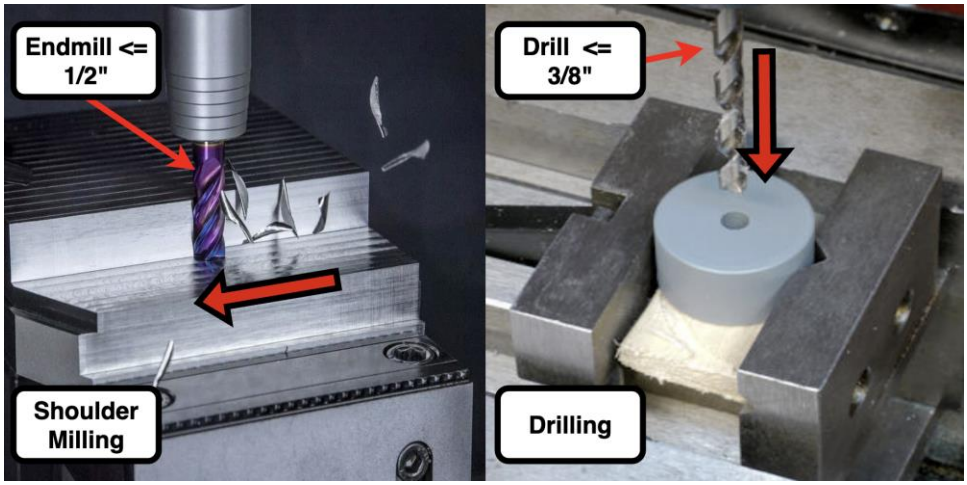
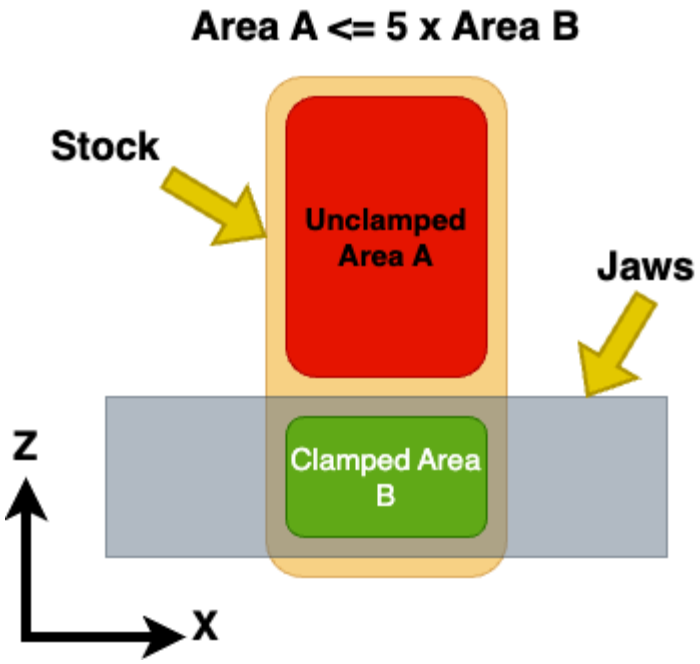
# Manual Mill Standard Operating Procedure

## LIMITATIONS

- ❑ This checklist is only for simple horizontal endmill operations with a tool diameter ≤ ½" and drilling into a flat face with a tool diameter ≤ 3/8”



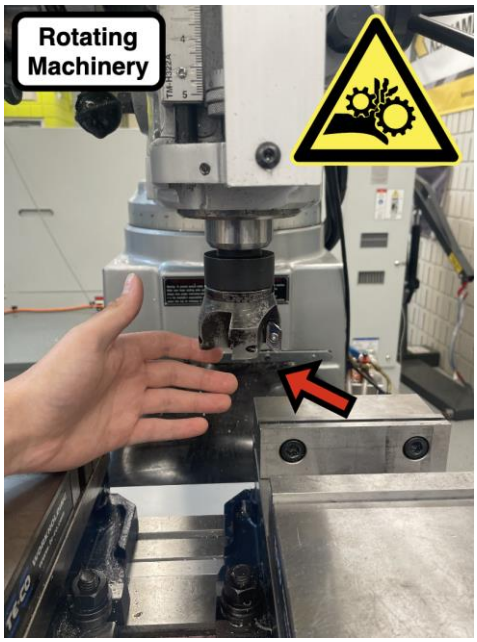

- ❑ This checklist only covers cutting materials ISO grade N, P1-3.
    - Note: Grade C is banned for all use on this machine.
    - You can find your material ISO grade here.
- ❑ Give the cross section of clamped stock below, the unclamped area B needs to be less than or equal to five times the clamped area A.




- ❑ Round stock, plate stock and organic stock requires specialized one on one training.

**MACHINE SPECIFIC HAZARDS**

- ❑ Hands can be caught in the rotating spindle

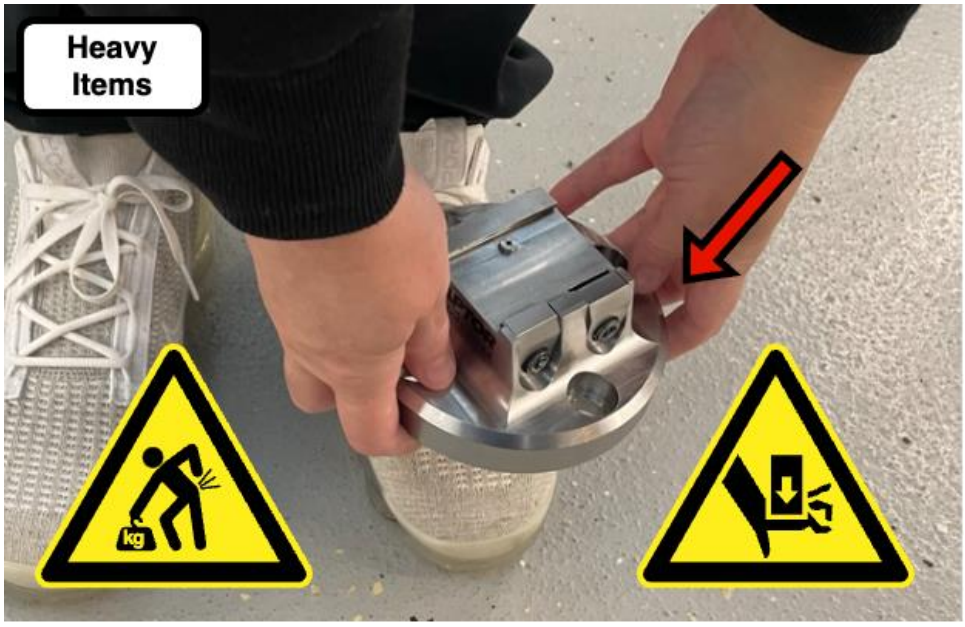



- ❑ Hands can get pinched during tool loading and in vice jaws.

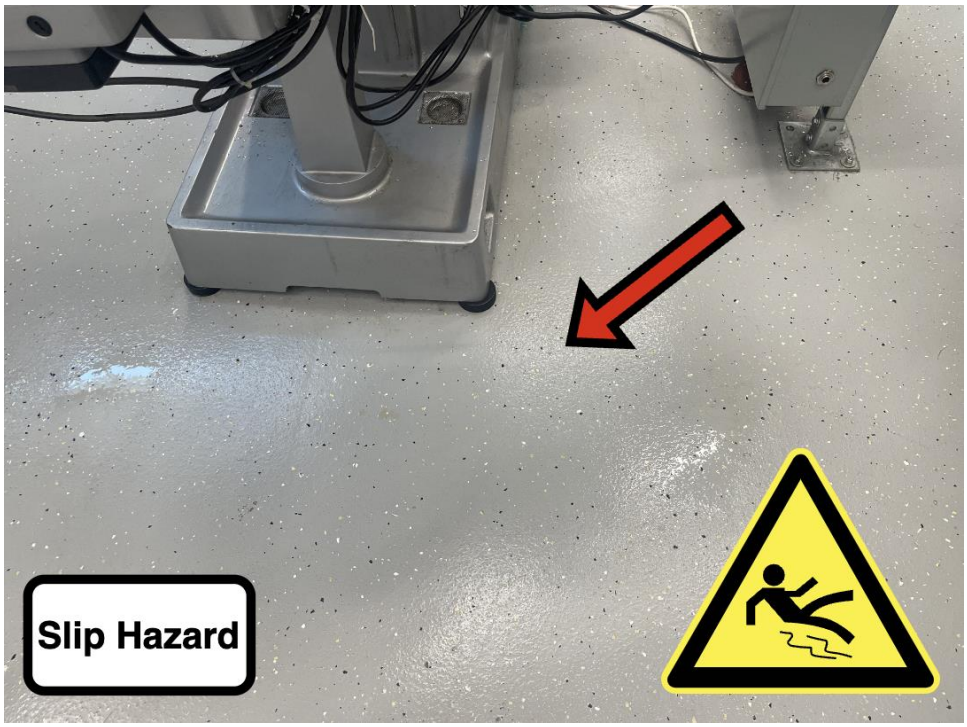

- ❑ The tools can cut your hands.


- ❑ Coolant can irritate your skin.

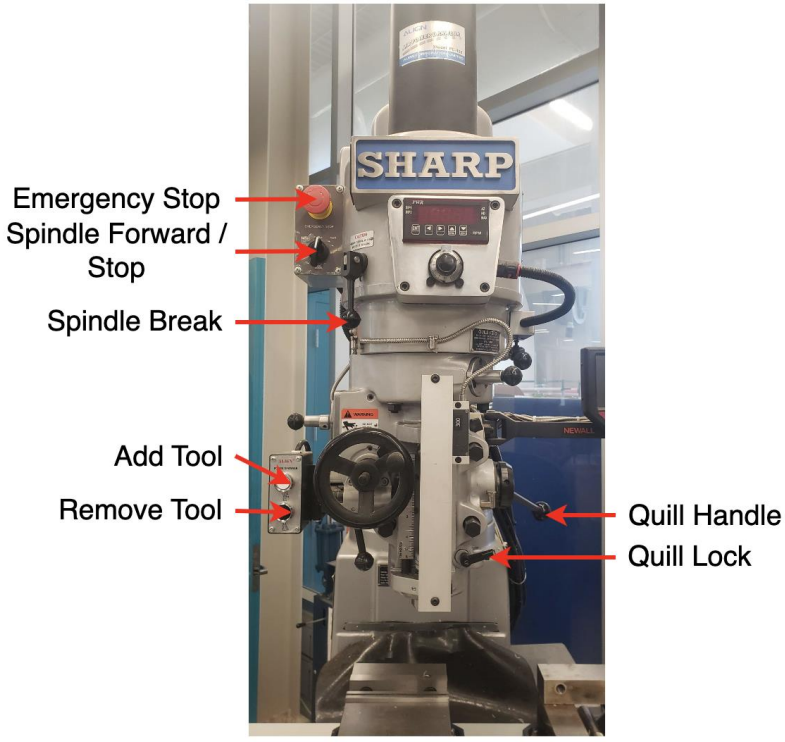

- ❑ Stock and tools can be heavy.




- ❑ There is a slip hazard when using coolant from a spray bottle




**MACHINE CONTROLS**

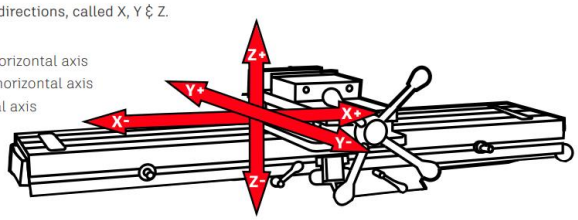


**MILL BASICS: MOVEMENT**

When using a mill, the material is clamped into a vise or directly to the table. The table is moved so that the workpiece moves past a spinning cutter.

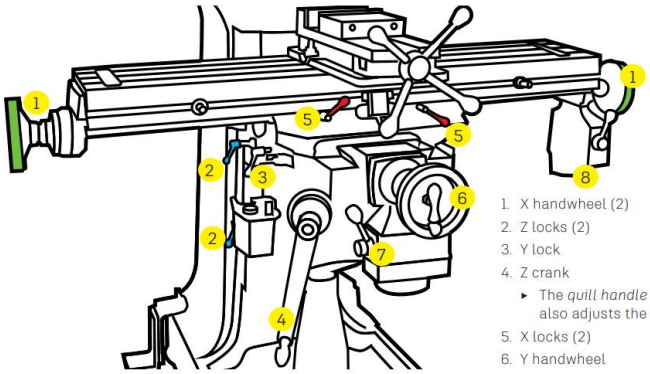
The table can move in 3 directions, called X, Y & Z.

- X is the long horizontal axis
- Y is the short horizontal axis
- Z is the vertical axis




- Handwheels and power feeds move the table horizontally (X & Y).
- Z crank moves the table vertically (Z).

- Locks keep the table from moving.
  - Lock each axis that is not moving.
  - Unlock an axis before moving it.

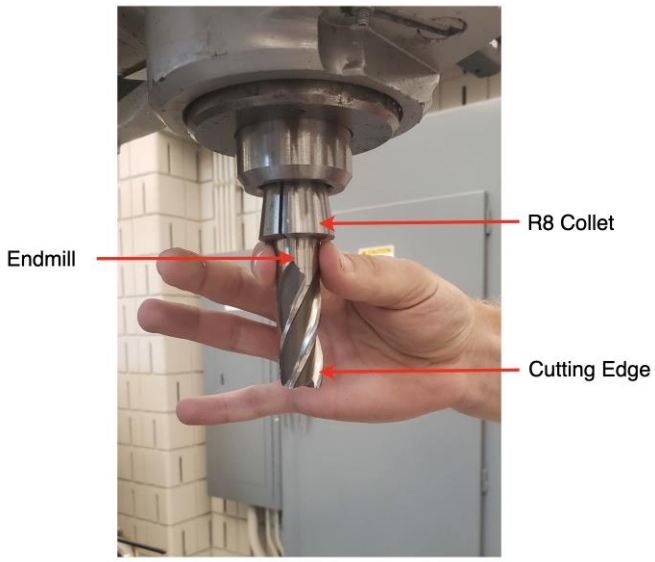



1. X handwheel (2)
2. Z locks (2)
3. Y lock
4. Z crank
   - The *quill handle* (next page) also adjusts the Z height.
5. X locks (2)
6. Y handwheel
7. Y power feed
8. X power feed


**PRE-FLIGHT**

## Tool Assembly

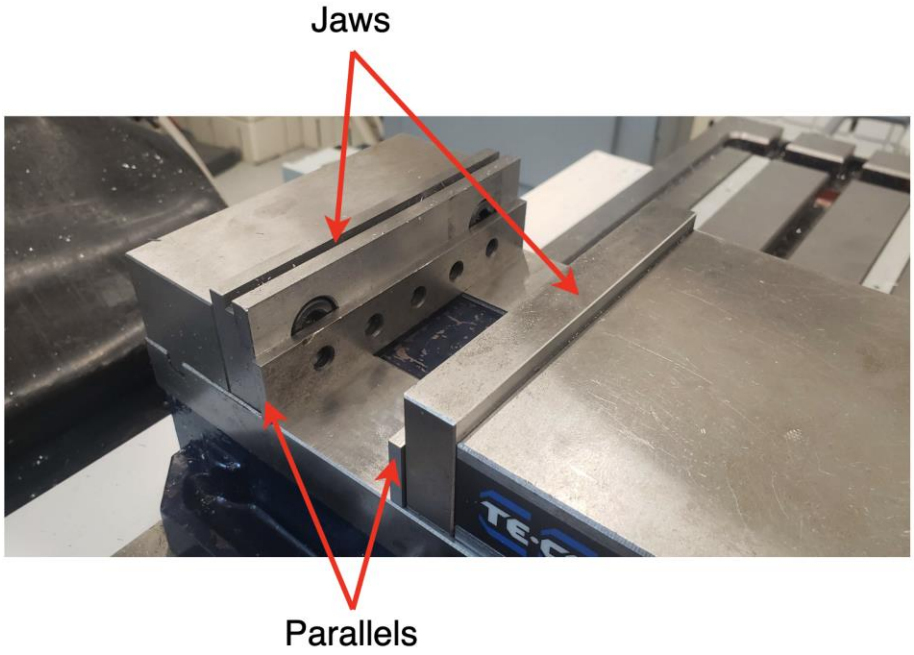
- Put tool into tool COLLET or JACOBS CHUCK
    a. NOTE: When inserting tool into JACOBS CHUCK, the chuck will need to be inserted into the machine and use the spindle break.
- Hold tool carefully away from CUTTING EDGE




- Slide tool into spindle aligning it with the groove
- Press the ADD TOOL/WHITE BUTTON to draw tool
- Release ADD TOOL/WHITE BUTTON once tool is drawn into place
- Let go of tool once it is secured
- Consult speeds and feeds chart for correct RPM, feeds and step over

## Stock Setup

- Open vice jaws, clean out chips/coolant with a rag
- Determine PARALLELS sizing, place stock into vice




- Tighten vice jaws while tapping top of stock with a mallet to seat parallels
- Ensure stock is rigid in jaws, parallels are seated

**Coolant Containment**

- Ensure the coolant plug is properly tightened

**OPERATE**

**Tool Height Zeroing**

- Use X & Y HANDLES to align part over part,
- Place paper underneath tool
- Slowly lower tool in z-direction using the QUILL HANDLE while moving paper back and forth
- Stop tool once you cannot move the paper
- Lock the quill using the QUILL LOCK
- Zero Z

**Milling**

- Move tool to starting point of stock using HANDWHEELS
- Set tool step over based on speeds and feeds chart
- Lower tool using the QUILL HANDLE to appropriate Z height based on speeds and feeds chart
- Release EMERGENCY STOP and twist spindle to FORWARD/FOR to spin up the spindle.
- Turn spindle to appropriate speed using RPM CONTROL knob
- Turn on POWER FEED in direction of cut using knob to adjust to appropriate feed
- Continue cut until tool is clear of the stock
- Turn off POWER FEED then spindle after cut or before if machine operation deviates from expected
- Turn EMERGENCY STOP on

**POST-FLIGHT**

**Tool Unloading**

- Hold tool carefully away from CUTTING EDGE
- Press REMOVE TOOL/BLACK BUTTON to release tool
- Disassemble tool, return bits and holders to proper location
- Return table to center and a normal height

**Stock Unloading**

- Open vice
- Remove part

**Coolant Cleanup**

- Use a drip pan and remove the nut to drain coolant

- Replace the nut after draining
- Drain the drip pan into the Hazardous Waste Barell in High Bay

## Cleanup

- Wipe large chips from machine using small brush
- Use shop vac to remove remaining chips
- Sweep chips off the floor into a dustpan and place in chip bag

- [ ] Mop floor if necessary
- [ ] Complete assigned 5-minute shop job at the end of your reservation.