EML2322L – MAE Design and Manufacturing Laboratory

LATHE SAFETY

1. **Always wear safety glasses** when operating the lathe.
2. **Remove chuck key from chuck immediately after use.** Breaking this rule can cause severe personal injury or equipment damage; to prevent the risk, ***never remove your hand from the chuck key when in use.***
3. **Verify cutting tool is not chipped and has the proper clearance angle.**
4. **Tighten tool-post properly** by applying ~20 lb of force to the end of the tool-post wrench.
5. **Set cutting tool on the vertical centerline of the workpiece.** Check tool height by gently clamping a plastic ruler between the workpiece and cutting tool or by using a lathe gage.
6. **Rotate the chuck through one revolution by hand to ensure adequate tool clearance. Be careful not to run the tool into the chuck.** When in motion the location of the chuck jaws is dangerously deceptive, so always note their location before turning the lathe on.
7. **Ensure the spindle is rotating in the proper direction** (CCW looking from the tailstock towards the spindle) **before cutting material.** Failure to do so damages tooling.
8. **Run the machine at the proper cutting speed.** Use the graphical speed chart posted on the clipboard by each machine.
9. **Allow the spindle to completely stop turning before reversing the direction of rotation by switching between *forward* and *reverse* on the spindle power switch.**
10. **NEVER bring anything (fingers, measuring tools, rags, air guns, etc.) within 6″ of the cutting zone.** Stated another way: ***ensure the lathe is fully stopped before making measurements or checking surface finish.***
11. **Be careful reaching across the lathe**, as doing so can bring your hand / wrist into the cutting zone (e.g. be cautious setting the DRO which is mounted on the headstock).
12. **Ramp SLOWLY and GENTLY into contact with the workpiece every time.**
13. **Keep hand on power feed handle ANY TIME the power feed is enabled.**
14. **Do not remove more than 0.100″ off the radius or end of a workpiece in a single pass.** If a cutting tool vibrates, reduce the depth-of-cut, feedrate, and/or spindle speed.
15. **Always ask if spindle speed and feedrate are to be changed while the lathe is running or once it has stopped.** Each machine is different and failure to adjust the machine in the proper manner will result in extensive mechanical damage.
16. **When loading drills, look closely to ensure the axis of the drill and spindle are coincident** before tightening the drill chuck.
17. **Never remove chips with your hands, as doing so can cause severe lacerations (even when the lathe is off) and can pull your hand into the rotating work and/or the tool.**
18. **File left handed** to prevent contacting the rotating chuck jaws. **Never use a file without a handle and always reduce the spindle speed to its lowest setting when filing.**
19. **Never polish or sand workpieces when the lathe is running, as the abrasive cloth used can easily catch and pull your fingers around the rotating workpiece.** The abrasive will also be deposited onto the machine's guideways, greatly accelerating wear.
20. **Before cleaning the lathe remove tools from the tool post and tailstock.**
21. **Be gentle when sliding the tailstock;** once it begins moving, it is easy to slam the drill into the workpiece or the tailstock into the stop pin which keeps it from falling off the ways.

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MILLING MACHINE SAFETY

General:

1. **Always wear safety glasses** when operating the milling machine.
2. **Always clamp work securely in the vise** or directly to the table; **never hold by hand.**
3. Always **transport parallels individually** (one in each hand) **and lower them gently into the vise** (never drop them in place), as doing so will damage the precision vise and parallels.
4. **Check speed range before turning on the spindle;** HI range is used for most operations; speed range must only be changed by a trained course instructor/TA.
5. **Before turning on the spindle, make sure the cutter is clear of the workpiece and vise.** Never bring cutting tools into contact with the vise. Check all clearances before machining and if interference appears possible, re-clamp the workpiece and/or tool.
6. **ALWAYS ensure cutter is rotating the proper direction before cutting material** (CW as viewed from the top of the spindle looking down towards the workpiece).
7. **Always adjust the spindle speed while the machine is running. NEVER ADJUST THE SPEED WITH THE SPINDLE TURNED OFF.**
8. **Run the machine at the proper cutting speed.** Use the graphical speed chart posted on the clipboard by each machine.
9. **NEVER bring anything (fingers, measuring tools, rags, air guns, etc.) within 6″ of the cutting zone. Stated another way:** ***ensure the mill is fully stopped before making measurements or checking surface finish.***
10. **Ramp SLOWLY and GENTLY into contact with the workpiece every time.**
11. **Never remove more than 0.100″ from the workpiece in a single pass.** If the cutting tool vibrates, reduce the depth of cut and/or feedrate.
12. **When using the power feed, keep your hand on the directional joystick to ensure your fingers aren't pinched between the rotating handle and power feed housing.**
13. **When using the power feed, wait five seconds for the gear-drive to stop rotating before switching directions using the directional joystick.**
14. **When loading drills, look closely to ensure the axis of the drill and spindle are coincident** before tightening the drill chuck.
15. **Never remove chips with your hands, as doing so can cause severe lacerations (even when the mill is turned off) and can pull your hand into the rotating tool**.
16. **Before cleaning the mill remove the sharp cutting tool from the spindle** using a rag to protect your hand.
17. **Do not use milling machine tables for storing tools, as they can easily be damaged by rolling off the tables onto the floor;** use the wooden work tables instead.

Installing Tools:

18. The proper technique for installing a tool is as follows:
    a. Make sure the power is off and the spindle has stopped rotating.
    b. **Always position one of the plastic table covers below the spindle before changing tools** to ensure the vise is out of the way of tools which are accidentally dropped.
    c. Release the 1.5″ long quill clamp on the right side of the quill housing by rotating the lever *counter-clockwise* using the palm or your right hand.
    d. Raise the spindle to the uppermost position using the quill handle on the right side.
    e. **Raise the silver spindle lock to the highest position by pressing the round button, raising it to the top of its travel and releasing the button. Ensure the spindle lock is all the way up by threading it finger-tight against the black quill stop.**
    f. Select the appropriate collet to fit the shank of the tool to be installed; *there should only be enough clearance for a piece of paper to fit between the shank and the collet.*
    g. Inspect the collet to make sure there are no chips on or inside it.
    h. Insert the collet inside the spindle bore. Collets are keyed and can only be installed in one angular orientation, so slowly rotate the collet while lifting it into the spindle. Once the proper orientation is found the collet will rise ~3″ into the spindle bore.
    i. Use your right hand to hold the tool being installed with a rag to protect your fingers against the sharp cutting edges of the tool.
    j. Insert the tool into the collet and hold both in the correct position with your right hand; *make sure the collet is clamping on the full diameter of the tool shank.*
    k. When the tool is located at the correct height in the collet, press the GREEN safety button and the RED '**IN**' button to the left side of the machine spindle. Press these buttons for 1-2 seconds until you hear a distinct change in tone signaling the tool and collet are clamped securely; *release immediately upon hearing this sound.*
    l. Finally, make sure the tool is securely clamped in the collet using a rag to protect your hand; if it is not, consult a laboratory instructor for assistance.

Removing Tools:

19. The proper technique for removing a tool is as follows:
    a. Make sure the power is off and the spindle has stopped rotating.
    b. **Always position one of the plastic table covers below the spindle before changing tools** to ensure the vise it out of the way of tools which are accidentally dropped.
    c. Release the 1.5″ long quill clamp on the right side of the quill housing by rotating the lever *counter-clockwise* using the palm or your right hand.
    d. Raise the spindle to the uppermost position using the quill handle on the right side.
    e. **Raise the silver spindle lock to the highest position by pressing the round button, raising it to the top of its travel and releasing the button. Ensure the spindle lock is all the way up by threading it finger-tight against the black quill stop.**
    f. Hold the tool being removed with a rag to ensure it does not fall onto the table. The rag will protect your hand against the sharp flutes of the cutter. Do not try to pull the tool out with your hand; simply allow it to be released from the spindle under gravity.
    g. Press the GREEN safety button and the RED **'OUT'** button to the left side of the machine spindle. Hold these buttons engaged for 1-2 seconds until the tool **and collet** are gently released from the machine spindle.
    h. Carefully wipe the tool and collet off with a rag and return them to their proper storage locations. Do not mix collets between machines.