

## **Instructions for AME 40463**

### **Lab Equipment**

NOTE: A 3 ring binder has been placed in B19 that contains the manuals for all the pieces of equipment. If you have questions not answered within these instructions, consult this reference. If you still have questions or concerns, it is your obligation to seek the TA's help.

#### **DRILL PRESS**

There are several drill presses available for your use. Each is equipped with a standard Jacob's Chuck. One of the drill presses has a moveable drilling platform.

- Do not perform milling operations in any of the drill presses -

To adjust the height of the table:

1. LOOSE THE LOCKING CLAMP on the column, at the back of the drill press.
2. TURN THE CRANK HANDLE until the table is in the desired location.
3. RE-TIGHTEN THE LOCKING HANDLE before drilling, to secure the table.

The table can also be tilted. For further information, consult the manual.

Different materials require different speed settings. If you will be drilling steel or other ferrous metals, please inform the TA so the proper speed may be set. Do not attempt to adjust the speed yourself.

When using the drill press, the workpiece should be secured in a vise fixed to the drill press table. Especially great care should be taken when drilling plastics. Drill bits can grab a plastic workpiece unexpectedly and lift it from the table (faster than you can let go!).

## VERTICAL MILL

Students must be certified by the TA before operating the vertical mill (mill certification exercise). The Enco vertical mill is used to perform milling (face, side and plunge mill) and drilling operations.

### Inserting a cutting tool:

1. Unlock the spindle and raise it to its topmost position using the handle on the right side of the machine. Re-lock the spindle.
2. If necessary, move the table or lower the milling table until there is sufficient clearance to remove the existing cutting tool.
3. Lift/open the top cover to allow access to the draw bar and draw bar nut.
4. Grasp the front pulley wheel and use the red wrench to loosen the nut (not the draw bar) 2-3 turns.
5. While carefully holding the cutting tool, use the large piece of brass (not a hammer, not the red wrench) to strike the top of the draw bar. You should now be able to remove the cutting tool from the collet.
6. Loosen the draw bar until the existing collet can be removed from the machine.
7. Insert the new collet with the keyway aligned to the indexing component located in the spindle (an acquired skill).
8. **Tighten the drawbar approximately 10 turns (1/2") with your fingers only.**
9. Carefully insert the new cutting tool into the collet.
10. **Tighten the nut, not the drawbar**, with the red wrench.

Before performing any machining operation using the vertical mill, the workpiece must be secured in a vise, or to the table, using clamps.

### Securing a workpiece to the table:

1. Loosen the U-clamps and move them out of the way.
2. Put the workpiece on the table and place the U-clamps on the workpiece in positions that will not obstruct the cutting tool.
3. Fasten the clamps by turning the nut. Make sure the workpiece is **securely** fastened or it will move during machining.

### Securing a workpiece in the vise:

1. Place the workpiece, supported by an appropriate set of parallels, in the vise.
2. Tighten the vise.
3. Use the dead blow hammer to strike the workpiece and seat it against the parallels.

It is important that you plan your work and know the order of the cuts you will be making before you begin cutting. This will minimize mistakes and save time.

Milling a workpiece:

1. Using the spindle handle, position the milling cutter near the top of the workpiece.
2. Lock the spindle to prevent the cutter from moving vertically during the cut.
3. Turn the handles to move the cutter away from the workpiece.
4. Lock the table with the appropriate set knob.

**Note:** If the cut is in the X direction (left or right), lock the set knob to prevent movement in the Y direction. If the cut is in the Y direction (forward or back), lock the set knob to prevent movement in the X direction. Locking the table will prevent tool breakage due to unplanned table movement.

5. Turn the machine on.
6. Raise the table a small amount and check to see if the milling cutter will contact the workpiece. If not, move the cutter away from the workpiece and repeat.
7. Use the appropriate handle to feed the table in the direction of the desired cut.
8. Take a measurement and raise the table to take another cut, if necessary. Repeat until the workpiece is the desired thickness.

A few things to keep in mind:

1. Be focused: Don't turn on the machine if you are distracted and **never** allow more than one person to operate the machine controls – you.
2. Cut slowly and carefully. Cutting too fast will cause excessive vibration and ruin the cutting tool and your workpiece.
3. Use lubrication. Oil has been provided and it should especially be used when drilling holes in metals. Use it sparingly; a large amount is not necessary.
4. Make shallow cuts. Do not try to mill 1/4" at a time.
5. Trust your instincts: If something seems wrong, shut off the machine immediately and ask the TA for assistance.

**LATHE**

Students must be certified by the TA before operating the lathe (lathe certification exercise). The Enco lathe can be used to fabricate round workpiece such as collars, bushings, etc. The lathe is a variable speed machine with forward and reverse capability (clockwise & counterclockwise rotation). The cutting tool is a triangular carbide insert mounted in a tool holder. Each of the 3 points is a cutting tool; each of these should be used before the insert is replaced.

To install a new cutting tool:

1. Use an Allen wrench to loosen the hold down screw.
2. Clean the insert holder with a brush to remove dirt, chips, etc.

3. Place the new insert in the tool holder.
4. Secure the new insert by tightening the hold down screw.

Note: When “facing” a workpiece, the insert should cut to the center, or just below the center, of the work piece. An insert cutting above the center of the workpiece is easily chipped or broken.

To install a workpiece in the chuck:

1. Using the chuck key, adjust the jaws to accept the workpiece.
2. Place the workpiece in the chuck.
3. Secure the workpiece by tightening the jaws with the chuck key.

To operate the lathe:

1. Move the forward/reverse lever to the neutral position.
2. The automatic feed levers (2) should be in the neutral position.
3. Turn =ON the power to the lathe by de-activating the emergency stop button (turn the red button).
4. Move the cutting tool several inches away from the workpiece.
5. Move the forward/reverse lever to the forward position (down). **The chuck should rotate counterclockwise when viewed from the tailstock.**
6. Face the end of the workpiece by turning the appropriate knob on the compound slide (.002”/increment).
7. Turn the diameter of the workpiece by turning the handle on the apron (.005”/increment).
8. Stop the lathe by moving the forward/reverse lever to the neutral position.

**BRAKE, SHEAR, and ROLLER**

The combination shear/brake/roller is located on the workbench in the center of the machine area. This machine may be used to cut, bend, and roll aluminum sheet metal and other pliable metals.

To shear:

1. Open the shear by rotating the handle located on the side of the machine.
2. Place the piece to be cut on the left side of the shear against the guide.
3. Align the blade with the line you want to cut along.
4. Rotate handle to cut.

**Never put your fingers in the shear.**

Do not cut bars, round stock, or steel with the shear as it will damage or break the shear. Use extreme caution when operating the shear, especially if more than one person is operating the machine.

To brake:

The brake is located in the center of the machine. Angles 0° to 45° can be created using the brake. Exceeding the maximum brake angle for a given material will result in fracturing or shearing.

1. Open the brake by rotating the handle located on the side of the machine.
2. Insert the piece to be bent/formed into the brake.
3. Align the teeth with the line you wish to bend along.
4. Slowly rotate the handle until the desired brake angle is achieved.

The brake teeth may be removed with an Allen wrench and reconfigured to allow for different bend lengths. If you remove or reconfigure the teeth, return them to their original configuration when you are finished.

**SCROLL SAW**

The scroll saw located on the work table with the sander uses a reciprocating motion to cut through materials such as wood, plastic, and thin, nonferrous materials. Cutting different materials and performing different cutting operations requires the use of different blades. Suggested blade usage is shown on page 19 of the owner's manual which is included in the white binder kept by the phone in the lab.

To cut a workpiece:

1. From the owner's manual, choose the proper blade required to cut the material (TPI refers to "teeth per inch").
2. Always disconnect the power from the wall receptacle (pull the plug) when installing or changing blades.
3. Mount the blade in the saw according to the instructions on pages 13 and 14 of the owner's manual. Blade adapters and "Quick Change" blade adapters are kept with the different sets of saw blades.
4. Using a pair of pliers, loosen the drop foot lock knob and adjust the height so that it rests on your workpiece as you are sawing.
5. Taking care to keep your fingers away from the path of the saw blade, gently push the workpiece through the saw using a scrap block of wood. Don't bend the blade because it can snap easily.