



## CLASS NOTES

# Metal 101: Introduction to Metalworking

### CLEARANCES

Bench Grinders  
Chop Saw (Metal)  
Disk Grinder  
Drill Press (Metal)  
Metal Grinder Dust Collection  
Vertical Band Saw (Metal)



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# Welcome

Welcome to the Introduction to Metalworking class at Protohaven!

## Shop Rules

### Be Safe

- Get safety clearances
- Wear protective equipment
- Watch and reset equipment after use
- Never use equipment that is red-tagged

### Take Care of Each Other

- Be aware of your surroundings
- Don't use a tool if it poses a danger to someone else

### Take Care of the Tools

- Get tool clearances
- Do not alter or use equipment beyond limits
- Notify staff when maintenance is needed

### Keep the Shop Clean

- Clean up after yourself
- Return tools to their original locations

## Tool Status Tags

Every tool at Protohaven has a status to let you know if the tool is safe to use.

If the tool status is *green*, the tool is safe to use. All features should be expected to work, and no extra care should need to be taken while using the tool.

If the tool status is *yellow*, the tool may still be used, but with extra caution. The information on the physical tag or in the online maintenance history will indicate what special care needs to be taken while using the tool. If the physical tag and the maintenance log disagree, alert a tech.



If the tool status is *red*: **DO NOT USE THE TOOL**. The tool is not safe to use. The information on the physical tag or in the online maintenance history will indicate what fixes are pending, and when a repair is expected.



Some tools in the shop are explicitly green tagged to let you know they are working. Other tools in the shop are not explicitly green tagged when they are working to reduce sign fatigue.

If you are in doubt about the status of a tool with no visible tag, check the tool status by following the link in the QR code attached to the tool, or check the Protohaven website for the tool status page:

<https://www.protohaven.org/equipment/>

## **Filing a Tool Report**

If you are using a tool, and the tool becomes unsafe, damaged, or is not working properly, you must notify a tech. The tech may instruct you to submit a tool report:

<https://airtable.com/appbIl0RlmbIxNU1L/shrluff2WSzy8c3xd>

Notifying the tech will help us keep signage up to date, and make sure the users who come in after you have all the information they need to use the tool safely, even if they don't use discord.

# Metalworking Safety

Do not work in the metal shop wearing anything that could end up pulling you into a machine. Do not wear:

- Long hair
- Loose sleeves
- Loose clothing
- Gloves

Do wear:

- safety glasses
- hearing protection (especially when grinding)

If you feel unsure of something, feel free to ask!

# Introduction

## Learning Objectives

### Terminology

<b>swarf</b>	Chips and dust carried away from the workpiece by the saw blade during the cut.
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# Tools

## Metal Chop Saw

The metal chop saw is a power tool suited for making cuts through thin stock: square rod, round rod, angle iron, or square tube.

The metal chop saw can be very dangerous: make sure you have a good understanding of how to operate this tool, and be very careful using this tool.

### Notes

#### Safety

##### **Safety Warning!**

**No freehand cuts.** Freehand cutting is a major cause of accidents and should not be attempted.

Be mindful of the area to the right of the metal chop saw; waste pieces may be violently thrown in that direction after a cut is complete. If another shop member is using the metal drill press, vertical metal band saw, or any of the grinders, wait until they have finished before making a cut.

Do not make cuts that produce waste pieces smaller than 8mm (5/16") in length. The waste piece must be 8mm (5/16") or greater to avoid the piece falling through the blade slot and causing any potential danger.

Don't use the metal chop saw for 45° angle cuts. Use this saw for cuts at 90°.

When making a cut, only let the blade approach the workpiece from the back or from the top. Do not let the workpiece touch the back part of the blade where the teeth are traveling upward: the teeth may pull the workpiece up and out of the vise.

The metal chop saw is not bolted down.

Unplug the saw while performing any maintenance.

#### Use

If you see several chipped teeth in a row during the blade inspection step, the blade needs to be replaced: please inform a tech on duty.

Apply gentle pressure during a cut. Use enough pressure to take light chips or shavings with the cutting heads. Applying insufficient pressure will prevent chip formation, cut poorly and dull the blade. Applying excess pressure will not make the machine perform any better, and will reduce the lifetime of the motor and the blade.

## Parts of the Metal Chop Saw

### Full View

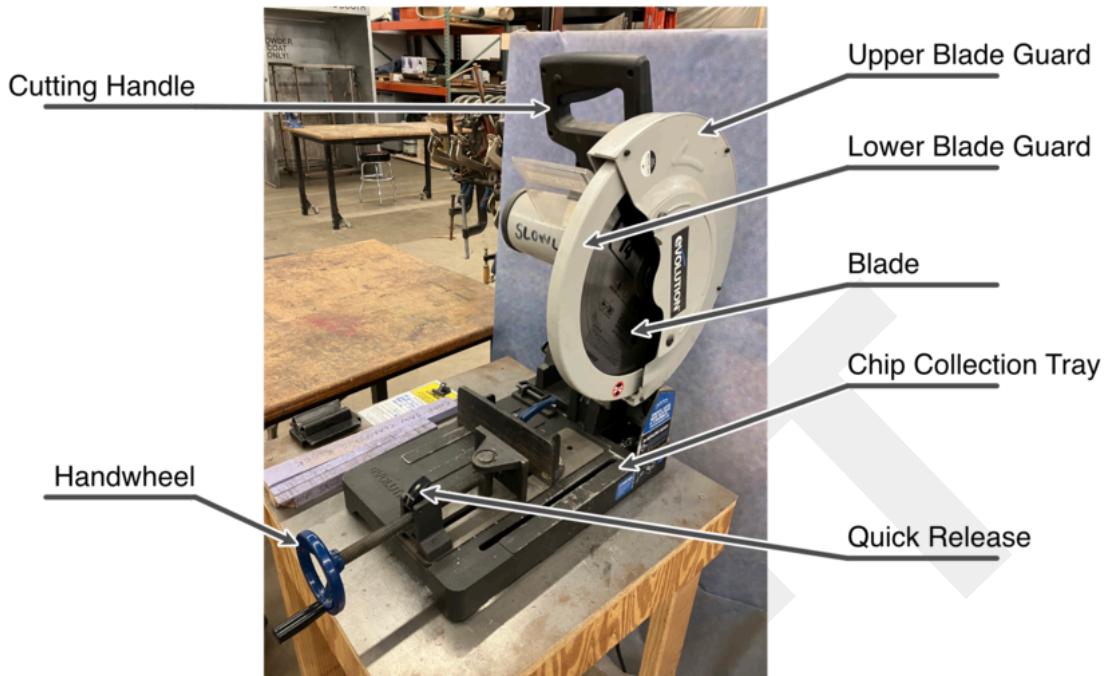


Figure 1: An annotated full view of the metal chop saw.

### Table View

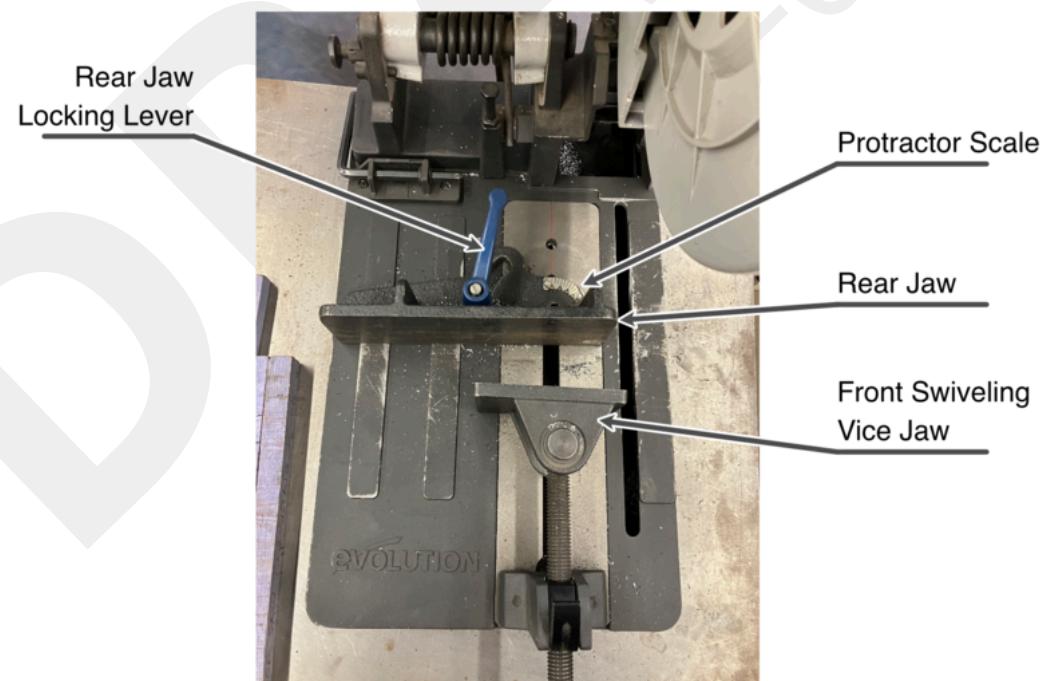


Figure 2: An annotated full view of the metal chop saw table.

### Lower Blade Guard

The lower blade guard will automatically retract as the saw is lowered into the cut, and then automatically cover the blade as the saw is lifted from the cut.

Do not hold the lower blade guard open.

### **Upper Blade Guard**

The upper blade guard is fixed in position to cover the top half of the blade at all times when in use.

### **Handwheel**

The handwheel tightens or loosens the vice jaws.

### **Quick Release Mechanism**

The quick release mechanism releases the clamping screw on the front vice jaw, so that the front swiveling jive jaw can be quickly adjusted.

Lift the blue handle to slide the front vice jaw away from or into the workpiece. Always replace the quick release mechanism before using the saw to make sure proper clamping force is being applied to the workpiece.

### **Front Swiveling Vice Jaw**

The front vise jaw can swivel to accommodate miter cuts. Miter cuts are prohibited on this tool: the abrasive chop saw in the blacksmithing area should be used instead.

Always make sure the front vice jaw has stable and full contact with the workpiece; see [Workholding](#) for more information about workholding with this tool.

### **Repositionable Rear Vice Jaw**

The rear vise jaw can be locked into an angled position to accommodate miter cuts. Miter cuts are prohibited on this tool: the abrasive chop saw in the blacksmithing area should be used instead.

Always make sure the rear vice jaw has stable and full contact with the workpiece; see [Workholding](#) for more information about workholding with this tool.

### **Cutting Handle**

Use the cutting handle to lower the cutting head into the work piece.

Only use the cutting handle with your right hand.

### **Rear Vice Jaw Locking Lever**

The rear vice jaw locking lever locks the rear vice jaw into place.

### **Protractor Scale**

Use the protractor scale to align the rear vice jaw to an angle when making miter cuts.

Miter cuts are prohibited on this tool: the abrasive chop saw in the blacksmithing area should be used instead.

### **On/Off Trigger Switch**

The on/off switch has two parts: the safety lock and the trigger switch. The safety lock is the button under the thumb when gripping the handle, and must be pressed to turn on the saw. The trigger switch is on the inside of the handle.

To turn on the motor, depress the safety lock, then squeeze the trigger switch.

### Chip Collection Tray

The chip collection tray catches chips and dust that are ejected downward out of the cut.

Check the chip collection tray for any previously cut material that extends into the cutting area, and might interfere with a cut. Clear out any interfering material before making a cut.

## Basic Operation

### Workholding

- Clear the machine of swarf and dust before clamping the workpiece.
- Make sure the workplace is secure.
- Make sure the workpiece doesn't rock in the clamp.
- Make sure the workpiece is in full contact with the table.  
*If the piece drops during the cut, it could rotate and pinch the blade.*
- Make sure the front is tight.
- Make sure the back jaw is set and clamped.

Check that **both** ends of the workpiece are secure in the vise. Pieces too short to be fully secured in the vise cannot be safely clamped, and should not be used with this saw.

Secure the part so the blade catches it on the down or through swing, not on the upswing.

TODO: image of this

Bring the unpowered saw blade down on the workpiece to check position of the cut:

- Make sure the cut is positioned where you want it on the workpiece.
- Make sure the waste piece is at least 8mm (5/16") in length.

Secure the part so the blade catches it on the down or through swing, not on the upswing.

### Setting Up

Inspect the entire blade for chipped teeth.

Clean the clamps and table before securing the workpiece. Make sure the clamping area is free of swarf and dust, and nothing will get on the clamping surfaces that may cause the workpiece to loosen or shift.

Ensure that the cut-off portion of the workpiece is free to move away from the blade at the end of the cut. Be very careful to make sure that the waste piece will not get jammed in the clamping area, against the blade, or in any other part of the machine.

Ensure that the workpiece is held securely in the vise. (see [Workholding](#))

Check to make sure no one is nearby who could get hit by a flying waste piece.

### Making a Cut

1. Plug in the machine.

*Do NOT put the electrical box on the table of the drill press.*

2. **Only use the right hand to operate the saw.**

*Keep your body away from cut, and out of the path of any flying debris.*

3. With the saw in a fully upright position, turn on the motor and let the blade come up to full speed.

4. Gently lower the saw blade toward the workpiece. Go slowly!

5. Gradually increase the pressure as the saw blade enters the workpiece.

*Do not force the saw blade into the workpiece. Let the saw blade do the work.*

6. Adjust the cutting pressure to suit the material.

*Use the least amount of pressure needed to make the cut. Use more pressure to move the blade through thicker parts of the workpiece, less pressure to move the blade through thinner parts of the workpiece.*

7. Reduce pressure as the blade begins to exit the material.

8. Turn off the motor.

9. Upon completion of the cut, allow the saw blade assembly to rise completely into its upper position.

10. Do not remove your hands or the workpiece from the tool until the blade has come to a complete stop and the blade is completely covered by the blade guard.

### Cleaning Up

- Use chip brushes and dust pans to clean up any swarf and dust.
- Pick up any waste pieces.
- Unplug the saw, and stow the power cable.

## Metal Drill Press

### Notes

#### Safety

Keep workpiece firmly attached to the table at all times. If the workpiece becomes loose, it may lift up and begin to spin on the drill bit, creating a very dangerous cutting hazard.

#### Use

Drilling produces a lot of heat, and it's easy to overheat a drill bit when cutting for an extended period in a hard material. Go slowly, take frequent breaks, and use a good cutting oil to help cool the work and improve the cut.

#### Consumables

The are shop-use drill bits available in the shop cart by the metal band saw, and there is a drill bit set available for checkout at the front desk. If you need a particular bit size, or want to be sure you have sharp drills, you should invest in your own drill bit set.

## Parts of the Metal Drill Press

## Full View

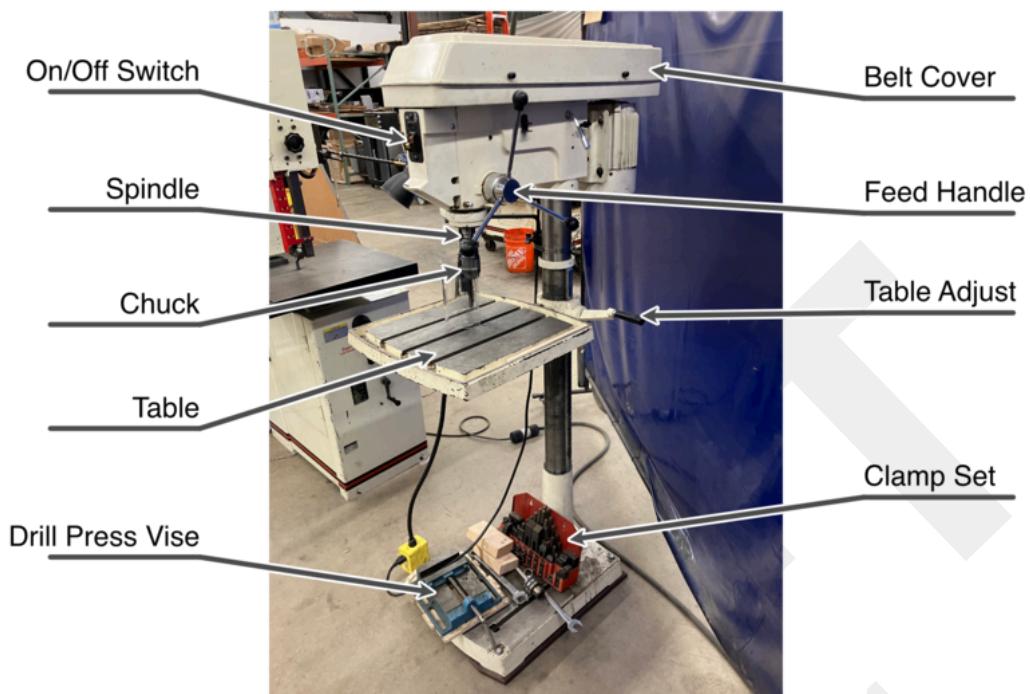


Figure 3: An annotated full view of the metal drill press.

## Belt Drive



Figure 4: An annotated view of the belt drive system.

## On/Off Switch

Put the switch into the **on** position to turn on the drill.

Put the switch into the **off** position to turn off the drill.

## Chuck

The chuck holds the drill bit in the spindle.

The chuck uses a set of jaws, which tighten around the shaft of the bit. Always make sure that the bit is firmly held by all three jaws.

## **Depth Stop**

The depth stop limits the amount of downward travel for the spindle.

Set the depth stop to drill holes of a specific depth in a work piece.

## **Feed Handle**

The feed handle lowers the spindle towards the workpiece.

## **Spindle**

The spindle is driven by the motor to turn the chuck and the bit.

## **Table**

The table supports the workpiece. The workpiece can be clamped to the table with the clamp set, or with the drill press vise.

## **Table Adjust Clamp**

Use the table adjust clamp to reposition the table. With the table adjust clamp loose, the table can be swung from side to side or moved up and down the drill press post.

Always make sure the table adjust clamp is fully tight before drilling a workpiece.

## **Belt Cover**

At the top of the drill press, the belt cover contains the belt drive system. Make sure the belt cover is closed before turning on the drill press.

## **Motor Tension Lock Screw**

There are two motor tension lock screws on either side of the drill cabinet. Loosen both screws to free the motor and enable the motor tension release lever.

Make sure the motor tension lock screws are firmly tightened before running the drill press.

## **Motor Tension Release Lever**

The motor tension release lever pulls the motor into a slack position, so the drive belts can be repositioned.

Always make sure the drive belts are under tension before running the drill press.

## **Clamp Set**

At the base of the drill press is a clamp set for use with the drill press table. The clamp set offers various screws and clamping bars that can secure a workpiece to the table.

## **Drill Press Vise**

At the base of the drill press is a drill press vise, which can hold a workpiece for drilling. The drill press vise must be clamped to the table using the clamp set to securely hold the workpiece.

## **Basic Operation**

### **Setting Up**

Ready the work area:

1. Turn on the light.
2. Clear off table of tools.

Set the appropriate speed:

1. Open the top of the drill press.
2. Loosen the two motor slide lock screws.
3. Release the motor tension release lever.
4. Configure the belts for the appropriate cutting speed.
5. Set the motor tension release lever.
6. Tighten the two motor slide lock screws.
7. Close the top of the drill press.

Secure a bit in the chuck:

1. Close the jaws of the chuck all the way.
2. Open the jaws just enough to accept the bit.  
*This will help keep the bit centered in the chuck.*
3. Slide the bit up into the jaws of the chuck.
4. Tighten the chuck.

*The metal drill press has a keyless chuck; you do not need a chuck key. Tighten the chuck by hand.*

Briefly run the drill to make sure the bit is on axis.

*The bit should not wobble when the drill is running.*

If needed, set the depth stop to make sure the drill press stops cutting at a specific depth.

## Workholding

### Safety Warning!

Proper workholding is critical to the safe use of the metal drill press.

If the workpiece comes loose while the drill is running, the workpiece will rise up and begin to spin, becoming a very dangerous hazard for anyone nearby.

Always make sure that your workpiece is securely clamped to the table of the metal drill press.

**DO NOT drill into the table or vise.** Use sacrificial wood under the workpiece for through holes.)

There is a clamp set stored at the base of the metal drill press which can be used to secure the workpiece to the table.

The clamp set can also be used to secure the table vise.

## Drilling

1. Turn on the drill.

2. Pull the feed handle with a slow firm pressure to advance the bit through the workpiece.

*Using cutting oil is recommended to control the temperature of the cut, and help the drill bite into the material.*

3. Reduce feed pressure near the end of the cut.
4. Turn off the drill.

If you are making a deep hole in the workpiece, you may wish to complete the cut in several passes.

### Cleaning Up

1. Unclamp the workpiece from the table.
2. Clear off the table of tools and clamps.
3. Clean the table of swarf and wipe up any cutting fluid.
4. Turn off the light.

## Vertical Metal Band Saw

The vertical metal band saw can remove large amounts of material from a workpiece.

### Notes

#### Use

In general, use of the vertical metal bandsaw is limited to cutting either mild steel or aluminum. A comprehensive chart of permitted materials is inside the upper cabinet.

A good rule of thumb is to only cut material that is at least as thick as the height of three teeth on the saw blade. This will reduce the chances of a tooth catching the top edge of the workpiece too deeply. There are better methods for cutting thin materials (see the Sheetmetal classes for more).

#### Materials

This tool can be used to cut:

- mild steel
- aluminum
- brass

This tool must not be used to cut:

- Ordinary tool steel
- High speed steel
- Stainless steel

## Parts of the Vertical Metal Band Saw

### Front Quarter View

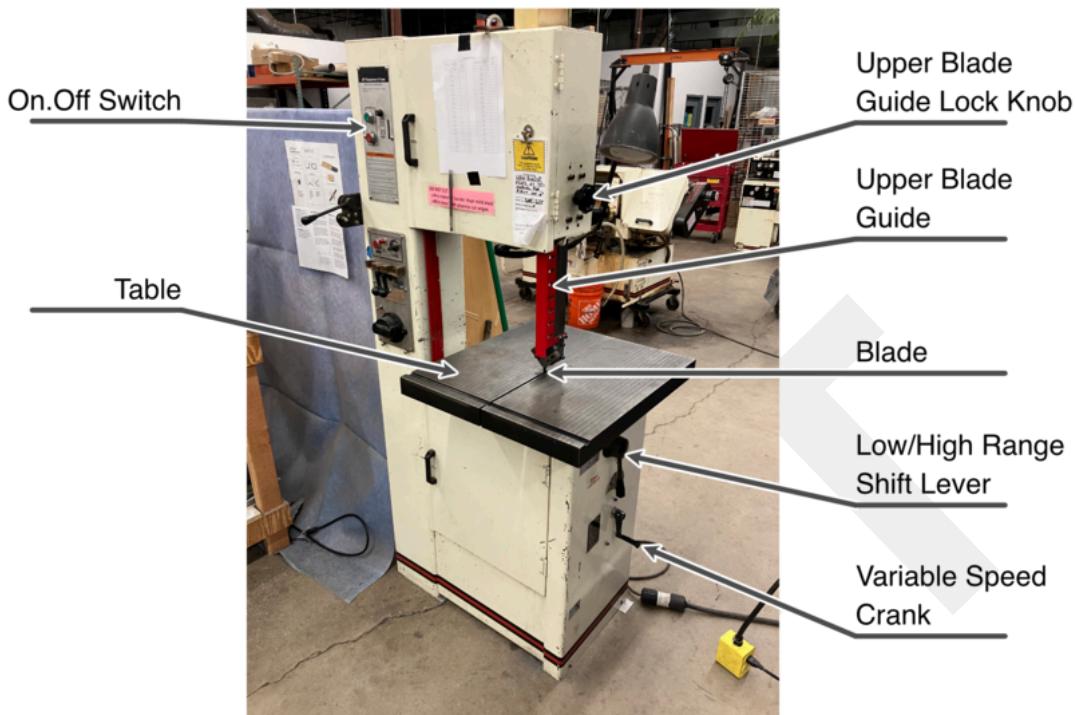


Figure 5: An annotated front quarter view of the vertical metal band saw.

### On/Off Switch

Press the **on** button to start the saw.

Press the **off** button to stop the saw.

### Low/High Range Shift Lever

The low/high range shift lever changes the gearing for cutting aluminum (low) and steel (high).

**Do not use this lever while the saw is running.** Turn off the saw before making any changes to the speed range.

### Variable Speed Crank

The variable speed crank adjusts the speed of the saw blade within the selected speed range.

**Do not turn this crank while the saw is stopped.** Only make speed adjustments when the blade is moving under power.

### Fence

Used the optional fence to register the workpiece a specific distance from the blade.

### Table Tilt

The table can be tilted to support angled cuts.



Figure 6: Annotated view of the vertical metal band saw table tilt mechanism.

To tilt the table left or right, loosen the two screws under the back of the table. Use the angle guide to set the necessary angle.

To tilt the table front to back, loosen the four screws under the right and left sides of the table.

Always re-tighten and screws under the table before making a cut.

### **Upper Blade Guide Lock Knob**

Use the upper blade guide lock knob to release or lock the upper blade guide during setup.

Use caution when releasing the blade guide: it is very heavy, and may cause injury or damage to the machine if not properly supported when released.

### **Upper Blade Guide**

The upper blade guide can be moved up and down to cover the unused part of the blade during a cutting operation.

Always cover as much of the blade as possible for a particular cut, leaving a 1/4" gap between the bottom of the blade guide and the top of the workpiece. Test the workpiece clearance first with the saw turned off. Be careful of workpieces with complicated profiles: make sure that all parts of the workpiece will clear the upper blade guide.

### **Work Lamp Switch**

Turn on the work lamp for better illumination during a cut.

## **Basic Operation**

### **Setting Up**

1. Plug in the vertical metal band saw.
2. Loosen the guard screw to free the blade guard.  
*Be careful: the guard is heavy, and may drop unexpectedly.*
3. Set the blade guard to just above the height of the workpiece.
4. Tighten the guard screw to lock the blade guard in place.

5. Check the blade alignment with the guides.

*The blade guides should be close to but not touching the blade, and should still turn freely. Make sure that the blade guides sit behind the teeth.*

6. Turn on the work light.

### Setting the Speed

First, **set the speed range shift lever to high or low** as appropriate for the workpiece material.

Make sure that the gearing is fully engaged in the new setting: you may need to manually advance the drive wheel to make sure the gears properly mesh.

The drive wheel is found in the bottom cabinet door to the right of the lever. Fully engaging the drive wheel can be difficult, make sure the gears are properly meshed before cutting. Gears that are not fully meshed will cause blade slippage.

Second, **set the speed crank to an appropriate speed** for the material you are cutting.

A table of appropriate speeds follows:

**Blade Speed (M/m)**

<b>Material</b>	<b>Thickness (in)</b>				
	<b>&lt; 1/4</b>	<b>1/4 - 1</b>	<b>1 - 3</b>	<b>3 - 6</b>	<b>6 &lt;</b>
Aluminum (6061,6063)	1500	1220	1065	915	770
Brass (Forging)	610	460	335	245	150
Brass (Free Cutting)	1220	915	610	450	300
Brass (High Leaded)	1065	825	565	410	260
Brass (Leaded)	610	460	275	215	150
Brass (Low Leaded)	455	305	150	60	20
Bronze (Commercial)	150	105	60	30	20
Bronze (Leaded Commercial)	915	610	450	305	150
Bronze (Magnesium)	125	75	40	25	20
Cast Iron	45	40	30	25	20
Copper (Cadmium)	90	60	30	25	20
Copper (Leaded)	765	550	360	240	120
Iron Plate (Thick)	45	30	20	20	20
Plastics	1500	1065	765	550	455
Rubber	460	155	90	60	45

### Blade Speed (M/m)

Material	Thickness (in)				
	< 1/4	1/4 - 1	1 - 3	3 - 6	6 <
Steel (Free Cutting)	60	45	40	30	30
Steel (High Carbon)	70	60	60	45	45

### Workholding

- Support the workpiece with the fence during the cut, if possible.
- If the fence cannot support the workpiece, hold the workpiece firmly during the cut. Hold the workpiece on both sides of the cut if it is safe to do so.

### Making a Cut

- Turn on the saw.
- Using the fence or with a firm grip, bring the workpiece up to the blade.
- Push the workpiece gently into the blade with constant pressure.  
*Go slowly. A gentle, consistent pressure will yield a better cut, and protect the workpiece and the tool.*
- Adjust pressure during the cut as needed.  
*Excessive pressure should not be used. Notify staff if the blade is not cutting properly.*
- Use gentle pressure at the end of the cut.
- Turn off the saw.

Wait until the blade has completely stopped before starting cleanup.

### Cleaning Up

- Use a chip brush to clean off the table.
- Sweep up any chips and dust in the surrounding area.
- Turn off the work light.
- Unplug the vertical metal band saw.

### Resources

## Metal Shop Dust Collection (Grinder Area)

Dust collection is an important part of any shop. Dust is a health hazard: dust is an irritant, and specific sizes of dust particles (PM2.5) can lodge in the lungs and accumulate there, leading to long-term and possibly severe health issues. Dust is also hard on metal tools, and can encourage surface rust and pitting.

### Notes

### Safety

Always use the metal grinder dust collector when using the bench grinders or the disk grinder.

Check the ducting from the metal dust collector to the grinders. Make sure all of the ducts are attached firmly to the grinders.

## Parts of the Metal Shop Dust Collection

### Front Quarter View



Figure 7: An annotated view of the metal dust collection in the grinder area.

### On/Off Switch

Put the switch in the **on** position to turn on the metal dust collection.

Put the switch in the **off** position to turn off the metal dust collection.

## Basic Operation

### Setting Up

Turn on the metal dust collection before grinding.

### Cleaning Up

Turn off the metal dust collection after grinding.

## Bench Grinders

Protohaven has a pair of two-disk bench grinders in the metal shop, useful for removing material from a workpiece.

The first bench grinder (on the left) holds:

- Wire brush wheel, suitable for any material (left)
- Aluminum grinding wheel, suitable for aluminum (right)

The second bench grinder (on the right) holds:

- Coarse grinding wheel, suitable for steel (left)
- Fine grinding wheel, suitable for steel (right)

## Notes

## Safety

Do not let the workpiece get drawn into the gap between the tool rest and grinding wheel. Keep the work perpendicular to the wheel face, and flat on the tool rest.

Use the entire wheel surface when grinding. Using only one part of the wheel surface will lead to uneven wear, and may lead to pieces of the wheel flying off.

It may be unsafe to grind small workpieces on the pedestal grinders. Consider using vice grips or other custom clamping jigs to keep control of your part and keep your fingers away from danger.

The wire wheel creates a lot of drag on the workpiece, and can catch the edge of a part and fling it violently.

## Care

- Only grind appropriate materials with each wheel.

*Using the wrong material may damage the grinding wheel.*

## Parts of the Grinders

### Front View



Figure 8: An annotated front view of the bench grinders. From left to right, the grinders are set up with: wire brush, aluminum, steel (coarse grit), steel (fine grit).

### On/Off Switch

Put the switch in the **on** position to turn on the motor in the grinder.

Put the switch in the **off** position to turn off the motor in the grinder. Wait for the grinder to completely spin down before leaving the area.

### Aluminum Grinding Wheel

The aluminum grinding wheel should be used for aluminum grinding only. Using other materials on this wheel may damage it.

### Blast Gates

The blast gates control airflow from the grinders to the dust collection system.

Make sure to open the appropriate blast gate and turn on the dust collection system before grinding.

### **Coarse Steel Grinding Wheel**

The coarse grinding wheel can be used to rapidly remove material from steels.

This grinding wheel should only be used with steels. Grinding other materials with this wheel may damage the wheel.

### **Fine Steel Grinding Wheel**

The fine grinding wheel can be used when a smoother finish is desired, but removes material more slowly than the coarse wheel.

This grinding wheel should only be used with steels. Grinding other materials with this wheel may damage the wheel.

### **Spark Shield**

A plastic shield that keeps sparks from flying up at the user. Use the spark shield if your workpiece can be used with it. Always wear personal eye protection (goggles or face shield) when using the grinders.

### **Quench Cup**

The quench cup is used to cool down a workpiece that is getting too hot from grinding. Only use water in the quench cups.

### **Tool Rest**

Use the tool rest to steady the workpiece while grinding. Be careful not to let the workpiece pinch in the gap between the tool rest and the grinding wheel.

### **Wheel Guard**

The wheel guard is an important piece of safety equipment. The guard will help protect you and other shop members if the grinding wheel breaks up under load.

### **Wire Wheel**

The wire wheel is useful for softening the edges of cut materials and cleaning surfaces. Use any material with the wire wheel (but check the results on a test piece first).

## **Basic Operation**

### **Setting Up**

1. If needed, check to make sure there is sufficient water in the quench cup to quench the workpiece.
2. If needed, adjust the tool rest to bring it to within 0.05" of the wheel surface.
3. Adjust the shield so that it will not impede the workpiece.
4. Inspect the grinding wheel you will be using for any chips, cracks, or severe indentations.
5. Open the appropriate blast gate.
6. Turn on the metal grinder dust collection.

## Grinding

1. Turn on the bench grinder.
2. Hold the workpiece firmly.  
*Use two hands if needed.*
3. Register the workpiece against the tool rest.
4. Present the workpiece to the wheel surface.  
*Make sure the workpiece does not get pulled down into the gap between the wheel and the tool rest.*
5. With steady and gentle pressure, move the surface of the workpiece slowly and smoothly across the face of the wheel.  
*If the workpiece is getting too hot, cool it in the quench cup.*
6. Turn off the bench grinder.
7. Wait until the grinding wheels come to a complete stop before cleaning up.

## Cleaning Up

1. Turn off the metal shop dust collection.
2. Close any open blast gates.

## Disk Grinder

The disk grinder can quickly remove material from a metal workpiece. It uses a flat surface and so can grind workpieces to precise angles that are not possible on the bench grinders.

## Notes

### Safety

#### **Safety Warning!**

#### **DO NOT WEAR GLOVES WHILE USING THIS MACHINE.**

Gloves can be pulled around by the disk into the gap between the disk and the table resulting in serious injury.

Do not leave the disk grinder unattended while the wheel is turning. Wait for the wheel to come to a complete stop before leaving the area after using the disk grinder.

### Use

The disk grinder can remove a lot of material very quickly: use caution to make sure you do not grind off more material than required from your part.

## Parts of the Disk Grinder

### Front View



Figure 9: An annotated front view of the disk grinder.

### On/Off Switch

Use the green button to turn on the disk grinder. The grinder will take a moment to spin up to full speed.

Use the red button to turn off the disk grinder. The abrasive disk will continue moving at speed for up to an hour after power is turned off.

### Brake

The brake will slow the abrasive disk. Stepping on the brake will also power off the machine.

Gently depress the brake to gradually lower the speed of the abrasive disk. It should take 30 seconds to stop the disk.

Stepping too hard on the brake bends the brake linkage, damaging the machine.

### Grinding Disk

The grinding disk is a large, very heavy disk covered with 80 grit abrasive paper.

Only use the right side of the disk that pulls the workpiece towards the table.

### Miter Gauge

Use the miter gauge to support a work piece while grinding. The fence can be set at a specific angle to grind an angle in the workpiece.

### Shield

The shield protects the top of the grinding disk from accidental contact and contains debris.

### Table

The table is used to support the workpiece while grinding. The table can be tilted up to 45°.

## Basic Operation

### Setting Up

Rotate the disk by hand to check for any places where the abrasive disk has worn or torn away.

If you find a spot where a small amount of abrasive has worn away, you can mark it on the table with tape and use undamaged parts of the disk. If a large section of abrasive has worn away, notify a shop tech.

### Grinding

When grinding, DO NOT tilt the workpiece up to bevel the edge: the workpiece will dig into the abrasive paper and tear it, resulting in a region that is unsafe to use. Instead, set the table angle.

1. Turn on the metal grinder dust collector.
2. Turn on the disk grinder.
3. Hold the workpiece firmly.  
*Use two hands if needed.*
4. Register the workpiece flat against the table.
5. Only use the right side of the disk.
6. Present the workpiece to the disk surface.

*Make sure the workpiece does not get pulled down into the gap between the wheel and the table.*

7. With steady and gentle pressure, move the surface of the workpiece slowly and smoothly across the face of the wheel.  
*If you have marked areas where the abrasive surface is torn on the table, avoid those areas when grinding..*
8. Turn off the grinder.
9. Wait until the grinding wheels come to a complete stop before cleaning up.  
*Gently press the brake pedal to reduce the disk speed.*

### Cleaning Up

Sweep up any dust.

Turn off the metal grinder dust collector.

# Resources

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