

Bridgeport Mill

Safety

Mandatory Eye Protection

Recommended Hearing Protection

No loose clothing. Tie back long hair.

Basic Operation of Mill

Locate the ON/OFF. This switch controls the Electric Motor and it's direction of Rotation.

Note the direction of Spindle Rotation will depend on the selection of Normal or Back Gear.

Gear Selection. High and Low Spindle speed are selected via the Gear lever selector. Along with the Step Belt pulley system various spindle speeds are available. Between 80 and 2700 Rpm's in 8 steps are possible.

Note Make when switching from High to Low / Low to High gear, be sure that the internal gears are fully engaged before switching ON the motor. Test by rotating the Spindle by hand.



Table Axis



The Table X & Y axis are shown above. The lock handle also shown.



The Z axis is controlled by 2 separate operations. The Table lift is used to lift the whole X-Y table into position. As shown in the right photo. The Spindle / Quill up / down motion is controlled by the level adjacent the spindle. Left photo. The spindle locking lever also shown.

Both Z axis control can be used to control cutting depths.

Spindle motion can also be via a controlled power feed option.

A spindle/quill depth stop can be used to cut to a fixed depth.

Cutting Tools and Tool Holders

Various tool holding options are available. R8 Collets as shown below can be used for drills or endmills. They typically are available in 1/16" inch increments. Standard Drill chucks can be used for drilling. Solid tool holders are available for larger sized cutter.

NOTE drill chucks can only be used for axial drilling. No side cutting (END MILL) allowed.



Loading or changing tool holders is accomplished by. See righthand photo.

To remove a tool from a machine, move the quill to the highest position and lock it in place with the quill lock. Engage the spindle break so it cannot spin. Place the Drawbar Wrench on the Drawbar on the top of the milling head and loosen. Do not fully loosen Draw bar. Hold whatever is in the collet (endmill, drill chuck, etc.) If you do not hold on to the collet and cutter, they will fall and can be damaged. Turn the wrench counterclockwise to loosen it. You will feel the spindle loosening and opening. This will release the collet and cutter from the spindle. To get the collet and cutter free you may need to tap the Drawbar with a rubber mallet.

Cutting Tools

Standard drills, Endmills, Face mills and other specialized cutting tools can be used in the mill.

Cutting Speeds (RPMS), as a general rule Higher RRM for small tools and softer material., Slower RPM for larger tools and harder materials. The various cutting tools will have a recommended Surface Feet per Minute (SFPM) number for different materials. Carbide tooling will have a faster SFPM than HSS tools.

A quick Cutting speed (RPM) calculations is $4 \times \text{Cutting Speed (SFPM)} / \text{Cutter Diameter}$.

Examples Drilling a 1/2 " dia. hole in mild Steel

Cutting speed for mild steel with HSS drill 90 SFPM

Cutter diameter .5 " dia.

$(4 \times 90) / .5 = 720 \text{ RPM}$

Endmill ¼ " dia. Carbide in Aluminum

Cutting speed Carbide with aluminum 300 SFPM

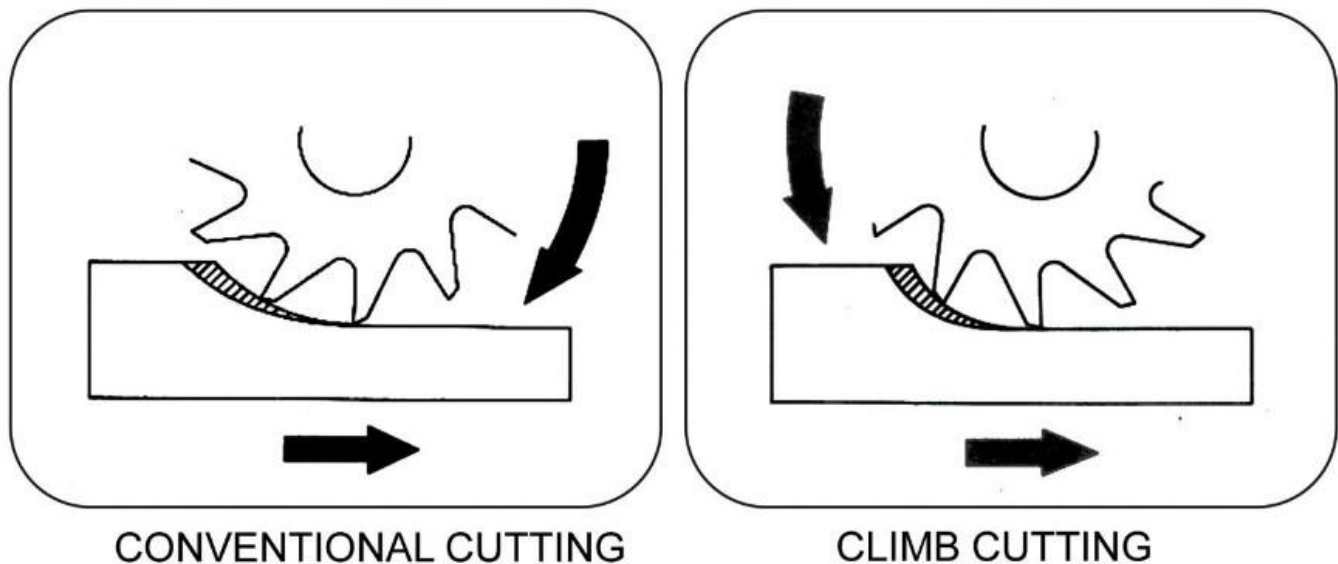
Cutter Dia. .25 " dia.

$$(4 \times 300) / .25 = 4800 \text{ RPM}$$

Cutter Feed Rate. As our Bridgeport mill is all manual you will have to control Feed rate by feel. By hand feeding too FAST you may overload the machine, break a cutter, move your work. Start slow and easy into the work piece.

Cutting Lubricants help to keep the tool cool, lubricate the cutting action and to help is chip removal. Climb

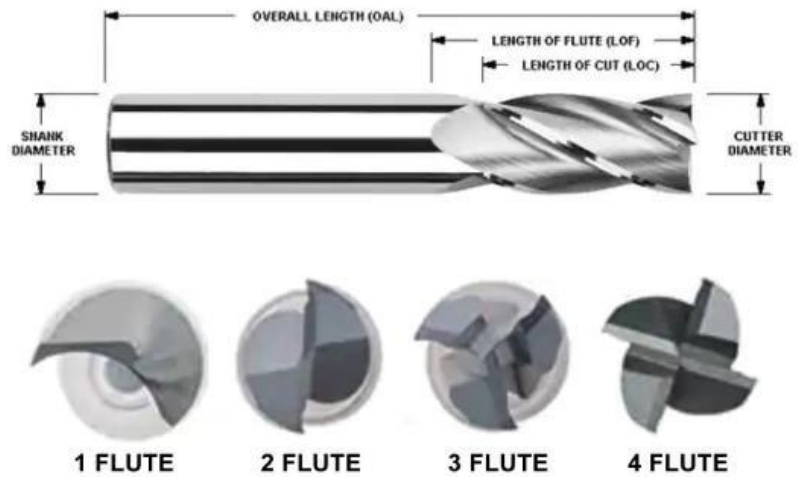
milling vs Conventional milling



In conventional milling, the workpiece is fed into the rotation of the cutter. This type of cut requires lower forces and is preferred for roughing cuts. In climb milling, the work moves with the rotation of the cutter .

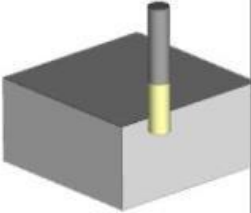
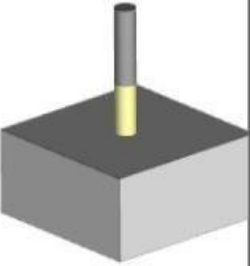
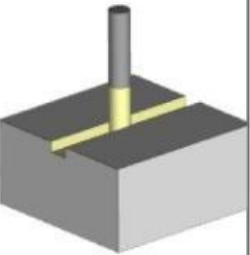
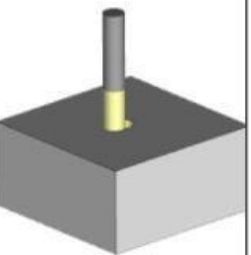
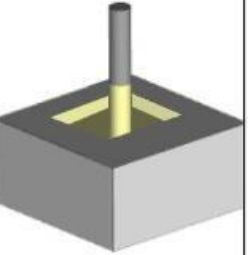
NOTE: Climb milling is NOT recommended for this milling machine. You will damage the cutter and or work piece. Understand the difference between Climb and Conventional milling.

Be aware of the metal chips that are coming off from your workpiece. They are HOT and Sharp.



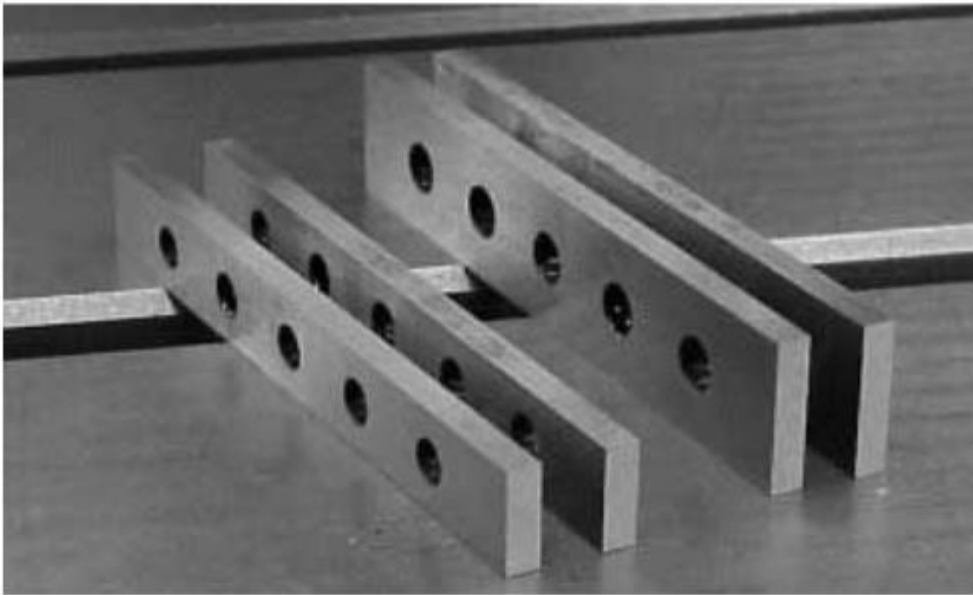
Various Endmills

Applications for End Mills

Side Milling	Face Milling	Slot Milling	Plunge Milling	Pocket Milling
				
Machining of an edge surface on the part.	Machining of a top face on the part.	Machining linearly between two points.	Axial feeding into a part along the Z axis.	Axial feeding along the X and Y axis to remove a region of material

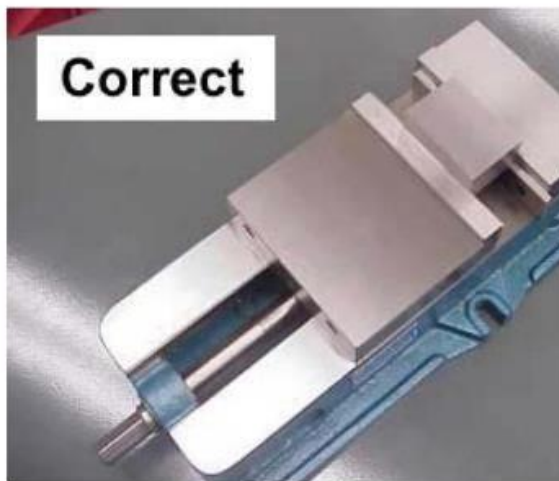
Work holding

Many work holding options are available. Table mounted Vice, Edge Clamping work to table, and Rotary Table. Below are some guidelines to using a table vice. If you are Mounting your work piece directly to the table, always use parallels or a sacrificial scrape under the work piece.

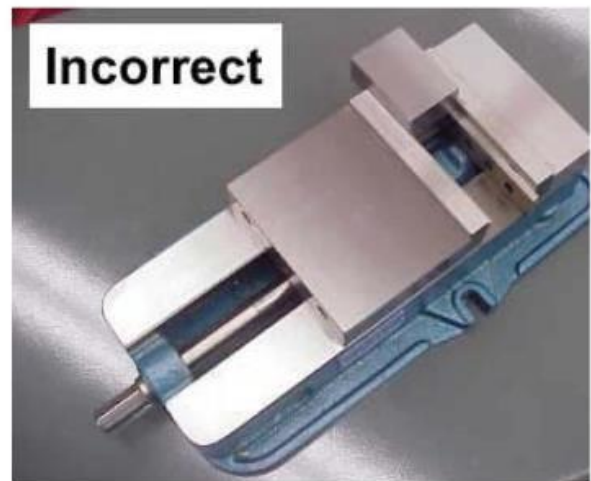


Parallels

The Vice and Clamping a Workpiece



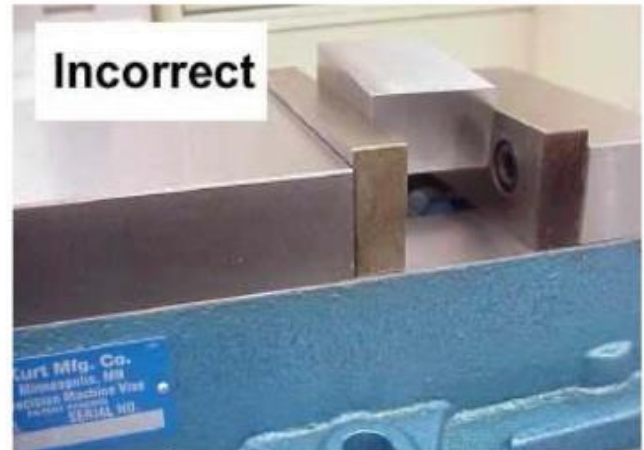
Locate the part in the center of the vise. This equalizes the pressure on the vise jaws.



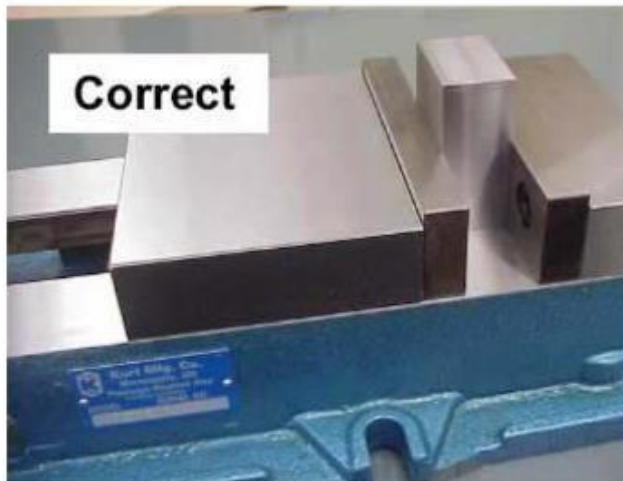
Holding the workpiece off center puts unequal pressure on the vise jaws. This can cause the piece to loosen up.



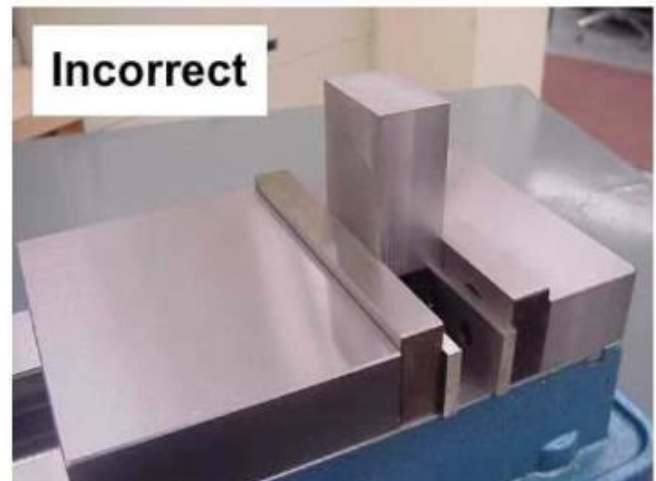
The workpiece should always be supported by the bottom of the vise or by parallels.



Work pieces that are not supported will move under the pressure of the cutting forces.



Keep the workpiece as low in the vise as possible.

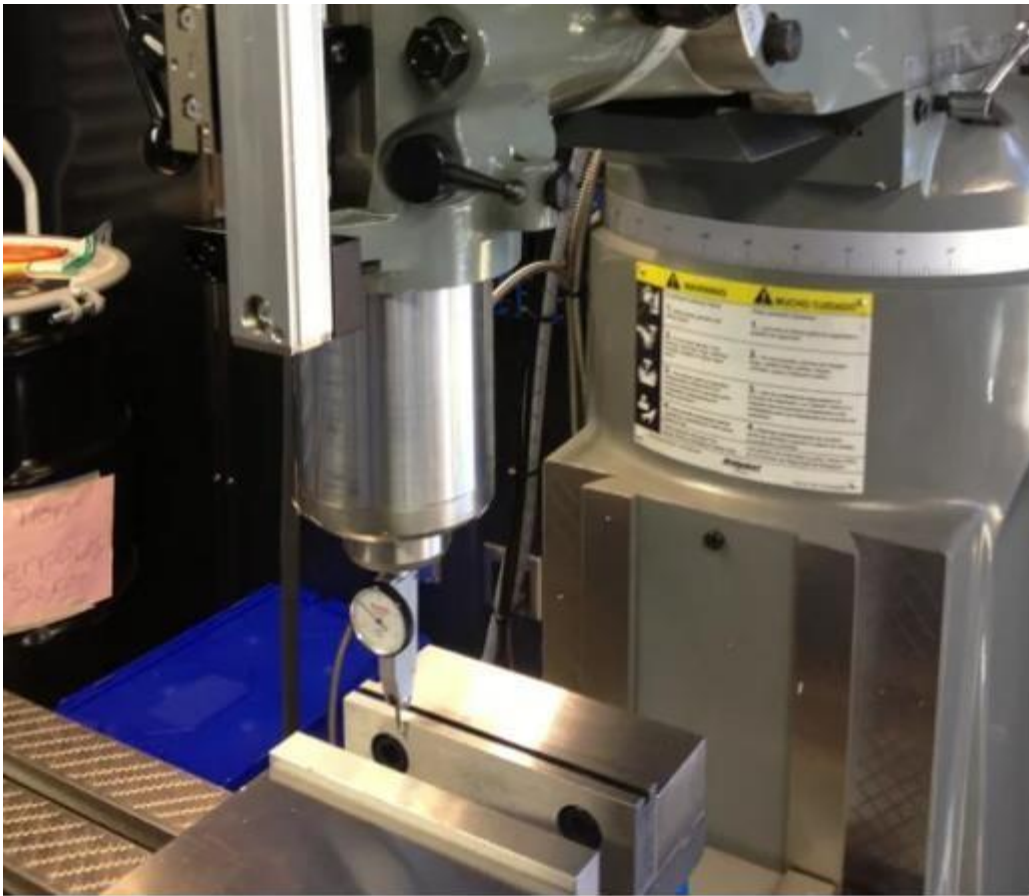


Work that extends out of the vise has a greater chance of loosening up under cutting conditions.

NOTE NEVER HAND HOLD your work piece while cutting. A rotating work piece is like a guillotine!

Work piece alignment.

To accurately locate and machine your work piece you will need to align your work holding device. This can be accomplished with a dial indicator. See photo below. By moving the X axis the dial indicator will indicate if the vice is parallel with the x axis.



Digital readout (DRO)

The DRO will provide many digital measurement options. Allow precision placement of drilled hole on your work piece. Accurate end milling. Drill a hole pattern.

Initially you will have to align / calibrate the DRO to your work piece. The method will be determined by the level of accuracy that you require. An edge finder is a quick and easy method of “zeroing” the DRO to your workpiece X & Y axis.

House Keeping and Maintenance

When you have completed your job **PLEASE** return all tools, clamps, measuring tools, etc to their normal location.

Clean the Machine and immediate work area of all chips and oils. You can use a brush, compressed air (be careful of flying chips). Wipe down machine with rag or paper towel.

No one likes to start a new job with a DIRTY machine. Please respect the next person using the machine.

Basic oil procedures can be found in the Bridgeport Manual.

If you find that something on the Machine is not working correctly or broken, notify a volunteer staff or leave a note at the front desk.