CNC Milling Machine Use Outline

1. **Part Drawing & Setup Sheet**
    a. Make sure you have a GOOD detail drawing with appropriate tolerances and fillet details before moving on.
    b. Complete a CNC Mill Setup Sheet prior to turning on the machine; this should contain ALL info necessary for another competent operator to setup and run your part program.

2. **Tool Selection**
    a. Try to select the cheapest, toughest, strongest, most favorable geometry tool for the job by considering materials, L:D ratios, number of flutes, roughing/finishing tools, coatings, and proper techniques for cutting deeper feature geometries.
    b. Avoid plunging with an endmill unless you own it and don't care about destroying it.
    c. Understand that cutting deeper produces proportionally higher axial forces, which tend to pull the tool out of the toolholder and the part out of the vise/workholding.

3. **Tool Setup, Loading & Probing**
    a. Request tools by bringing your setup sheet to Mike and ask for the tools you need; do not rummage through the cabinets, as that's how tools get misplaced.
    b. Select the shortest toolholder possible, and be careful to NEVER touch the tapered portion, as doing so will cause corrosion that permanently degrades its precision.
    c. Clean each toolholder before use. Wipe off the taper with a clean rag, remove any corrosion from the taper using a piece of Scotch-Brite, spray a light coating of WD-40 on the freshly cleaned taper, and place a SMALL dab of grease on the pull stud bulb. Place a small amount of oil on the collet nut threads and the tapered portion of the toolholder into which the collet is inserted and properly torque collet nuts.
    d. When installing tools in ER-style collet chucks, always load the collet into the collet nut BEFORE installing the collet nut onto the collet chuck or you will damage all three.

    e. **When installing a toolholder into the CNC, ALWAYS rotate the spindle so the toolholder engagement tangs are closest to the operator and visually check that they engage their mating slots in each toolholder before releasing the toolholder clamping button. In addition, be VERY CAREFUL when inserting a toolholder into the spindle TO NOT slam the pull stud into the side of the precision ground taper.**
    f. Put tools away when done. When you are finished with your part, unload any tools you loaded, returning the tools to their appropriate plastic containers and to Mike for storage, and return toolholders and collets to their respective carts. Each time, every time.

    g. **Probe each tool length IMMEDIATELY after loading it, as forgetting to do so can result in extensive tool and machine damage.** If you don't have time to probe a tool, DON'T load it.

4. **Workpiece Loading & Probing**
    a. Load the part using the most robust workholding available. If clamping in the vise, use the long steel handle, not the short aluminum toy, as the higher cutting forces in the CNC mill will yank a lightly clamped part right out of the vise.
    b. Set workstop (if needed).
    c. Use the electronic workpiece probe to set ALL THREE part zeros.

5. **Load Program**
    a. Make sure your program uses a program number that is not in use.
    b. Copy the program from your USB to the program memory.
    c. Select that program as the active program.

6. **Program Dry (aka Test) Run**
    a. Understand a replacement VF-2 runs about $80k. Remember this value because that's how much it can cost to fix a serious mistake if you don't follow this document.
    b. Offset the Z-axis height value stored in the relevant work offset by an inch or more in the POSITIVE Z direction (away from the part); **record this offset value.**
    c. Jog the Z-axis so the tool is at least 6" above the part.
    d. Set the RAPID override to 5% any time you are within 6" of the part (which is still fast on the VF-2 when approaching the workpiece, so ALWAYS be careful).
    e. Open the program in the machine editor, press the RESET button, and go to MEM mode.
    f. With your left thumb ALWAYS on the green CYCLE START button and your right thumb on the red FEED HOLD button, begin the program by pressing CYCLE START and pause the program by pressing the FEED HOLD BUTTON.
    g. As each tool approaches the part, FEED HOLD the program, SPINDLE STOP, and verify the DISTANCE TO GO value on the POSITION screen matches the actual measured distance.
    h. Run enough of the program to ensure the part zero and scaling are correct.
    i. When ready to run the program, offset the Z-axis height value stored in the relevant work offset machine register by the SAME VALUE previously entered above, only in the NEGATIVE Z direction (towards the part).

7. **Prototype (First Part) Run**
    a. Jog the Z-axis so the tool is at least 6" above the part.
    b. Set the RAPID override to 5% any time you are within 6" of the part (which is still fast on the VF-2 when you are approaching the workpiece, so ALWAYS be careful).
    c. Set the SPINDLE SPEED to 60% and the FEEDRATE to 40% overrides.
    d. Run the first tool, being very cautious to FEED HOLD if anything LOOKS or SOUNDS wrong!
    e. If everything seems fine, then you can monitor the spindle speed and chipload on the CURRENT COMMANDS screen, and slowly bring the overrides up to 100%.
    f. When a tool change occurs, be careful not to douse all the tools with coolant (you may have to manually turn off the COOLANT on the control panel after FEED HOLDING). Dousing the toolholders with coolant causes them to stick in the spindle. If this occurs, remove each of the affected tools, wiping off the toolholder and spindle tapers, and reapplying WD-40 as each tool is reinstalled.
    g. Reset the SPINDLE SPEED (60%) and FEEDRATE (40%) overrides for each new tool used in your program and repeat steps d thru f.

8. **Important Points**
    a. NEVER run the CNC while talking to or with another person.
    b. Never press the ENTER button on the controller without knowing what you are doing.
    c. Understand high efficiency machining places large axial forces on the part and workpiece
    d. Do not leave the machine dirty overnight.
    e. Do not leave a tool in the spindle or in carousel pocket #1 overnight
    f. Protect your ears during cleanup.