tool and the work being performed.**
- ALWAYS MAINTAIN A 3" MARGIN OF SAFETY (Keep hands and body parts away from line of cut).
- Make all adjustments with the power off.
- **Do not expose more than 1/2" of blade between material and bottom of upper guide.**
- Allow saw to reach full speed before beginning cut.
- Hold stock flat on table top.
- Do not cut stock that does not have a flat surface. (i.e. do not attempt to cut spherical objects).
- Feed stock only as fast as teeth will remove material.
- Avoid backing out of cuts when possible.
- Plan relief cuts in advance – think first.
- Do not make turns too tight – listen for blade twisting.
- If “clicking” noise is heard, **SHUT OFF POWER – BLADE MAY BE DAMAGED.**
- Stop machine and blade before removing scrap pieces.
- On 15" Band saw allow blade to coast to a stop before cleaning.
- Band Saw blades continue to move after power has been shut off. Use brake when available to stop blade or stay with machine until blade stops.
- Operate the machine from front side (side with doors). Avoid standing to side of machine.
- Ask for help when cutting long or wide or difficult to handle pieces.
- Saw is for use in cutting wood and some other soft materials (ask shop attendant) **absolutely no metal cutting on these band saws.**
- Keep hands and body parts away from line of cut.

## Procedure for using Band Saws

- 1) Inspect material. It should be flat and free of debris (dirt, nails, screws, etc.)
- 2) Check blade pitch. Use proper blade for various cuts (ask shop attendant).
- 3) **Adjust upper guide to within 1/2" above surface of material.**
- 4) For straight cuts set up fence (see attendant for assistance).
- 5) Turn on saw. Machine should run smoothly with a consistent buzz. Report strange noises to shop attendant.
- 6) Feed material while standing directly in front of blade. Avoid standing to side of blade.
- 7) Keep hands and body parts away from line of cut. Sometimes the blade may "jump" through the material. This occurs when the blade cuts through a portion of the material that may have a lesser density, thus offering less resistance to cutting. The blade will actually speed up and cut at a greater velocity. If you are near the end of a cut and your fingers are in the line of cut injury could occur.
- 8) Begin feeding material into blade. Use enough pressure to feed material through blade at a slow consistent speed. If material smokes or burns report it to shop attendant.
- 9) If you need to pull material out of blade do so with caution, proceed slowly and if blade pulls away from guides do not try to pull piece out any further. If blade gets stuck in saw kerf and pulls out of guides turn off machine and seek help from shop attendant.
- 10) For angled cuts check with shop attendant for help.

Typical Band Saw detail





## 10" Table saw

The 10" Table saw is a frequently used piece of equipment. It can be used to cut solid wood, composite wood products such as plywood and particleboard and some types of plastics. The table saw shown above is configured primarily for ripping wood (cutting parallel to the grain of the wood). Two table saws in the shop are configured in this manner. One is set up with a blade used for making cuts as shown and the other is setup with a dado blade used for cutting grooves in material.

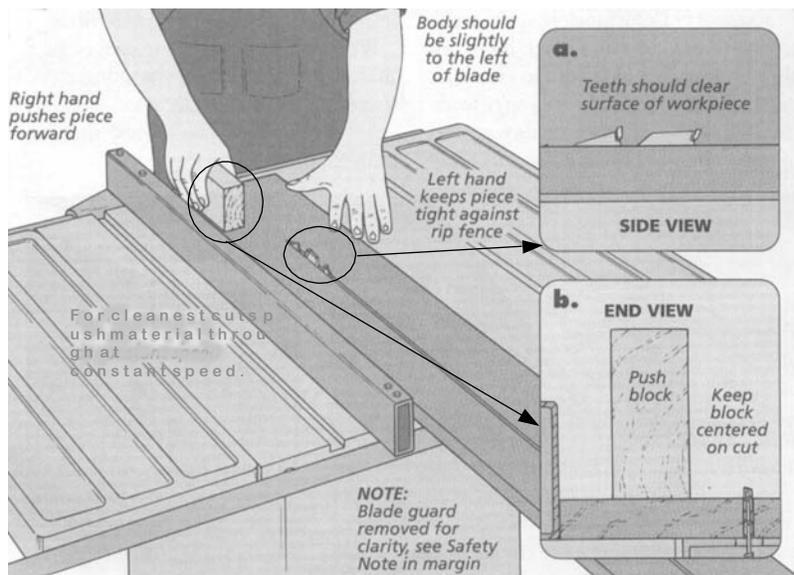
## Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Hearing Protection is recommended while using these machines.**
- **Stay focused on the tool and the work being performed.**
- **Seek shop attendant approval before using these machines.**
- Material to be cut on table saws should be flat and straight on at least two adjacent surfaces. Free of dirt, loose knots and splits.
- Be sure to check for any metal objects embedded in the wood (nails, screws, staples, etc.)
- Be sure to check for any metal objects embedded in the wood (nails, screws, staples, Etc.)
- Use a push stick whenever cutting pieces less than 6" wide.
- Do not rip material greater than 2" thick on this machine.

- If guards need to be removed please ask shop attendant for help.
- **DO NOT LET GO OF MATERIAL UNTIL IT IS COMPLETELY PAST THE BLADE.**
- Avoid standing directly in-line with blade. If possible stand off to the side of blade.

## Procedure for ripping material on table saw

- 1) Inspect material. It should be flat and straight, free of loose knots, dirt, or metal objects.
- 2) Use appropriate blade for material being cut. Seek attendant's help if needed.
- 3) Adjust blade tilt if needed, use appropriate throat plate for beveled cuts. Seek attendant's assistance if needed.
- 4) To adjust fence to desired width, lift large handled knob upwards and slide fence bar towards or away from saw blade.
- 5) Guards should be kept in place. But can be removed if they interfere with passage of material through blade (By shop attendant only).
- 6) Lock down fence by pushing large handled knob downwards.
- 7) Have push stick ready for use if there is less than six inches between fences and saw blade.
- 8) Remove dust shield if it interferes with passage of push stick (Usually about 3" width).
- 9) Remove Splitter if it interferes with passage of push stick (Usually about 1 3/4").
- 10) Turn on saw
- 11) Place material flat on table saw surface and tight against fence.
- 12) With steady even pressure and moderate speed push material into blade.
- 13) As material moves through blade continue holding material tight against fence and flat against table.
- 14) Minimize saw marks and burning by not pausing during the sawing process.
- 15) When end of board approaches reach for push stick if needed (Material less than 6" wide).
- 16) When reaching for push stick, do not let go of material at any time. Switch hands as necessary to reach for push stick.
- 17) **Do not let go of material until it is completely past saw blade.**



## Cross-cutting on Table Saw

The table saw may also be used for cutting material across the length or perpendicular to the grain (cross-cutting). In the woodshop cross-cutting can be performed on the table saw in two ways. The Crosscut Box is the easiest and safest way to cut material perpendicular to the grain. Using the miter gauge is another option for cross-cutting material on the tables saw

### Procedure for using Crosscut Box on Table Saw

- 1) Crosscut Box is used only for cutting material to length. Cuts performed on crosscut box are perpendicular to the length of the material and grain direction.
- 2) Mark the material with a pencil at the point where it will be cut.
- 3) Material should have at least one flat and straight face and at least one flat and straight edge.
- 4) Place material in crosscut box so it sits tightly in the corner of the crosscut box fence and the crosscut box bottom.
- 5) Line up the mark on the material with the edge of the blade. (Blade should be to the waste side of the cut).
- 6) Make sure material is away from blade. Start saw.
- 7) Hands should be outside of blade shield and at least 6" away from blade.
- 8) With one hand holding material firmly in place, use other hand to push crosscut box through saw blade.
- 9) As soon as material has passed completely through blade pull the crosscut box back to the original starting position.
- 10) Turn off saw. Wait for blade to completely stop before reaching for material.

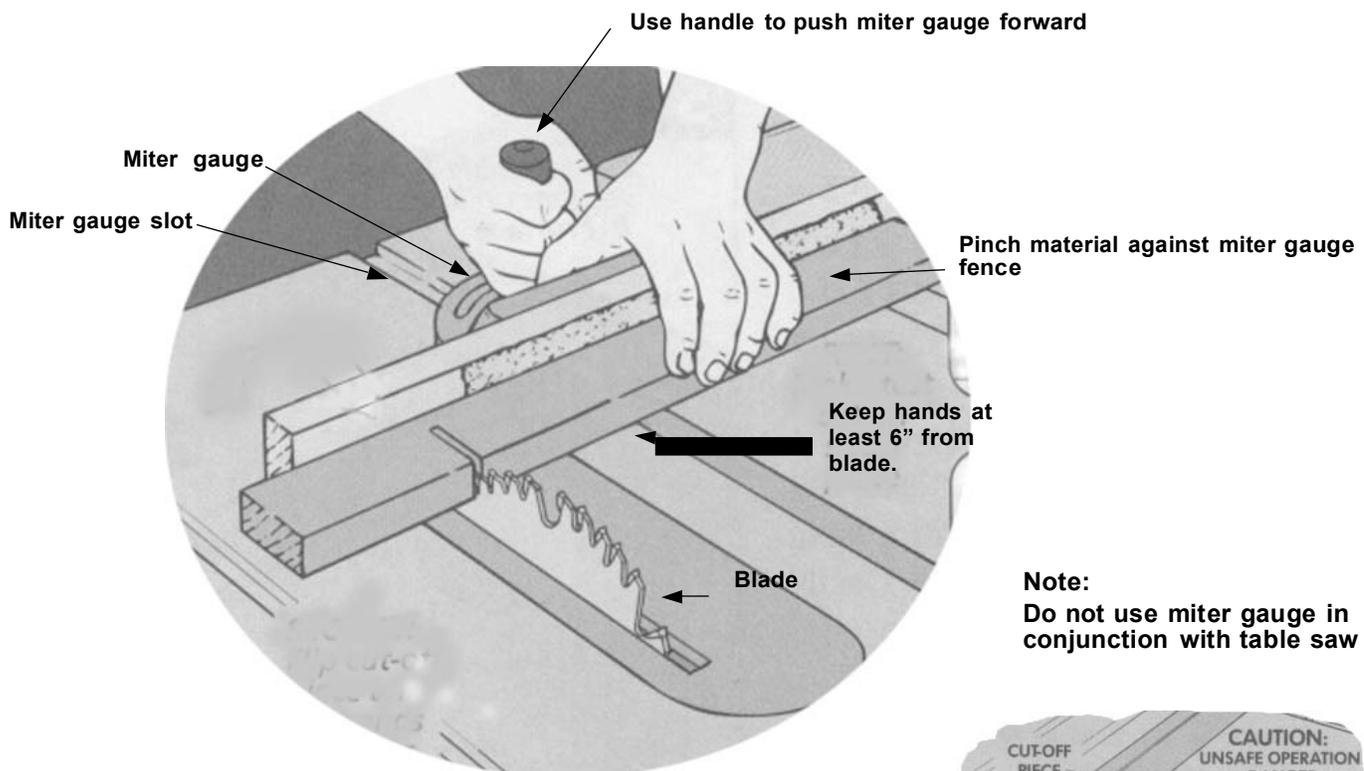
Crosscut

it

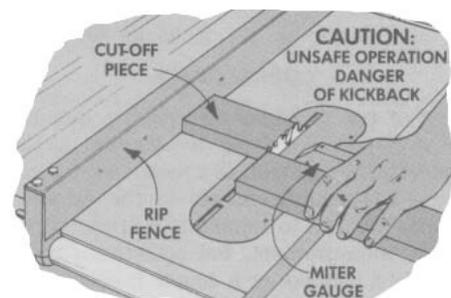
## Procedure for using Miter Gauge on Table Saw

Miter Gauges are stored on the shelf of the extension table on each of the shops table-saws. **NEVER USE TABLESAW FENCE IN CONJUNCTION WITH MITRE GAUGE. (I.E. DO NOT USE FENCE AS A STOP).**

- 1) Mark the material with a pencil at the point where it will be cut.
- 2) Material should have at least one flat and straight face and at least one flat and straight edge.
- 3) Place miter gauge into the slot in the table saw (bar on the miter gauge should be pointing away from front of saw).
- 4) Line up the mark on the material with the edge of the blade. (Blade should be to the waste side of the cut).
- 5) Make sure material is away from blade. Start saw.
- 6) Hands should be outside of blade shield and at least 6" away from blade.
- 7) Hold material tight to miter gauge and with steady speed push it and material through blade.
- 8) While still holding material and miter gauge pull back to starting position. Remove scrap after blade has completely stopped.

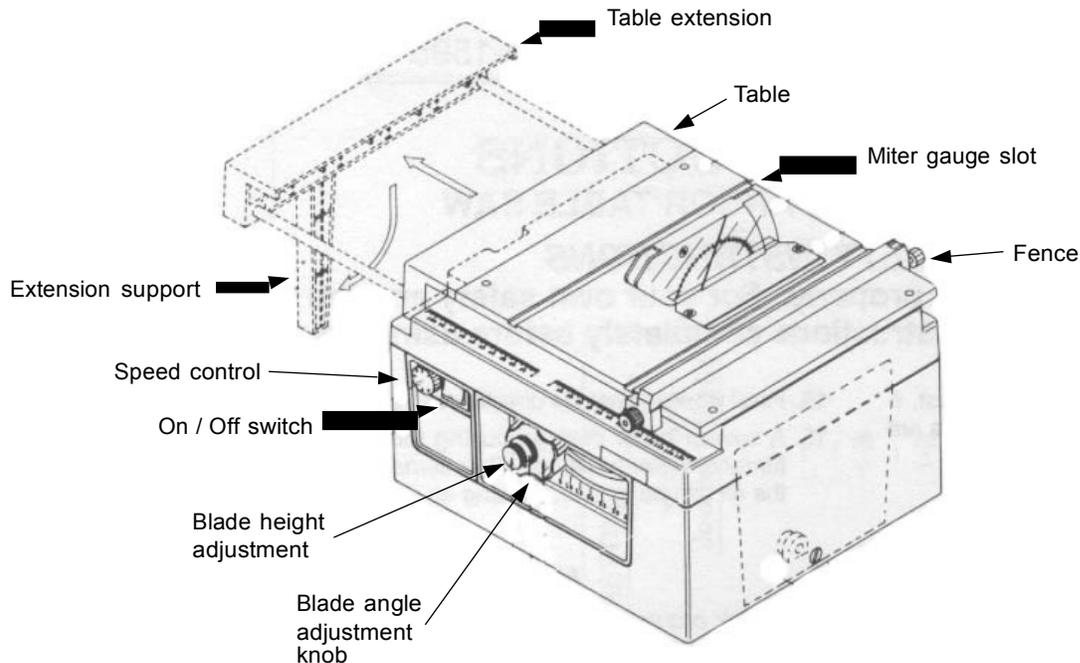


**Note:**  
Do not use miter gauge in conjunction with table saw fence.



## Model Table Saw

The Model Table Saw is a versatile machine particularly useful for cutting small or thin material. As the name implies it is an ideal tool for cutting model-making materials.



## Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the tool and the work being performed.**
- Any material to be cut on table saw should be flat and straight on at least one edge and free of dirt, loose knots and splits.
- Be sure to check for any metal objects embedded in the wood (nails, screws, staples, etc.).
- Use a push stick whenever performing rip cuts on pieces less than 3" wide.
- If guards need to be removed please ask shop attendant for help.
- Avoid standing directly in line with blade. If possible stand off to the side of blade.
- **The Model Table saw should only be used for cutting material less than 1/4" thick.**

## Procedure for using Model Saw (Ripping)

- 1) Inspect material. It should be flat and straight, free of loose knots, dirt, or metal objects.
- 2) To adjust fence to desired width, unscrew thumbscrews at both ends of fence. Slide fence bar towards or away from saw blade.
- 3) Guards should be kept in place. But can be removed if they interfere with passage of material through blade.
- 4) Lock down fence by tightening thumbscrews at both ends of fence.  
**Do not over-tighten fence lock-down screws.**
- 5) Have push stick ready for use if there is less than 3" between fence and saw blade.
- 6) Remove dust shield if it interferes with passage of push stick. (Usually about 3" width).
- 7) Turn on saw.
- 8) Place material flat on table saw surface and tight against fence.
- 9) With steady even pressure and moderate speed push material into blade.
- 10) As material moves through blade continue holding material tight against fence and flat against table.
- 11) Minimize saw marks and burning by not pausing during the sawing process.
- 12) When end of board approaches reach for push stick if needed (Material less than 3" wide).
- 14) When reaching for push stick, do not let go of material at any time. Switch hands as necessary to reach for push stick.
- 15) **Do not let go of material until it is completely past saw blade.**
- 16) Turn off saw.
- 17) Wait for blade to stop spinning completely before reaching for material.

## Procedure for cross cutting on the Model Saw

**NEVER USE TABLESAW FENCE IN CONJUNCTION WITH MITRE GAUGE. (I.E. DO NOT USE FENCE AS A STOP).**

- 1) Mark the material with a pencil at the point where it will be cut.
- 2) Material should have at least one flat and straight face and at least one flat and straight edge.
- 3) Place miter gauge into the slot in the table saw. (Bar on the Miter gauge should be pointing away from front of saw).
- 4) Line up the mark on the material with the edge of the blade. (Blade should be to the waste side of the cut).
- 5) Make sure material is away from blade. Start saw.
- 6) Hold material tight to miter gauge and with steady speed push it and material through blade.
- 7) While still holding material and miter gauge pull back to starting position. Remove scrap after blade has COMPLETELY STOPPED.

## Additional Table Saw Safety

Each use of Table saw must be done so with shop staff approval.



Never reach across saw blade while machine is on or blade is in motion.

**Incorrect**

## About Kickback

One of the biggest hazards associated with table saw use (aside from the risk of being cut) is the potential for material that is being cut to bind and be thrown back toward the operator. This is known as kickback. Kickbacks may vary in intensity—anywhere from a mild backwards push, to a violent hurling of the material. Almost all kickback is caused by operator error – either not properly controlling the material through the cut or attempting to cut inappropriate or defective material (Material with curved or warped surfaces). Many of the safety rules that follow are designed to minimize the risk of kick-back. Please know and follow these safety rules for the protection of yourself and others.

## 10 tips to avoiding table saw kickback



### Correct

All material to be cut must be flat and have a straight edge to ride against the rip fence or the miter gauge. Material should always be held firmly on table surface and the rip fence or miter gauge.



### Incorrect

Do not attempt to cut round or curved objects on the table saw.

**Please Note: Some guards may have been removed for clarity in some of the following photos. Guards should always be in place when practical.**



### Correct

Always use the rip fence, the miter gauge or other stable material supporting jig.



### Incorrect

**Never attempt a freehand cut with a table saw.** (A cut using only hands to guide material.)



**Correct**

Table Saw blade height should be adjusted so that top of blade projects 1/8" to 1/4 " above surface of material being cut.



**Incorrect**

Do not raise blade height more than 1/4" above surface of material.



**Correct**

Use correct stance. Stand with firm stance and feet spread shoulder width apart bend arms and knees to move material through blade



**Incorrect**

Do not lean upper body over blade to push material through blade.



**Correct**

Always push the material between the blade and the rip-fence completely beyond the blade and the splitter guard before letting go.



**Incorrect**

Do not let go of material while it is still engaged in blade.



**Correct**

Use push sticks or push blocks to rip narrow pieces (Generally material less than 6" wide).



**Incorrect**

Do not attempt to push narrow pieces past blade using fingers.



**Correct**

Always keep hands to the sides of the blade when pushing material through blade.



**Incorrect**

Never place hands or fingers in path of cut or in line with blade.



**Correct**

Always push the portion of material that travels between the rip fence and the saw blade.



**Incorrect**

Do not continue pushing material forward from left side once the end of material approaches blade.



**Correct**

Use left hand to push material against rip fence. Use right hand to push material through blade. As material passes through blade and end of material approaches throat plate do not use left hand to push material against rip fence.



**Incorrect**

Do not continue using left hand to push material forward or towards fence once end of material approaches blade. Do not allow left hand to travel with material towards blade.



**Correct**

Use a Miter gauge or other special jigs to support material while cross cutting.

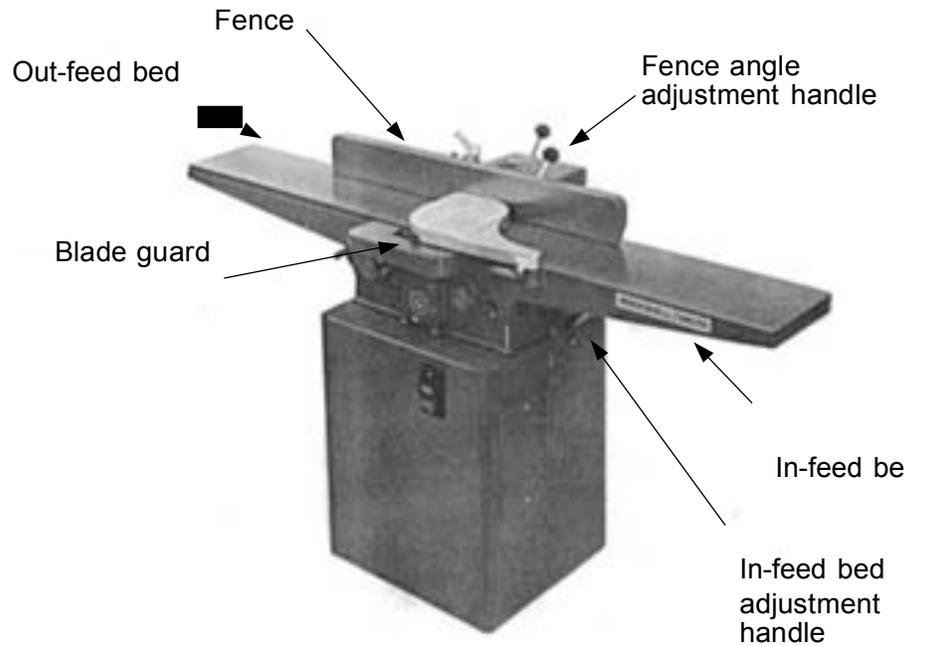


**Incorrect**

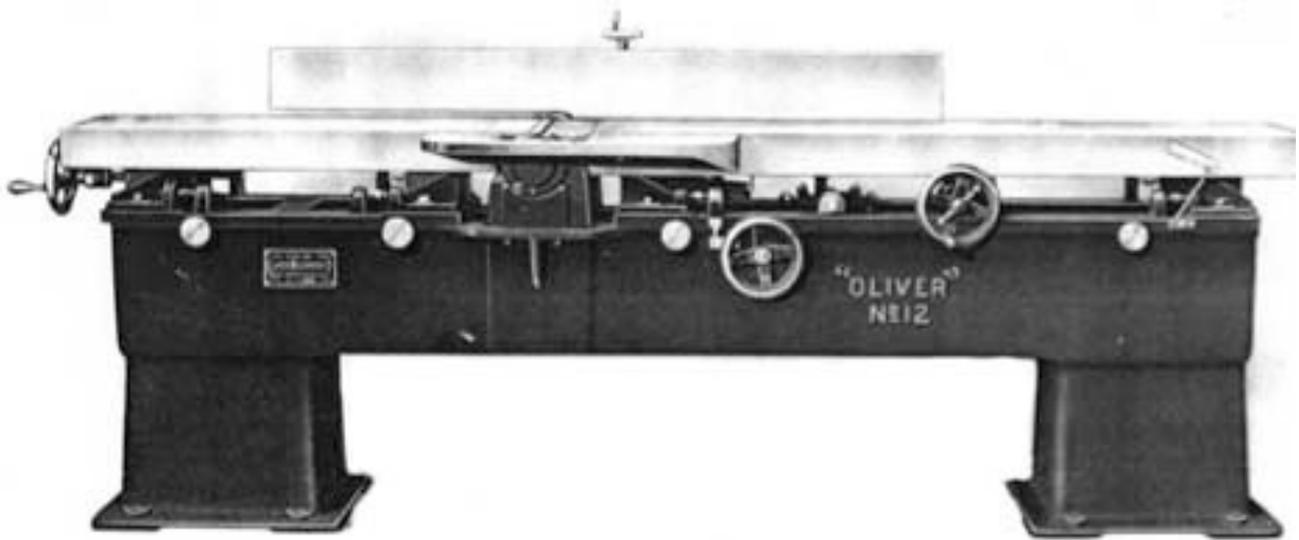
Never cross cut narrow stock (Material less than 12" in width) to length using the rip fence.



6" Jointer



8" Jointer



20" Jointer

## 6" Jointer and 8" Jointer

The Jointer is a primary piece of woodworking equipment. It is used to make wood material flat and square in preparation for other machining procedures.

Safe and proper use and good technique are essential for accurate and consistent performance.

### Safety

- **Protective eyewear should always be worn when operating these machines.**
- **Stay focused on the tool and the work being performed.**
- **For safety reasons material should be at least 12" long and 3" wide and at least 1/2" thick.**
- **Never attempt to process end grain (end of board) on this machine.**
- **Never reach down to free material that gets stuck on the out-feed bed while machine is on and operating.**
- For best performance cuts should be limited to 1/16" maximum in hardwoods and 1/8" maximum in softwoods.
- Ask for shop attendant's assistance for help changing depth of cut settings.
- It is easier to flatten shorter lengths of material. Cut longer boards to rough length before flattening.
- **When flattening material less than 1 1/2" thick use a push board to hold material down.**

### Procedure for flattening a board:

Seldom does a board come from a lumberyard or sawmill truly flat or square. More often than not boards will have a warp, twist or bow or a combination of all of these things.

A jointer can remove these undesirable qualities and leave the material in a more workable condition.

- 1) Inspect material. It should be clean and free of debris; dirt, nails, screws and loose knots.
- 2) Check settings on machine. Depth of cut should be 1/16" or less for hardwoods or 1/8" or less for softwoods.
- 3) Turn the machine on.  
If material is bowed or cupped place it on the in-feed table with the cup or bowed side down.

**Fingers should be above surface of material at all times.**

- 4) Begin feeding material through cutter knives. Apply downward pressure to the leading end of the board and a combination of downward and forward pressure on back end of board. **If material gets caught on out-feed bed DO NOT reach down to free material. Hold material in place and turn off machine. Back material out after machine has stopped completely.**

- 5) As material passes over cutter knives gradually shift more downward pressure to back end of board. Material should pass over knives with relatively little vibration

*(Procedure cont'd)*

and with a moderate noise level. Noisy cuts or cuts that generate a lot of vibration indicate dull knives. Report this to shop attendant.

- 6) Repeat steps 5 and 6 until material is flat on one side.

## Procedure for jointing the edge of a board

Once the face of a board has been flattened an edge that is straight and 90° to the face can be obtained.

- 1) Inspect material. It should be clean and free of debris; dirt, nails, screws and loose knots.
- 2) Check settings on machine. Depth of cut should be 1/16" or less for hardwoods or 1/8" or less for softwoods.
- 3) Make sure dust collector is on.
- 4) Turn the machine on.  
Place the flat face of the board against the fence. Apply pressure at the leading end of the board and press it flat against the fence. At the back end of the board use your other hand to begin pushing the board.

**Fingers should be above surface of material at all times.**

- 5) **Use push block if needed. . If material gets caught on out-feed bed DO NOT reach down to free material. Hold material in place and turn off machine. Back material out after machine has stopped completely.**
- 6) As the material passes over the cutter head use one hand to keep the board against the fence and tight to the bed. Allow the board to slide past as the other hand pushes the material. Ask for help if you don't understand this procedure.
- 7) Repeat steps 6 and 7 until the edge is square to the face and straight along the length. Use a square to check for square.

## 20" Jointer

The 20" Jointer is the flagship piece of equipment in the shop. Its 20" knives will allow the user to flatten all but the widest boards. Safe and proper use and proper technique are essential for accurate and consistent performance.

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the tool and the work being performed.**
- **Always use a push-board when using this machine.**
- **Use of this machine must be approved by shop supervisor.**
- For safety reasons material should be at least 18" long and 6" wide and at least 1" thick.
- For best performance cuts should be limited to 1/16" maximum in hardwoods and 1/8" maximum in softwoods.
- **Never reach down to free material that gets stuck on the out-feed bed while machine is on and operating.**
- Ask for shop attendant's assistance for help changing depth of cut settings.
- It is easier to flatten shorter lengths of material. Cut longer boards to rough length before flattening.

### Procedure for flattening a board:

Seldom does a board come from a lumber-yard or sawmill truly flat or square. More often than not boards will have a warp, twist or bow or a combination of all of these things.

A jointer can remove these undesirable qualities and leave the material in a more workable condition.

- 1) Inspect material. It should be clean and free of debris; dirt, nails, screw and loose knots.
- 2) Check settings on machine. Depth of cut should be 1/16" or less for hardwoods or 1/8" or less for softwoods.
- 3) Make sure dust collector is on.
- 4) Turn the machine on.
- 5) If material is bowed or cupped place it on the in-feed table with the cup or bowed side down.
- 6) Apply downward pressure to the leading edge of the board and a combination of downward and forward pressure on back end of board.

**Fingers should be above surface of material at all times.**

- 7) Begin feeding material through cutter knives. As material passes over cutter knives gradually shift more downward pressure to back end of board. Material should pass over knives with relatively little vibration and with a moderate noise level. Noisy cuts or cuts that generate a lot of vibration indicate dull knives. Report this to shop attendant. **If material gets caught on out-feed bed DO NOT reach**

**down to free material. Hold material in place and turn off machine. Back material out after machine has stopped completely.**

- 8) Repeat steps 7 and 8 until material is flat on one side.

Procedure for jointing the edge of a board.

Once the face of a board has been flattened an edge that is straight and 90 degrees to the face can be obtained.

- 1) Inspect material. It should be clean and free of debris; dirt, nails, screws and loose knots.
- 2) Check settings on machine. Depth of cut should be 1/16" or less for hardwoods and 1/8" or less for softwoods.
- 3) Turn the machine on.
- 4) Make sure dust collector is on.
- 5) Place the flat face of the board against the fence. Apply pressure at the leading end of the board and press it flat against the fence. At the back end of the board use your other hand to begin pushing the board. **If material gets caught on out-feed bed DO NOT reach down to free material. Hold material in place and turn off machine. Back material out after machine has stopped completely.**

**Fingers should be above surface of material at all times.**

- 6) As the material passes over the cutter head use one hand to keep the board against the fence and allow the board to slide past it as the other hand pushes the material. Ask for help if you don't understand this procedure.
- 7) Repeat steps 6 and 7 until the edge is square to the face and straight along the length. Use a square to check for square.

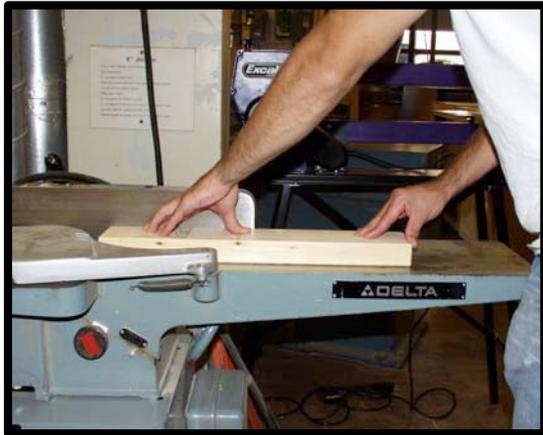
## Jointer Safety (illustrated)



Proper stance and posture are important when operating any of the shops Jointers. Assume a wide stance. Feet should be firmly placed and body weight should be evenly distributed. Bend at knees and waist when pushing material forward. Fingers should never touch table surfaces when processing material.



Never reach down to free material that gets stuck on out-feed bed.



**Correct**

Hands and fingers should be above the surface of the material.



**Incorrect**

Hands and fingers should never touch table surfaces.



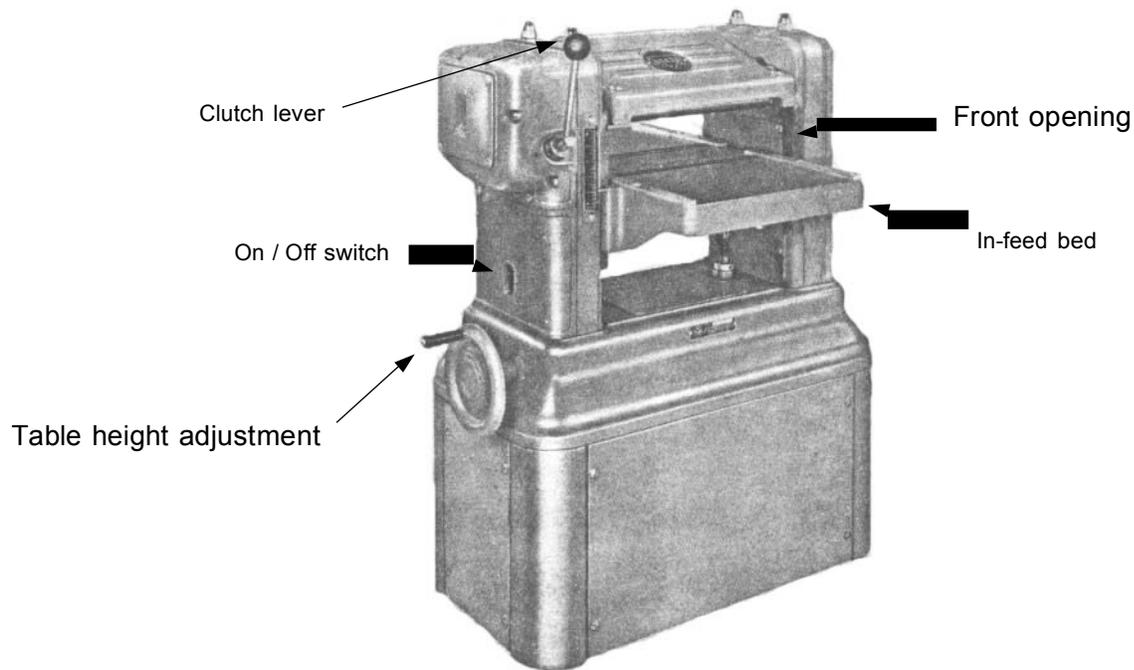
**Correct**

The jointer is for flattening the edge or face of a board.



**Incorrect**

Do not use the jointer to flatten, smooth or straighten the end of a board (end-grain).



## 13" Planer

The 13" Planer is ideally suited for planing small to medium size (1" - 12" wide) boards of solid wood. It can be used to plane rough sawn wood or wood that has been previously flattened.

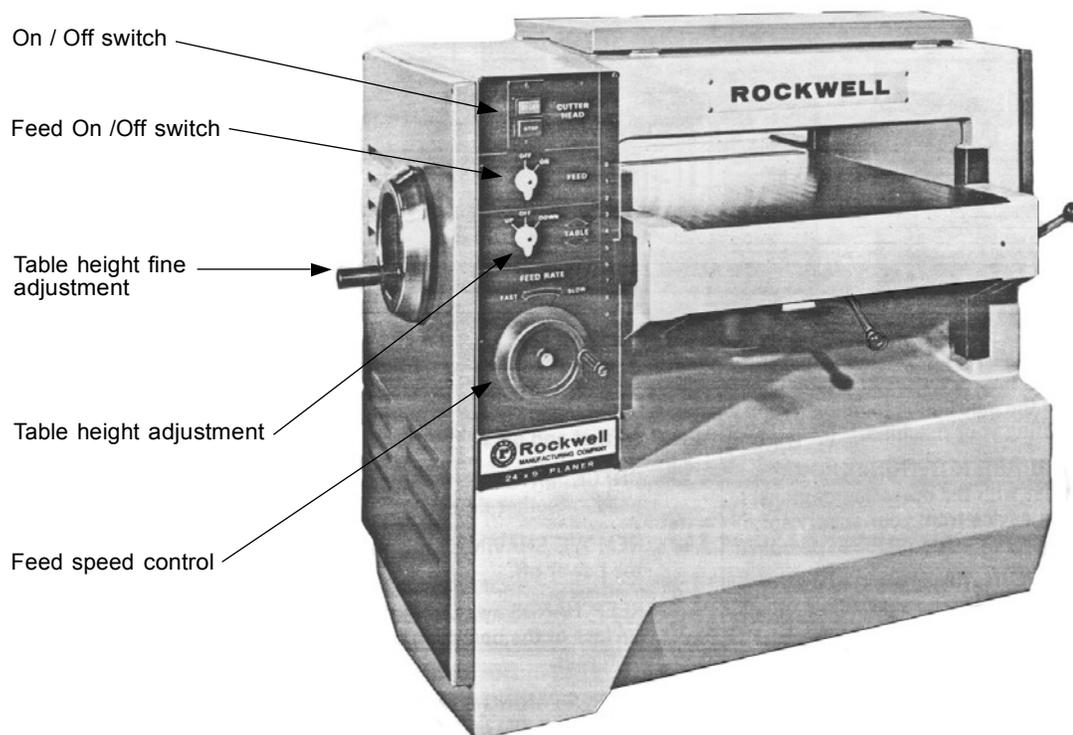
PLANERS DO NOT FLATTEN BOARDS. If there is a bow, cup or twist in a board the planer will not remedy these characteristics. A planer will merely smooth the face of a board and plane it to a consistent thickness. The planers in the woodshop are vital pieces of equipment and crucial to the completion of many projects. Be gentle with these machines and read the operating procedures carefully.

## Safety

- **Do not stand directly behind machine when operating.**
- **Do not look into front opening of planer while it is on and operating.**
- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the tool and the work being performed.**
- The use of hearing protection is recommended when using this machine.
- Do not attempt to remove too much material per pass (more than 1/32" / pass).
- Always measure thickness of board at several points along the length
- For the first pass set the machine according to the thickest part of the board.
- Material to be surfaced should be at least 12" long.
- If needed see attendant for assistance with this machine.

## Procedure for planing a board

- 1) Check board for maximum thickness.
- 2) **Adjust planer for thickest part of board. Be sure planer is off.** Insert board into front of planer and raise or lower table bed until material barely clears the in-feed roller. (The in-feed roller is a serrated metal rod about 3" in from the front of planer).  
**Machine should be off for this step !!!**
- 3) Use hand crank on left side of machine to raise / lower bed.
- 4) Turn on machine (Green button).
- 5) Make sure dust collector comes on.
- 6) Feed board into machine with grain of wood parallel to direction of feed.
- 7) If material gets stuck in planer, pull or push clutch to right (When facing front of machine) and give board a push into machine.
- 8) Raise bed for next pass.
  - For boards 6" and under turn crank handle clockwise maximum 1/2 crank / pass.
  - For boards 6" and over turn crank handle clockwise maximum 1/4 crank / pass.
- 9) Repeat steps 7 and 8 until desired material thickness is obtained.



## 24" Planer

The 24" Planer is ideally suited for planing large boards of solid wood. It can be used to plane rough sawn wood or wood that has been previously flattened.

**PLANERS DO NOT FLATTEN BOARDS.** If there is a bow, cup or twist in a board the planer will not remedy these characteristics. A planer will merely smooth the face of a board and plane it to a consistent thickness. The planers in the woodshop are vital pieces of equipment and crucial to the completion of many projects. Be gentle with these machines and read the operating procedures carefully.

## Safety

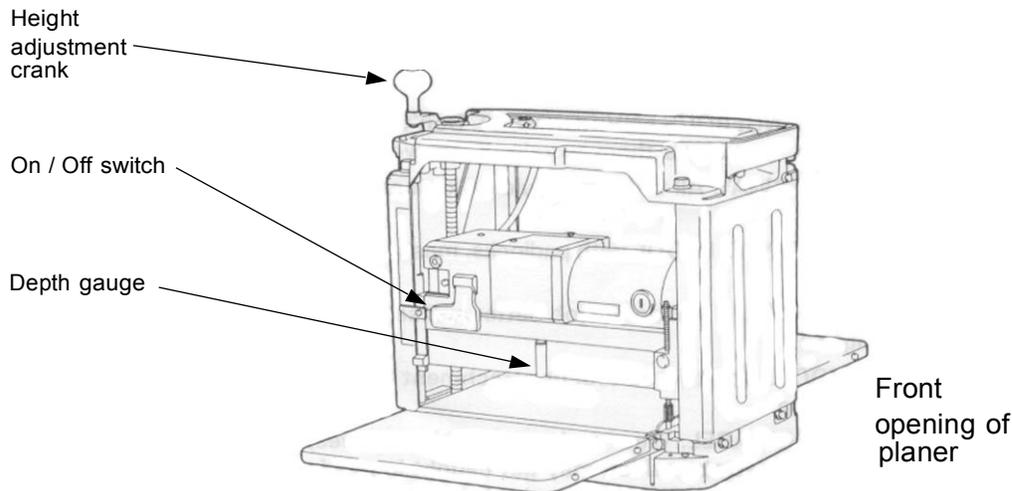
- **Do not stand directly behind machine when operating.**
  - **Do not look into machine while it is on and operating.**
  - **Protective eyewear should always be worn when operating this machine.**
  - **Use Hearing protection when operating this machine.**
  - **Stay focused on the tool and the work being performed.**
  - Do not stand directly behind machine when operating.
  - Do not attempt to remove too much material per pass (more than 1/16" / pass).
  - Always measure thickness of board at several points along the length.
  - Set the machine according to the thickest part of the board for the first pass.
  - Do not adjust feed rate crank unless machine is running.
  - Material to be surfaced should be at least 16" long.
  - If needed see attendant for assistance with this machine.

## Procedure for planing boards

- 1) Check board for maximum thickness.
- 2) Turn on machine (Green button).
- 3) Make sure dust collector comes on.
- 4) Use power raise/lower switch to set machine to maximum board thickness (according to indicator gauge). Use Hand crank on side of machine to raise/ lower bed in small increments. (To use hand crank push handle inwards while turning.)
- 5) Turn feed knob to on.
- 6) Feed board into machine.
- 7) Raise bed for next pass.

- For boards 12" and over turn crank handle clockwise maximum 1 crank pass. (Height is adjusted by holding table height fine adjustment crank in while simultaneously turning crank handle clockwise).

- 8) Repeat steps 7 and 8 until desired material thickness is obtained.



## 12" Finish Planer

The 12" Finish Planer is ideally suited for removing small amounts of material on small to medium size (1" - 12" wide) boards of solid wood.

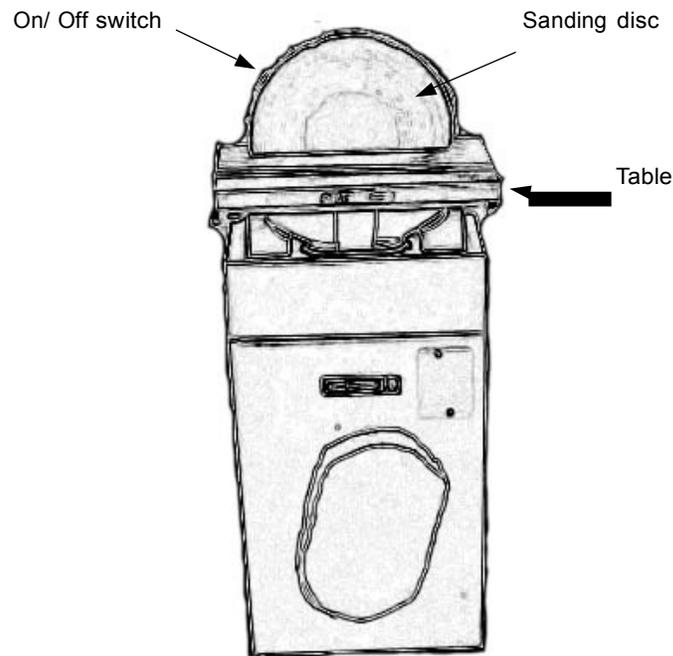
PLANERS DO NOT FLATTEN BOARDS. If there is a bow, cup or twist in a board the planer will not remedy these characteristics. A planer will merely smooth the face of a board and plane it to a consistent thickness. The planers in the woodshop are vital pieces of equipment and crucial to the completion of many projects. Be gentle with these machines and read the operating procedures carefully.

## Safety

- **Do not stand directly behind machine when operating this machine.**
- **Do not look into front opening of planer while it is on and operating.**
- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- The use of hearing protection is recommended while operating this machine.
- Do not attempt to remove too much material per pass (more than 1/32" / pass).
- Always measure board thickness at several points along the length.
- For the first pass set the machine according to the thickest part of the board.
- Material to be surfaced should be at least 12" long.
- If needed see attendant for assistance with this machine.

## Procedure for planing a board

- 1) Check board for maximum thickness.
- 2) **Adjust planer for thickest part of board. Machine should be off for this step!**  
Insert board into planer and raise or lower cutting head until depth gauge at front of planer just barely touches material.
- 3) Use hand crank on top of machine to raise / lower cutting head.
- 4) Turn on machine (Black switch).
- 5) Feed board into machine with grain of wood parallel to direction of feed.
- 6) Raise bed for next pass.
  - For boards 6" and under turn crank handle CCW maximum 1/4 crank / pass.
  - For boards 6" and over turn crank handle CCW maximum 1/8 crank / pass.
- 7) Repeat steps 5 and 6 until desired thickness is obtained.



## 12" Disc Sander

The 12" Disc Sander can be used to do rough sanding work on straight edges and on convex curved surfaces. As with all power sanders care must be taken not to remove too much material at once.

### Safety

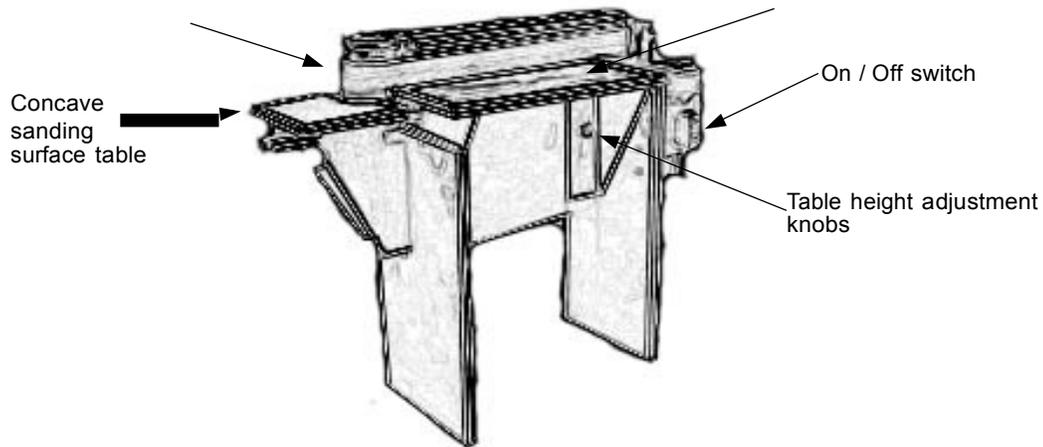
- **Protective eyewear should always be worn when operating this machine**
- **Stay focused on the machine and the work being performed.**
- **Use of a dust mask is recommended while using this machine.**
- Long hair should be tied back and restrained.
- Loose clothing should be restrained or removed. Roll up sleeves.
- Be sure to wear eye protection.
- To keep material from "jumping" sand only to the right of center.
- Do not force material into disc.
- Material to be sanded should be flat on at least one face.
- Disc Sander is for use on wood only. Do not attempt to sand plastic, metal, plaster or rubber.
- If disc appears to be clogged or dirty ask shop attendant for assistance.

### Procedures for Sanding:

- 1) Make sure dust collector is on.
- 2) Turn on Sander.
- 3) Place flattened surface of material on table to the right of center of disc.
- 4) Hold material firmly and gently move it into spinning disc.
- 5) Move material steadily back and forth across right half of disc.
- 6) Turn off machine when finished and allow disc to coast to a stop.
- 7) **Do not sand items with wet or soft glue.**

Sanding belt

Table



## 6" Edge Sander

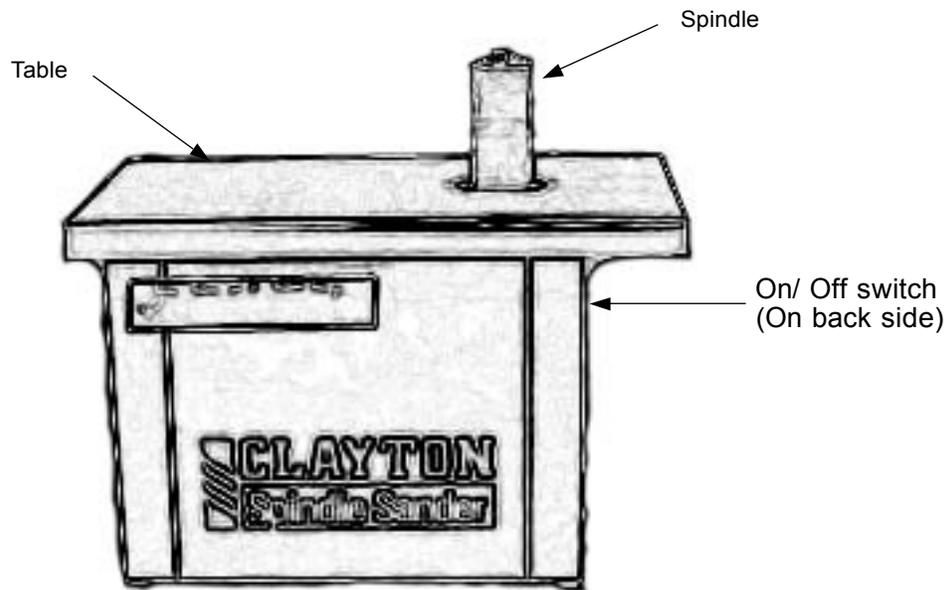
The 6" Belt Sander is best used for sanding edges of boards. Like all sanding operations it is not highly accurate. It should not be used to obtain precise angles or measurements. The machine is best suited for light sanding and removing irregularities or imperfections in material prior to final sanding.

### Safety

- **Protective eyewear should always be worn when operating the 6" Edge Sander.**
- **Stay focused on the machine and the work being performed.**
- **Use of dust mask is recommended**
- Long hair should be tied back and restrained.
- Loose clothing should be restrained or removed. Roll up sleeves.
- To keep material from "launching" do not point material against the direction of belt travel. Or sand objects that will permit fingers to get closer than 3" from belt.
- Do not force material into belt.
- Material to be sanded should be flat on at least one face.
- Edge sander is for use on wood only. Do not attempt to sand plastic, metal, plaster or rubber.
- If belt appears to be clogged or dirty ask shop attendant for assistance.

### Procedure for sanding board edges

- 1) Turn on sander (Dust collector should come on momentarily, if it doesn't seek help from shop attendant).
- 2) Hold material flat and firmly on table.
- 3) Sand material in short "bursts" Do not leave material in one place continuously.
- 4) It also helps to move material along the length of belt moving from right to left.
- 5) Do not sand small pieces with this machine. Material to be sanded should be at least 6" in width and 12" in length. Fingers should be at least 3" away from sandpaper.
- 6) Use caution when sanding end grain. Avoid pointing end of board opposite direction of sandpaper travel.
- 7) **Do not sand items with wet or soft glue.**



## 6" Oscillating Spindle Sander

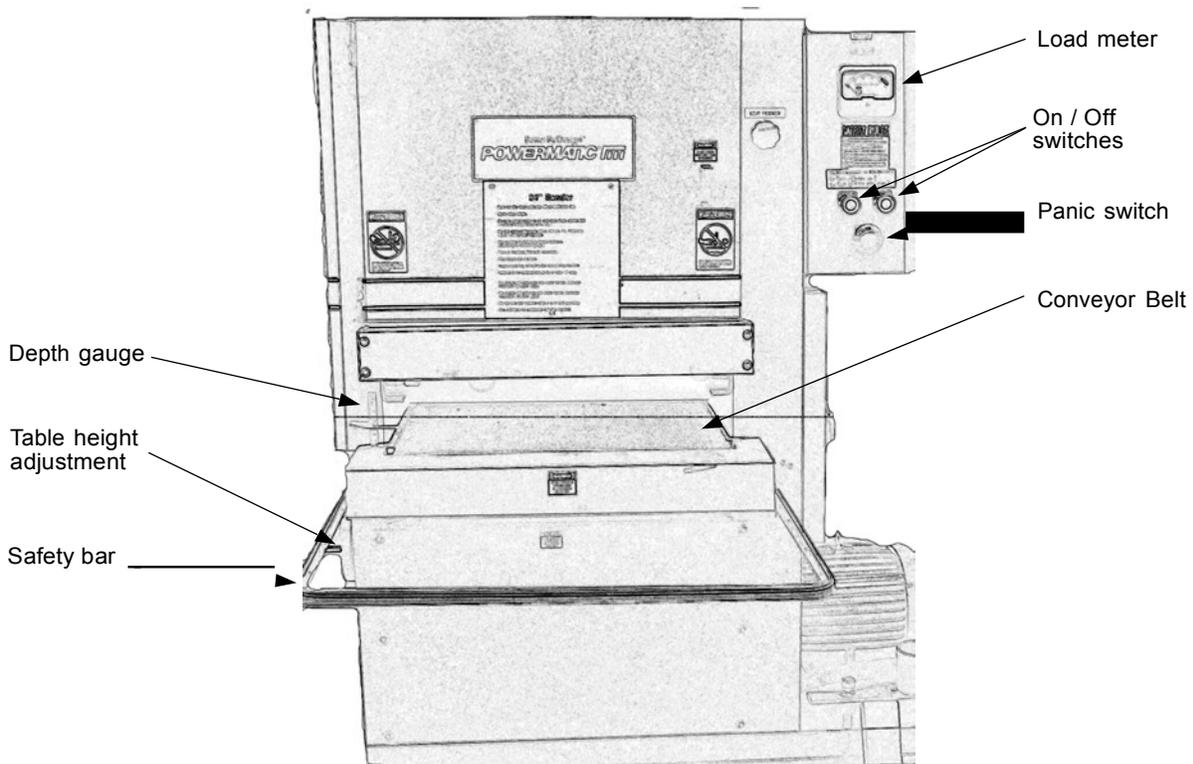
The Oscillating Spindle Sander is used for sanding concave surfaces. The spindle rotates and simultaneously oscillates vertically leaving a smooth scratch free surface on the material being sanded.

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- Long hair should be tied back and restrained.
- Loose clothing should be restrained or removed. Roll up sleeves.
- Do not force material into spindle.
- Material to be sanded should be flat on at least one face.
- This sander is for use on wood only. Do not attempt to sand plastic, metal, plaster rubber.
- If spindle appears to be clogged or dirty ask shop attendant for assistance.
- Different diameter drums are stored in the office. 1/2" dia., 3/4" dia., 1" dia., 1 1/2" dia. and 3" dia.
- Ask attendant for the appropriate drum size and corresponding ring.

### Procedure for sanding

- 1) The dust collector must be on and the blast gate open before the sander may be used. Do not use the sander if either gate or dust collector are not functioning when the sander is turned on.
- 2) Hold the material flat and firmly on the table away from the spindle.
- 3) Ease the material into the spindle, move the material from side to side around the spindle to obtain a smooth even surface.
- 4) Do not sand material with wet or soft glue.



## 24" Wide Belt Sander

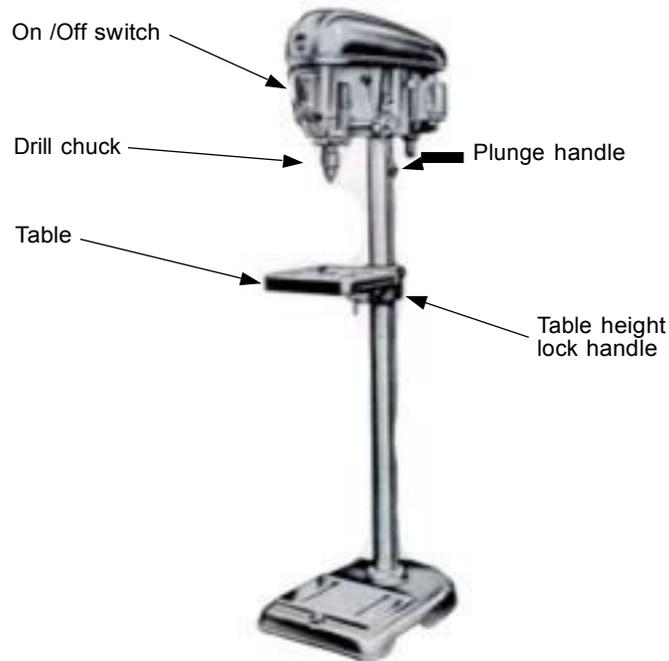
The 24" Sander can be used to prepare material for final sanding as well as thickening stock that is too difficult to be thickened in the planer. Be aware that the 24" Wide Belt Sander uses a coarse sanding belt that leaves deep scratches in the material that can be removed by other sanding methods.

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- **Always check material for consistency in thickness. Do not attempt to process material that deviates more than 1 / 32" in thickness.**
- Use the sander primarily to lightly sand material in preparation of finish sanding.
- Use the sander to thickness material only when it is not feasible to use the planer.
- Let machine run for 1-2 minutes before processing any material.
- To stop machine in an emergency press panic button or contact red strip on safety bar. Ask attendant for help resetting machine after emergency stop.

## 24" Wide Belt Sander Operating Procedure

- 1) Check to make sure air compressor is on (auto) and blue hose is attached (Pressure should be set at 80 psi).
- 2) Set machine for initial pass using indicator gauge. **Set machine for thickest board thickness** (seek attendant help).
- 3) Place material on conveyor In front of machine opening.
- 4) Turn on main power at cutoff switch (seek attendant for help).
- 5) Start machine. (Pull both green knobs). **The dust collector should come on momentarily and the blast gate should open if neither are functioning when the machine is turned on do not use sander.**
- 6) Avoid contacting the red safety bar surrounding the machine.
- 7) Watch load indicator on machine. Load should not exceed 75% consistently.
- 8) Remove material from out-feed end.
- 9) For material 12" and under turn crank handle 1/2 turn clockwise per pass.
- 10) For material over 12" turn crank handle 1/4 turn clockwise per pass.
- 11) When finished press both green knobs to turn off machine.
- 12) **Allow machine to completely stop. Turn off main power supply.**
- 13) **Do not sand items with wet or soft glue.**

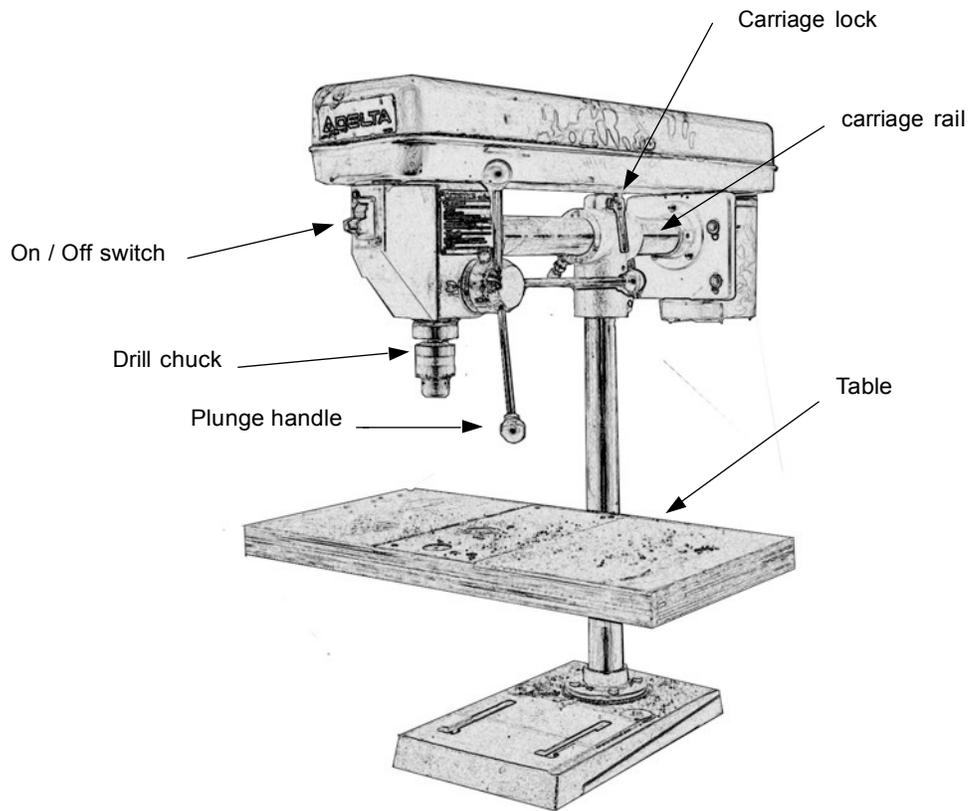


## 15" Floor Drill Press

The 15" Drill press can drill holes in wood, metal and plastics depending on the type of drill bit used. The shop has a variety of basic drill bits and a small collection of specialty bits. Please follow the operating directions carefully for this machine. The shop has two Floor Drill Presses. One allows for the table to be tilted

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- General Rule: The larger the bit the slower the speed. Ask shop attendant for help changing speed.
- Always remove chuck key before starting drill press.
- Make adjustments with power off.
- Securely lock bits into chuck by tightening all three holes.
- Be sure to use scrap beneath material to be drilled.
- Avoid drilling into drill press table.
- Loosen lock knob before using crank handle to raise drill press table.
- Drill only wood, plastics, mild steel, aluminum, brass with the drill press.
- **Always clamp down metal or plastic material.**
- Hold material to be drilled securely. For small pieces use a drill press vise or clamp.
- Do not drill full depth of hole in one plunge. Take several small plunges.
- Shut off power, remove bit and clean drill press and surrounding area when done.



## 32" Radial Drill Press

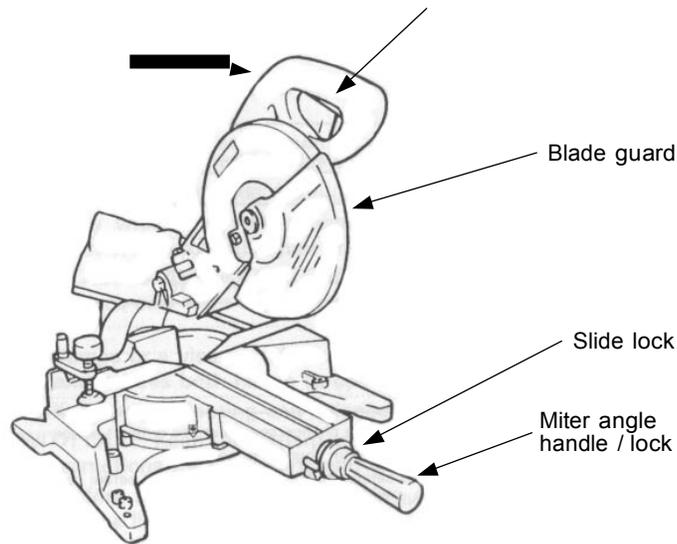
The Radial Drill Press has a movable carriage that allows the user to drill holes in the center of large pieces (up to 32" from the edge). It also has a tilting carriage feature that gives it the ability to drill holes at an infinite number of angles.

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- General Rule: The larger the bit the slower the speed. Ask shop attendant for help changing speed.
- Always remove chuck key before starting drill press.
- Make adjustments with power off.
- Securely lock bits into chuck by tightening all three holes.
- Be sure to use scrap beneath material to be drilled.
- Avoid drilling into drill press table.
- Loosen lock knob before using crank handle to raise drill press table.
- Drill only wood, plastics, mild steel, aluminum, brass with the drill press.
- **Always clamp down metal or plastic material.**
- Hold material to be drilled securely. For small pieces use a drill press vise or clamp.
- Do not drill full depth of hole in one plunge. Take several small plunges.
- Shut off power, remove bit and clean drill press and surrounding area when done.

On / Off trigger handle

Safety lock button



## 12" Sliding Compound Miter Saw

The Sliding Compound Miter Saw can make 90-degree cross cuts and compound angles in wood and wood composite. It cuts quickly with a fair degree of accuracy.

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- Cut only wood and wood based material with this saw.
- **Material should be flat and straight. Do not attempt to cut bowed or twisted boards with this machine. This could cause a kickback.**
- Hands and finger should be kept a minimum of 8" from blade.
- **Do not cut pieces less than 12" with this saw.**
- Do not operate saw with hands crossed. I.E., Left hand should always stay to left of saw and used for holding material and right hand should always be used to operate saw switch.

### Procedure for crosscutting

- 1) Adjust bevel angle and miter angle to desired settings (seek attendant assistance).
- 2) Adjust adjustable fence to clear blade guard travel (seek attendant assistance).
- 3) Hold material firmly and flatly against fence and table.
- 4) Pull saw carriage out past material.
- 5) Simultaneously push safety lock button and squeeze trigger handle to start saw.
- 6) Allow blade to reach full speed before lowering saw into material.
- 7) Lower saw blade into material with a slow steady rate of feed.
- 8) Push saw carriage through material and back towards fence.
- 9) If material starts to bind against blade, lift saw from material and take several shallow passes until cut is complete.
- 10) Allow blade to come to a complete stop before raising blade.
- 11) After cut is complete do not reach for material until blade is fully covered by blade guard.

## Sliding Compound Miter Saw Safety



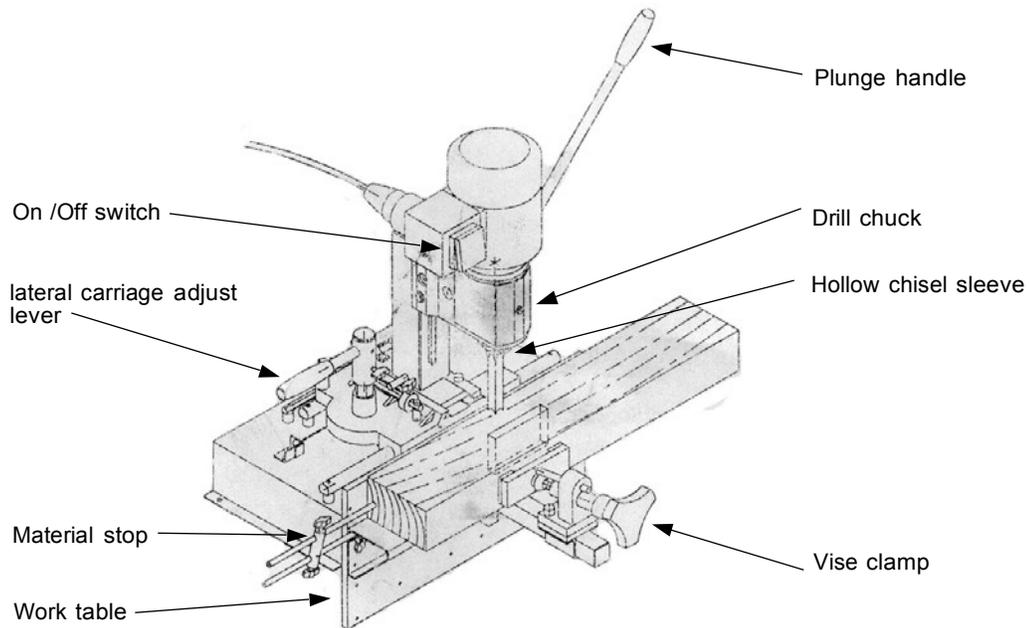
### Correct

Always keep left hand to left of saw to hold material in place and use right hand to operate saw switch.



### Incorrect

Never operate saw with hands or arms crossed.



## Hollow Chisel Mortiser

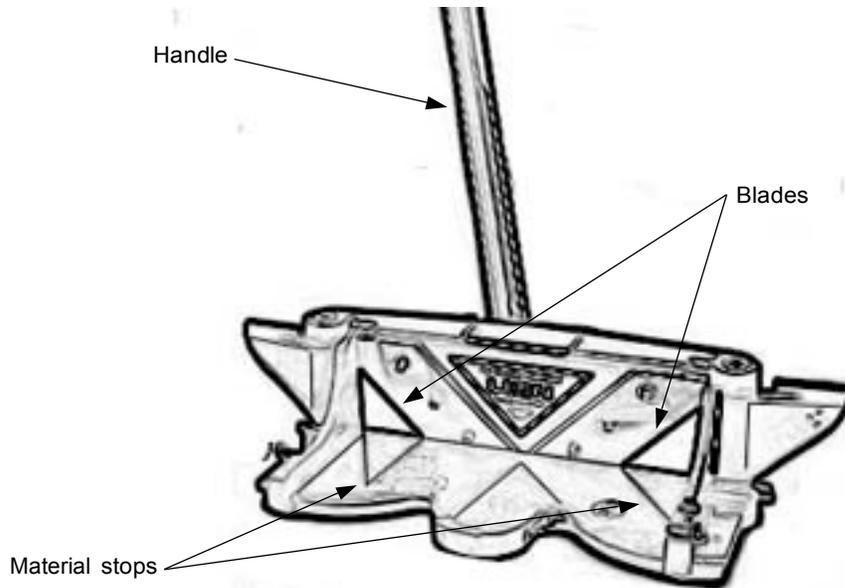
The Hollow Chisel Mortiser utilizes a hollow square chisel to cut square holes (mortises) in wood. A series of these square hole may be made next in a line to form a rectangular hole called a mortise. Traditional woodworking joinery often utilizes mortise and tenon joinery. The Hollow Chisel Mortiser operates much like a drill press and the safety procedures should be followed similarly.

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- Make adjustments with power off.
- Be sure to use scrap beneath material to be drilled.
- Clamp material with front vise securely.
- Do not drill full depth of hole in one plunge. Take several small plunges.

### Procedure for mortising

- 1) Select desired bit and hollow chisel combination for desired hole width.
- 2) Tighten bit in chuck and hollow chisel in sleeve.
- 3) Secure material to work table with vise clamp.
- 4) Use levers to locate starting position of mortise.
- 5) Set stops if needed.
- 6) Turn on machine.
- 7) Firmly lower bit and chisel into material by pushing down on plunge handle.
- 8) Do not attempt to cut entire depth of mortise in one plunge. Use a series of plunges.
- 9) Raise bit, move lateral lever to position material for next mortise.



## Lion Mitre Trimmer

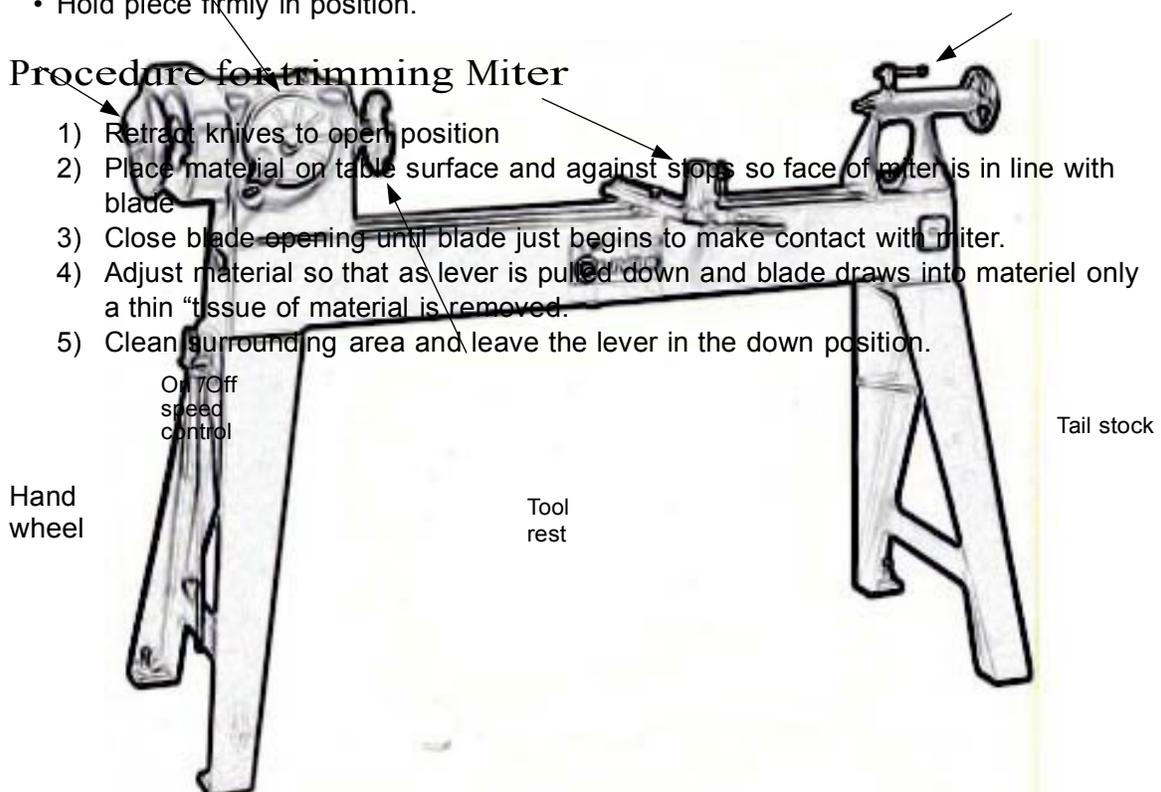
The Lion Miter trimmer is used to trim miters after they have been cut on the table saw, sliding compound miter saw or band saw. It utilizes a razor sharp blade to remove thin shavings of material that corrects the inaccuracies of a miter saw. It is an ideal tool to help achieve greater accuracy when joining miters together as in picture frames.

### Safety

- **Protective eyewear should always be worn when operating this machine.**
- **Stay focused on the machine and the work being performed.**
- Keep finger away from blades.
- Hold piece firmly in position.

### Procedure for trimming Miter

- 1) Retract knives to open position
- 2) Place material on table surface and against stops so face of miter is in line with blade
- 3) Close blade opening until blade just begins to make contact with miter.
- 4) Adjust material so that as lever is pulled down and blade draws into material only a thin "tissue of material is removed.
- 5) Clean surrounding area and leave the lever in the down position.



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## 10” Wood Lathe

The Lathe is used for making things round in cross-section. Material is mounted in the chuck and tools are used to “cut” the shape as the material spins. Shaped spindles, bowls and other semi-circular objects can be turned on the lathe.

### Safety

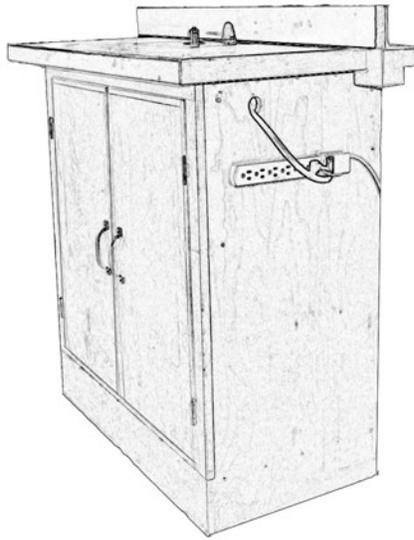
- **Get instruction and demonstration on lathe use from shop manager before attempting to use this machine.**
- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- **Cutting edge of tool should always be angled above center-line.**
- **Do not angle the cutting tool below level of tool rest.**
- Only change variable speed with motor running.

- Make all other adjustments with the power off.
- Adjust tool rest height appropriately to center of the material being turned.
- Keep tool rest as close to the work as possible.
- **Rotate material by hand to check clearance before starting** material should rotate freely and not make contact with tool rest or other stationary objects.
- Remove tool rest before sanding or polishing.
- Double check setup before turning power on.
- Examine material for flaws and inspect glue joints for structural soundness before starting.

(10" Wood Lathe cont'd)

- When roughing off:
  - a. Do not jam tool into work piece.
  - b. Do not make cut too big a cut.
- Turning between centers:
  - a. Make sure all tail stock is snug to work and locked.
  - b. Lubricate tail stock center if it is not ball bearing type.
  - c. Check that screw fasteners do not interfere with tool at the finish dimension of the work piece.
- Shut off power and clean.
- Always operate lathe at the prescribed speeds.

DIAMETER OF WORK	ROUGHING OFF	GENERAL	CUTTING FINISHING
Under 2" diameter	900-1300 rpm	2400-2800 rpm	3000-4000 rpm
4" – 6" diameter	600-800 rpm	800-1200 rpm	1800-2400 rpm
6" – 8" diameter	400-600 rpm	800-1200 rpm	1200-1800 rpm
8" – 10" diameter	300-400 rpm	600-800 rpm	900-1200 rpm
Over 10" diameter	300 rpm	300-600 rpm	600-900 rpm



## Router Table

The Router Table is simply a handheld router mounted on a fixed plate, inverted and mounted in a cabinet or stand. The shop has a variety of router bits that can be used to shape and groove material. As with any machine in the shop certain precautions and procedures should be followed when operating this machine.

### Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- **Always unplug the router when changing bits.**
- Do not attempt to remove too much material in a single pass. Raise bit in 1/8<sup>th</sup> inch increments or adjust fence in 1/8" increments.
- **Always feed material from the right side of the bit to the left side of the bit.**
- **Never position material between bit and fence or use the back side of bit.**
- Do not attempt to route pieces less than 8" x 8". Keep fingers at least 2" inches away from bit.
- Material to be routed should be flat and free of and free of any debris (nails, screws, knots, bark).
- Always hold material firmly but not forcefully against fence or bearing guide.

### Procedure for operating router table

- 1) Select desired router bit (Seek attendant assistance).
- 2) Unplug router from power strip.
- 3) Adjust height of bit or depth of fence so no more than 1/8" in depth or width will be removed per pass.
- 4) Turn on router.
- 5) Hold material steady against fence or bearing and begin feeding material from right to left. reposition hands and fingers as necessary.
- 6) Repeat step 4-6 as many times as needed until desired width or depth of cut is obtained.

## Horizontal Boring Machines



Big Horizontal Boring Machine



Small Horizontal Boring Machine

## Big Horizontal Boring Machine

The Big Horizontal Boring Machine can be used for drilling holes horizontally in wood material. With some degree of care it can also be used for milling slot mortises in wood material.

### Safety

- **Eye protection is required when using this machine.**
- **Do not talk with observers while operating this machine.**
- **Restrain back loose clothes. Roll up sleeves.**
- **Tie back long hair.**
- Use the right spindle to mill slot mortises.
- Use the left spindle to drill holes.
- Use only one spindle at a time. Remove bit from spindle not being used.
- Do not force material into bits.

### Procedure for drilling holes

- 1) Material should sit flatly on work surface.
- 2) Screw drill bit in left spindle
- 3) Ask shop attendant to engage spindle to gearwheel.
- 4) Turn machine on.
- 5) With moderate pressure push material into drill bit.
- 6) Oil moving parts every 15 minutes. Seek attendant for help with this.
- 7) Take small "bites" remove material from bit to clear debris.
- 8) If drilling through hole keep fingers clear of exit hole area on backside of material.
- 9) Remove material and turn off machine when finished.
- 10) Clean up machine and surrounding area.

### Procedure for milling slot mortise

- 1) Material should sit flatly on work surface.
- 2) Select desired bit size.
- 3) Insert bit into right spindle. And screw down set screw.
- 4) Turn on machine.
- 5) Slowly move material into bit and move material back and forth along bit.
- 6) Take very light passes. No more than 1/32" at a pass.
- 7) Try to stay perpendicular to axis of bit.
- 8) Continue steps 5 –7 until desired depth is reached.
- 9) Oil moving parts every 15 minutes. Seek attendant for help with this.
- 10) Turn off machine and clean up surrounding areas.

## Small Horizontal Boring Machine

The small Horizontal Boring Machine can be used for drilling holes horizontally in wood material. With some degree of care it can also be used for milling slot mortises in wood material.

### Safety

- **Eye protection is required when using this machine.**
- **Do not talk with observers while operating this machine.**
- **Restrain back loose clothes. Roll up sleeves.**
- **Tie back long hair.**
- Do not force material into bits.
- Keep fingers back from bit and direction of feed.

### Procedure for drilling holes

- 1) Material should sit flatly on work surface.
- 2) Insert bit in spindle.
- 3) Turn machine on.
- 4) With moderate pressure push material into drill bit.
- 5) Take small "bites" remove material from bit to clear debris.
- 6) If drilling through hole keep fingers clear of exit hole area on backside of material.
- 7) Remove material and turn off machine when finished.
- 8) Clean up machine and surrounding area.

### Procedure for milling slot mortise

- 1) Material should sit flatly on work surface.
- 2) Select desired bit size.
- 3) Turn on machine.
- 4) Slowly move material into bit and move material back and forth along bit.
- 5) Take very light passes. No more than 1/32" / pass.
- 6) Try to stay perpendicular to axis of bit.
- 7) Continue steps 5 –7 until desired depth is reached.
- 8) Turn off machine and clean up surrounding areas.

## Metal Working Machines

14" Bandsaw

24" Metal Shear

12" Straight Sheet Metal Brake

48" Magnabend Metal Brake

1" Belt Grinder

Buffing Wheel

Bench Grinder

4 1/2" Grinder

1/4" Electric Die Grinder

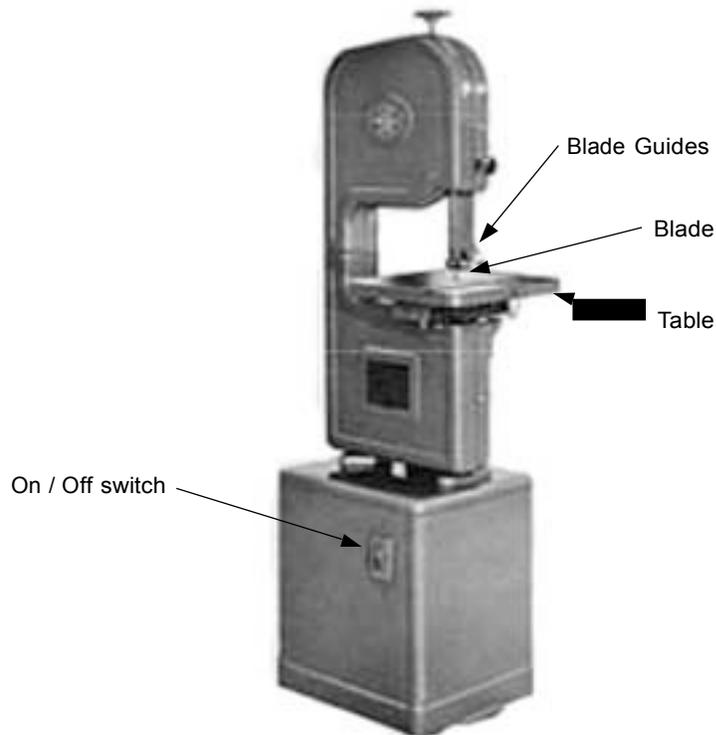
Cut Off Saw

Power Shear

Mig Welder

Oxygen – Acetylene Welder





## 14" Metal Band Saw

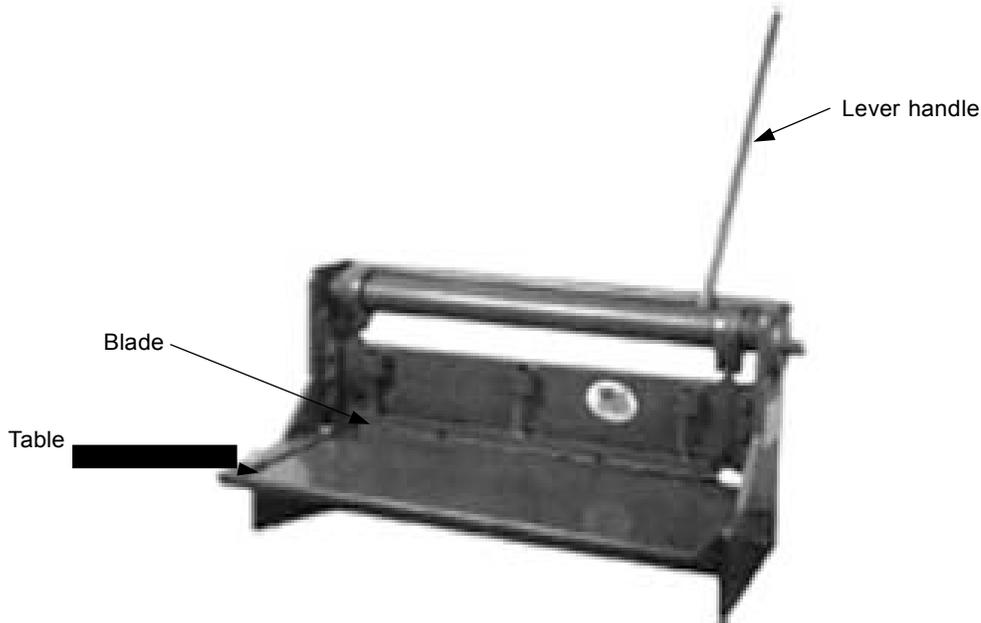
The 14" Metal Band Saw is specially designed to cut metals up to 1/4" thick with the exception of stainless or tempered steel. It can be used to make straight line cuts as well as curved cuts.

### Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- **This band saw is for use in cutting metal only absolutely no wood cutting.**
- Make all saw adjustments with power off.
- Make sure material is not touching blade when turning power on.
- Avoid letting saw guides drop on the work piece.
- Metal waste may have sharp edges, use hand brush to sweep away debris.
- Keep hands and fingers at least 2" away from blade and line of cut.
- Allow saw to reach full speed before beginning cut.
- Material should be flat and contact table completely.
- Do not force material into blade.
- Avoid backing out of cuts when possible.
- Do not make turns too tight – listen for blade twisting.
- If "clicking" noise is heard, **SHUT OFF POWER – BLADE MAY BE DAMAGED.**
- Operate machine from front side (side with doors). Avoid standing to side of machine.
- Ask for help when cutting long or wide or difficult to handle pieces.

## Procedures for sawing metal on 14" metal band saw

- 1) Inspect material. It should be flat and free of debris (dirt, nails, screws, etc.)
- 2) **Check blade pitch. Use appropriate blade for material type and thickness(ask shop attendant).**
- 3) For straight cuts set up fence (see attendant for assistance).
- 4) Turn on saw. Machine should run smoothly with a consistent buzz. Report strange noises to shop attendant.
- 5) **Use cutting lubricant to lubricate blade.**
- 6) Feed material while standing directly in front of blade. Avoid standing to side of blade.
- 7) Near the end of cut reposition hands as necessary to avoid injury.
- 8) If you need to pull material out of blade do so with caution. If blade gets stuck in saw kerf and pulls out of guides turn off machine and seek help from shop attendant.



## 24" Sheet Metal Shear

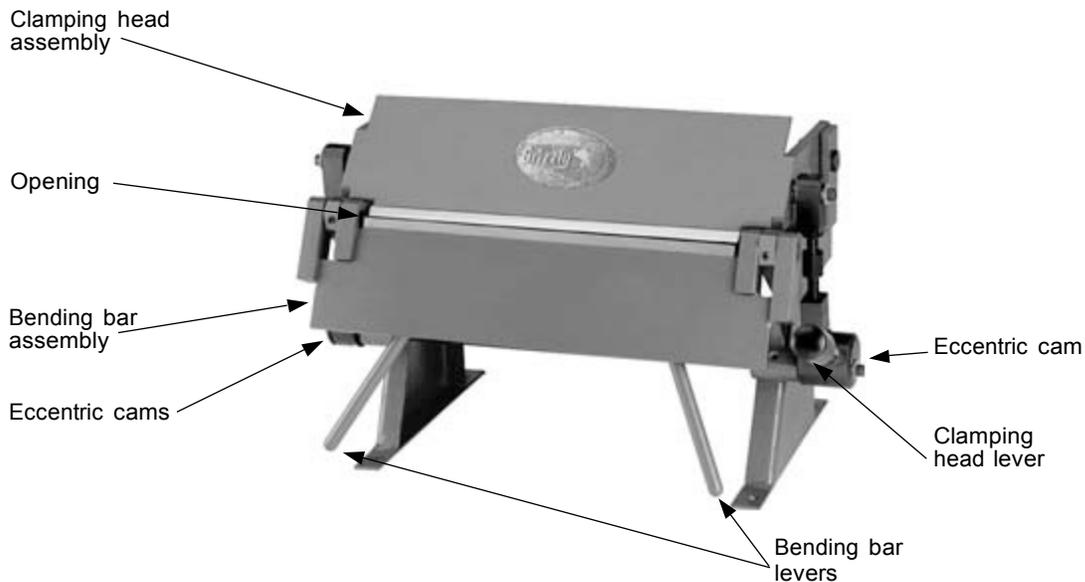
The 24" Sheet Metal Shear can be used to cut sheet type metals up to 24" wide. It can cut steel up to 1/32" thick and aluminum or copper up to 1/16" thick.

### Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- **Do not attempt to cut stainless steel or tempered steel with this machine.**
- **Do not cut wire or metal rod with this machine.**
- Keep fingers back at least 1 1/2" from blade.
- Be careful of metal edges. They can cut.

### Procedure for cutting sheet metal

- 1) Be sure material is not stainless steel or tempered steel. Ask Shop attendant for help with magnet test if not sure.
- 2) Place material on work surface and line up with straight edge on right side of table.
- 3) Slide material under blade until desired amount of material to be removed is in line with table edge.
- 4) Hold material firmly in position with left hand
- 5) Pull down on shear lever handle with right hand to complete cut
- 6) Raise lever to starting position.
- 7) Remove material. And clear away debris or scrap from backside of shear and place in appropriate recycling receptacle.



## 12" Straight Sheet Metal Brake

The 12" Straight Metal Brake can be used to bend sheet type metals up to 12" wide. It can bend 18 gauge steel, aluminum, copper up to a 120° angle.

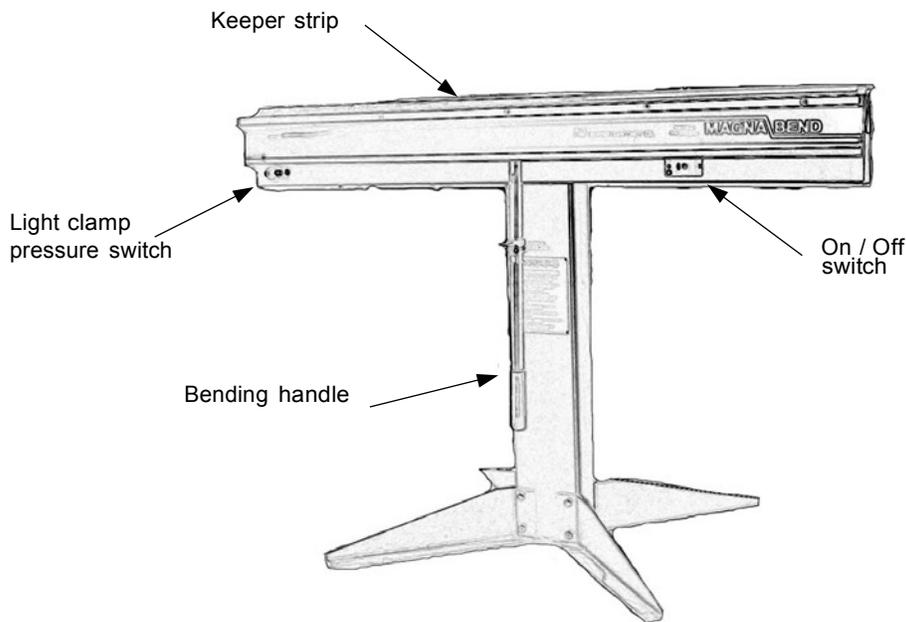
**Do not bend wire or metal rod with this machine.**

### Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- Do not attempt to bend stainless steel or tempered steel with this machine.
- Keep fingers away from moving parts when clamping or bending material.

### Procedure for bending sheet metal

- 1) Be sure material is not stainless steel or tempered steel. Ask Shop attendant for help with magnet test if not sure.
- 2) Mark location of bend on material.
- 3) Raise clamping head assembly and slide material underneath and into opening lower clamping head assembly slightly to lightly hold material in place and lineup mark with edge of clamping head assembly.
- 4) Adjust clamping head assembly for material thickness by turning eccentric cams clockwise or counterclockwise to tighten or loosen. (Get attendants assistance if needed).
- 5) Pull down on clamping head lever firmly to lock material into place.
- 6) Raise bending bar levers until desired bend is achieved.
- 7) Raise clamping head lever and remove material.



## 48" Magnabend Sheet Metal Brake

The 48" Magnabend Sheet Metal Brake is a unique and versatile tool for bending complex shapes in sheet metal up to 18 gauge thick. In lieu of the traditional bulkhead used to clamp and hold the material in place the Magnabend Brake utilizes a thin profile keeper strip and an electromagnet to clamp material in place while performing bending procedures. In addition the capabilities of the electromagnet allow the user to improvise an array ordinary metal shapes that may be used as forms.

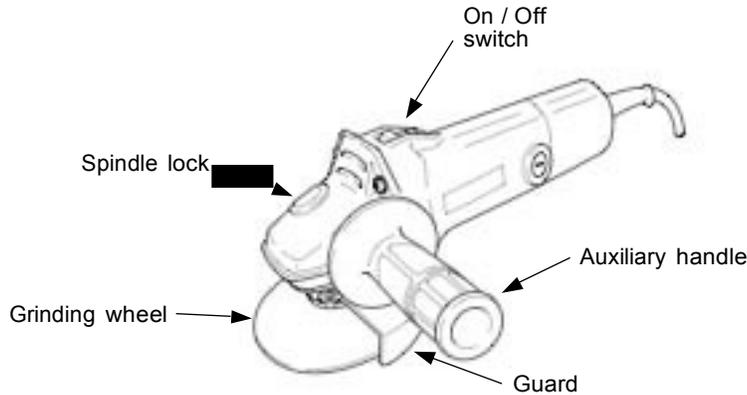
### Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- **Do not operate machine with wet hands or wet material.**
- Do not attempt to bend stainless steel or tempered steel with this machine
- Keep fingers away from moving parts when clamping or bending material.

**Do not bend metal wire or rod with this machine.**

### Procedure for bending sheet metal

- 1) Be sure material is not stainless steel or tempered steel. Ask Shop attendant for help with magnet test if not sure.
- 2) Mark location of bend on material.
- 3) Adjust keeper strip for material thickness.
- 4) Slide material under keeper and position mark on material with edge of keeper strip.
- 5) Activate light clamp pressure feature by pressing red button switch while holding material in place.
- 6) While continuing to press on switch pull up on bending handle until an electric "buzz" can be heard, at this point release the button switch and continue bending.
- 7) When desired bend is achieved lower bending bar to starting position and remove material.



## 4 1/2” Disc Grinder

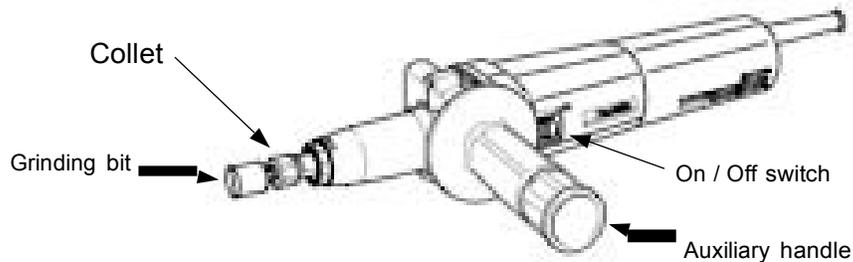
The 4 1/2” Disc Grinder can be used to grind various metals with the appropriate grinding disc. It can be used to grind welds or shape and texture various metal items.

### Safety

- **Eye protection is required at all times when using this tool.**
- **Stay focused on the tool and the work being performed.**
- **Restrain loose clothing, tie back long hair, remove or restrain loose jewelry.**
- **The use of a work apron is encouraged when using this tool.**
- **The use of a dust mask is encouraged when using this tool.**
- **The use of gloves is recommended when using this tool.**
- **Do not remove guard.**
  
- **This tool may only be used outside on the concrete work pad.**
  
- Grinding metal can generate sparks, wear appropriate clothing.
- Use appropriate grinding disc for work to be performed. Ask for assistance if you are not sure which disc to use.
- Wear gloves, metal edges can be sharp and can get hot with grinding.
- Position disc guard to appropriate position for work to be performed.
- Grind material using only the edge portion of disc.
- Do not force grinder into material. Use only enough pressure to control tool.
- Clean and sweep surrounding area when finished.

### Grinding procedure

- 1) Select appropriate disc for material.
- 2) Be sure material is securely fastened or restrained before proceeding.
- 3) Turn on grinder by pushing forward on switch, and then downward to lock switch in on position.
- 4) With a firm grip and light pressure slowly introduce grinding wheel to material.
- 5) Only edge portion of grinding wheel should contact material.
- 6) Keep grinder moving, back and forth or side-side.
- 7) Stop periodically, turn off grinder and check work.



## 1/4” Electric Die Grinder

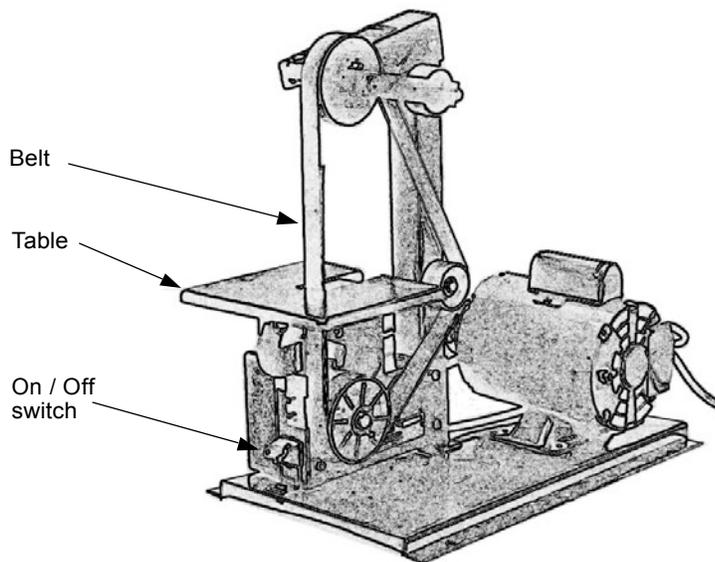
The 1/4” Electric Die Grinder can be used to perform a large variety of small grinding operations. This is made possible with the large variety of grinding tips available. The shop has a limited variety of grinding attachments available other specialty accessories may be purchased from various merchants. Various materials may be ground or shaped when the appropriate accessory is used.

### Safety

- **Eye protection is required when using this tool.**
- **Stay focused on the tool and the work being performed.**
- **Restrain loose clothing, tie back long hair, remove or restrain loose jewelry.**
- **The use of a work apron is encouraged when using this tool.**
- **The use of a dust mask is encouraged when using this tool.**
- **Use tool outside if abrasive media on tool causes sparking.**
- See shop attendant for assistance when changing attachments.
- Use appropriate media for work to be performed. Ask for assistance if you are not sure what media to use.
- Start tool before making contact with material. Do not start tool on surface of material.
- Do not force tool into material. Allow abrasive media to lightly contact work.
- Clean surrounding area when finished.

### Grinding procedure

- 1) Select appropriate grinding bit for material.
- 2) Be sure material is securely fastened or restrained before proceeding.
- 3) Turn on grinder by pushing forward on switch and then downward to lock switch in on position.
- 4) Introduce grinding wheel to material.
- 5) Allow bit to lightly contact material, do not push bit into material.
- 6) Keep grinder moving, back and forth or side-side.
- 7) Stop periodically, turn off grinder and check work.



## 1" Belt Grinder

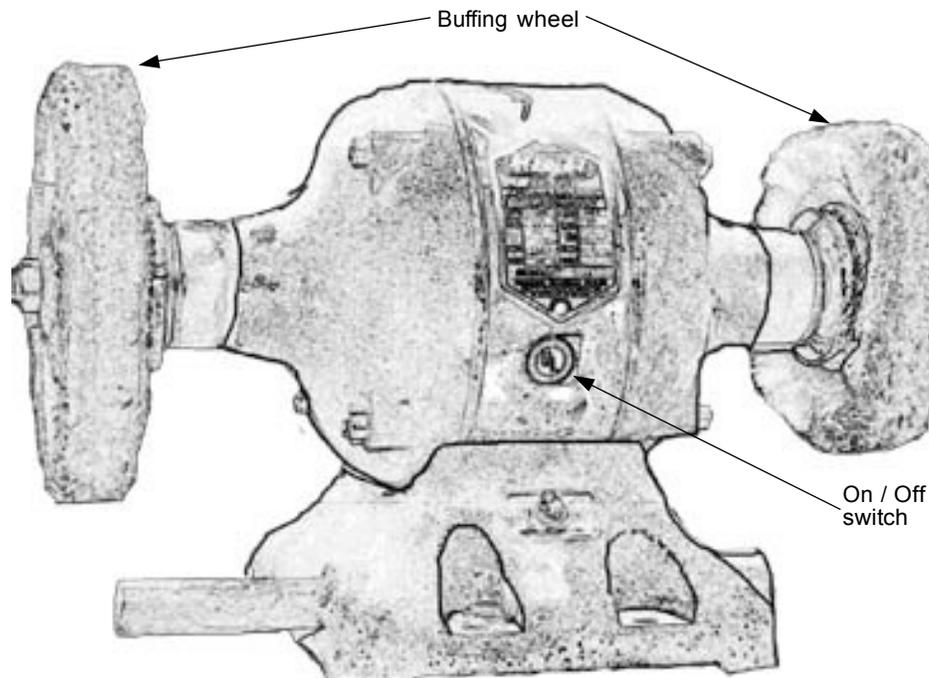
The 1" Belt Grinder is ideal for finishing metal edges cut by the hacksaw or band saw. It can be used to shape most types of bar stock and smaller pieces of sheet stock greater than 1/8" thick.

### Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the tool and the work being performed.**
- **Do not grind Aluminum, plastic or wood on this machine.**
- Tie back long hair
- Restrain loose clothing and roll up sleeves
- Any nearby rags or containers of flammable liquids should be moved away.
- Never angle material being ground downwards.
- Do not grind aluminum on this machine.

### Procedure for grinding

- 1) Place material flat on tool rest and away from belt.
- 2) Turn machine on.
- 3) Slowly move material into belt.
- 4) Material should contact belt squarely
- 5) Move material back and forth along width of belt.
- 6) If material starts to feel warm remove it from belt for a brief time and allow it to cool off. Then proceed as before. It may help to have a cup of water on hand to dip material in. Be sure to dry off material before resuming. Avoid getting the tool rest wet.
- 7) Turn off machine when finished clean up the machine and surrounding area.



## Buffing Wheel

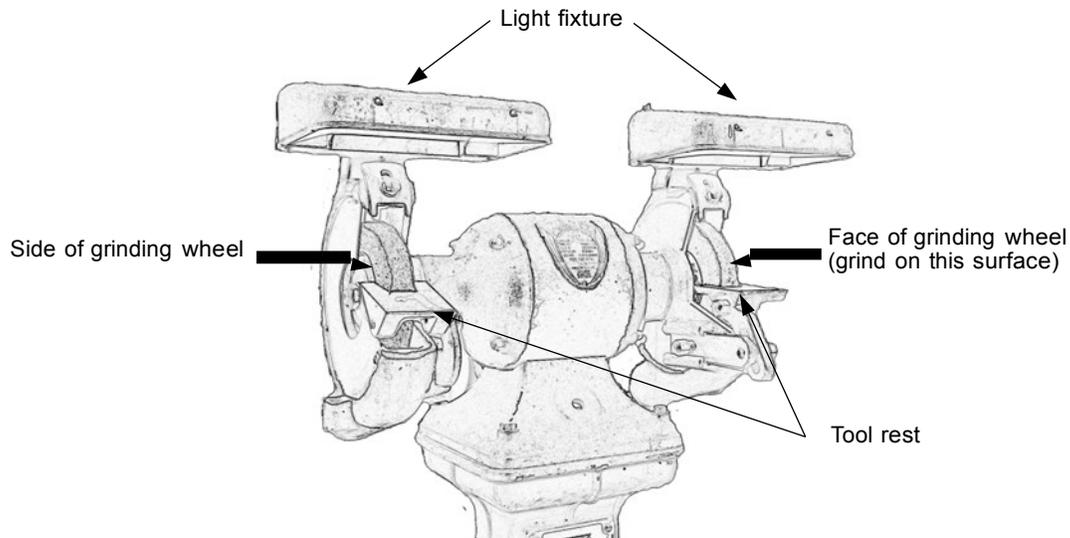
The buffing wheel can be used to hone edge tools and to polish metal and polish the edges of "Plexiglass" or other plastics.

## Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- Use front edge of buffing wheel.
- **Do not use side of wheel.**
- Do not point material directly into wheel.
- Always use the bottom portion of the wheel for polishing work.
- Do not force material into wheel. Allow material to "graze" the edge of wheel.
- Do not stand in line with wheel. Always stand off to the side of wheel.
- Use buffing compound sparingly.

## Procedure for polishing

- 1) Turn on machine
- 2) Hold the material firmly and angle it downwards
- 3) With material still angled downwards move it into the portion of wheel below centerline.
- 4) Move and rotate material in wheel always using bottom portion of wheel.
- 5) Check material frequently to monitor progress.
- 6) When desired level of polish is achieved turn off machine and clean up the surrounding area.



## Bench Grinder

The Bench Grinder can be used to grind ferrous metals, only mild steel and hard steel. tempered steel and stainless steel. It can be used to sharpen an edge, shape or finish a rough end on a sawn piece of material. The bench grinder has two grinding wheels that allow for grinding a coarse finish on the material or smooth finish.

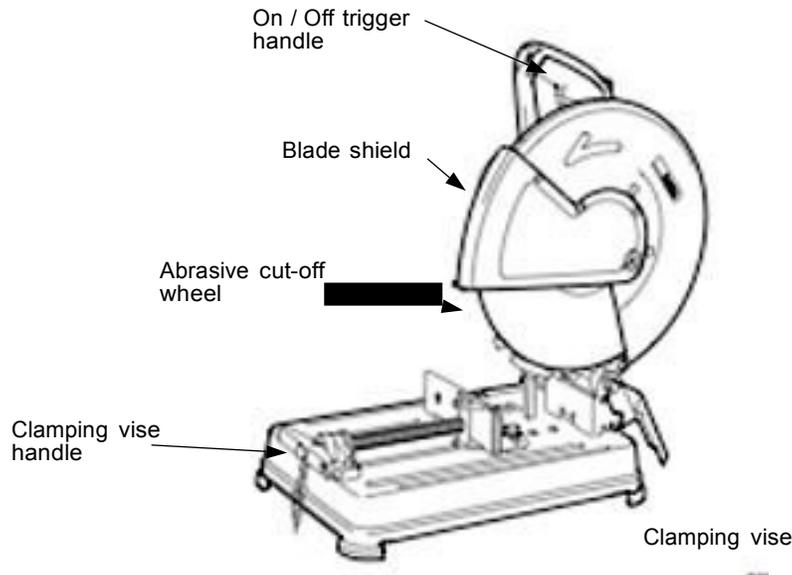
### Safety

- **Eye protection is required when using this machine.**
- **Stay focused on the machine and the work being performed.**
- **Restrain loose clothing and tie back long hair.**
- **Never angle material downwards below horizontal axis of wheel center.**
- **Never use the side of the wheel as a grinding surface.** Grind material using only the face of the wheel (surface facing tool rest).
- Wear gloves. Grinding creates sharp edges and hot surfaces.
- Grinding metal can generate sparring, where protective clothing.
- Have cooling container of water close by.
- Tool rest should always be angled upwards and material should rest flat on tool rest.
- Keep material moving along grinding wheel in a side-to-side motion.

**Do not grind aluminum, copper, brass or other non-ferrous metal on grinder.**

### Grinding procedure

- 1) Start machine.
- 2) Place material on tool rest. Be sure it is angled upwards above centerline and rests flat and firmly on surface.
- 3) Slowly push material into grinding wheel face until material grazes grinding wheel face. Do not force material into grinding wheel.
- 4) Move material from side to side. Checking periodically for results and cooling in water as necessary.
- 5) Turn off machine when finished and clean surrounding area.



## Metal Cut-Off Saw

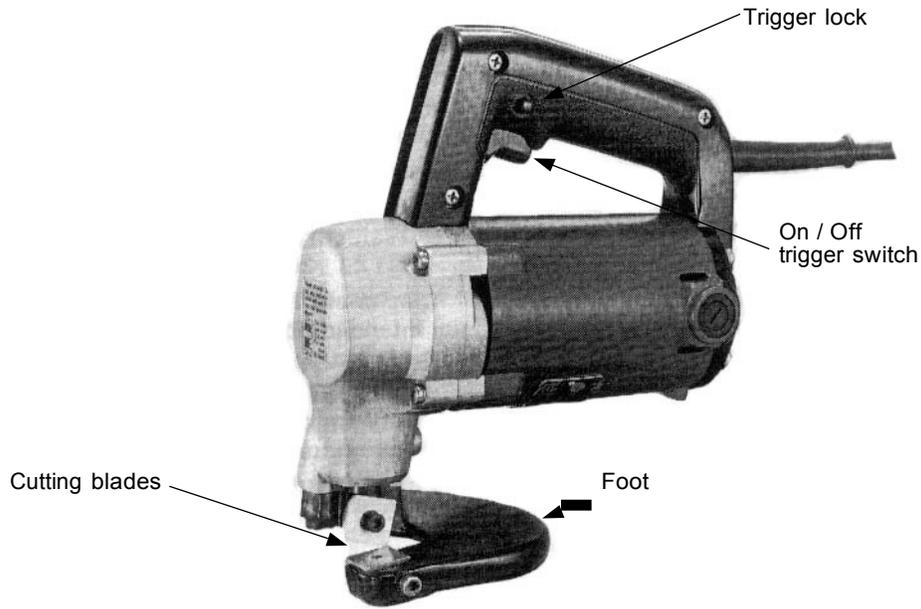
The metal cut off saw can be used for cutting structural steel shapes to length. It can cut material up to 3/8" thick x 4 1/2" tall.

### Safety

- **Eye protection is required when using this tool.**
- **Stay focused on the machine and the work being performed.**
- **Use of a dust mask is encouraged with this machine.**
- **The use of hearing protection is encouraged when using this machine.**
- **Restrain loose clothing.**
- **Tie back long hair.**
- **Use of a dust mask is required with this machine.**
- Wear gloves, the metal is sharp and can get hot.
- Cutting metal can generate sparking. Wear protective clothing.
- Never use the side of the wheel as a grinding surface.
- Clean area when finished.
- **All metal sawing with this tool is to be performed outdoors, No exceptions.**

### Procedure for cutting metal with Metal Cut-Off Saw

- 1) Position material to be cut below blade.
- 2) Without turning on saw line up blade with line of cut.
- 3) Securely clamp material in to vise.
- 4) Engage trigger to start saw.
- 5) Slowly lower blade in to material.
- 6) Do not force blade through material. Feed blade only as much material as it will take without slowing motor down.
- 7) When cut is finished raise saw lever and wait for blade to stop. Remove material and clean up surrounding area.



## Power Shear

The Power shear can cut sheet metals up to 10 gauge thickness. Use it for cutting all sheet metals with the exception of hardened steel and stainless steel.

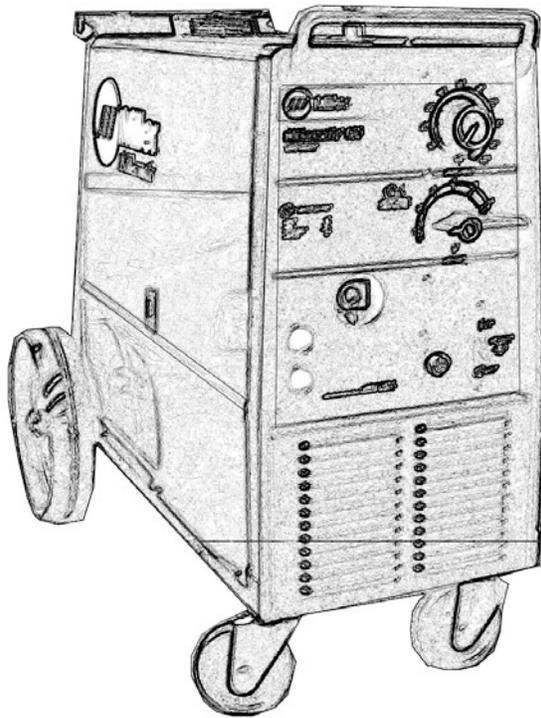
### Safety

- **Eye protection is required when using this tool.**
- **Stay focused on the tool and the work being performed.**
- Cutting metal can be hazardous watch out for edges and wear protective clothing and gloves.
- Clean area when finished.
- **Do not attempt to cut stainless steel or tempered steel with this tool.**

**Do not cut wire or metal rod with this tool.**

### Procedure for using Power Shear

- 1) Adjust blades for material thickness (Ask shop attendant for assistance).
- 2) Securely clamp and support material along line of cut.
- 3) Line up cutting blades with cut line.
- 4) Pull trigger handle and feed power shear into material. Follow cut line. allow foot of power shear to support area immediately in front and behind tool.
- 5) Stop and readjust clamps and supports as necessary.
- 6) When end of cut approaches support waste side of cut as needed watch for sharp edges of metal.



**Use of Mig Welder is restricted to those that have completed a training seminar in welding conducted twice a semester or by special arrangement.**

## Mig Welder

The Mig Welder can be used to fuse various metals together.

### Safety

- **Eye protection is required when using this machine.**
- **Do not talk with observers while operating this machine.**
- Special eye protection is required while welding (provided).
- Gloves are required at all times (provided).
- Protective clothing (what should be worn while operating this machine):
  - Long sleeves
  - Long pants
  - Leather shoes
  - Leather apron
- Be sure to connect ground to material being welded.
- **All welding is to be performed outdoors.**
- **Slab must be dry and there must be no visible threat of rain.**
- Set up and proceed as per instructions in Welding Safety Class.

**Use of Oxygen – Acetylene Welder is restricted to those that have completed a training seminar in welding conducted twice a semester or by special arrangement.**



## Oxygen – Acetylene Welder

The Oxygen – Acetylene Welder bonds metal together with high heat and a filler material. It can be used to bond steel and brass. It can also be used to cut material up to 3/8" thick. And melt many types of metal alloys. The gas tanks are under high pressure so extreme caution should be taken when handling this equipment.

### Safety

- **Eye protection is required when using this tool.**
- **Do not talk with observers while operating this machine.**
- **No smoking near equipment.**
- Always wear subdued safety visor and gloves.
- Select proper tip and pressure for the job.
- Never allow line pressure to go above 5 PSI on acetylene tank.
- Make sure you turn off both needle valves on handle when finished.
- Make sure you turn off cylinder valves when finished.
- Clamp stock to bench while overhanging the cut line.
- Never remove cylinders from cart. Always ask for assistance.
- Do not apply flame to pressurized cylinders.
- When opening cylinder valves, stand away from regulators.
- Open cylinder valves slowly on oxygen.
- Keep hoses from coming into contact with open flame.
- Always keep torch in your line of vision.
- Never hand a lit torch to another person.
- **All welding is to be performed outdoors.**
- **Slab must be dry and there must be no visible threat of rain.**

# Workshop User Safety Agreement

The undersigned has been through a basic shop orientation and has had basic shop safety and procedures explained to him / her and agrees to the following:

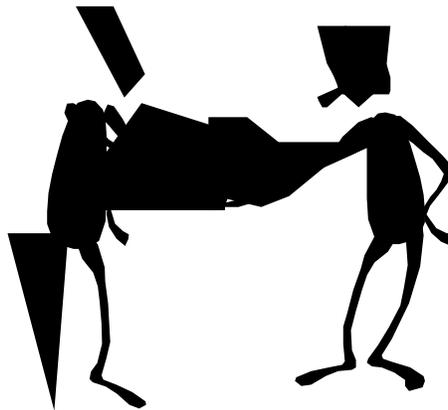
- Successfully completed a basic shop orientation.
- Had shop policies and procedures explained to him / her.
- Received demonstrations on all basic major machines.
- Been instructed to ask for help on any machine with which he/she is not familiar. And will not operate any machine without further instruction.
- Will be responsible for wearing eye protection at all times in the shop facilities.

Name \_\_\_\_\_

Class (FR, Soph., Jr., Sr., M. Arch I, II, III)

Signed \_\_\_\_\_ Date\_\_\_\_\_

\_\_\_\_\_  
Ted Wong (Shop Director)



# Workshop User Safety Agreement (Student Copy)

The undersigned has been through a basic shop orientation and has had basic shop safety and procedures explained to him / her and agrees to the following:

- Successfully completed a basic shop orientation.
- Had shop policies and procedures explained to him / her.
- Received demonstrations on all basic major machines.
- Been instructed to ask for help on any machine with which he/she is not familiar. And will not operate any machine without further instruction.
- Will be responsible for wearing eye protection at all times in the shop facilities.

Name \_\_\_\_\_

Class (FR, Soph., Jr., Sr., M. Arch I, II, III)

Signed \_\_\_\_\_

Date\_\_\_\_\_

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Ted Wong (Shop Director)