

Manufacturing Process Sheet

CSU EMEC - Trivet

CSU EMEC Contact Information: (970) 491-3366 CSU Engineering Building 400 Isotope Dr. Fort Collins, CO, USA 80521	
---	--

Name(s): Erin Keown
Team: MECH200B L01
Date Requested: 03/22/2022
Target Due Date: 03/24/2022

Part Name: Trivet
Part Number: 2
Quantity Required: 1
Drawing Number: 2

Material: Aluminum
Raw Stock Size: Width 5in, Depth 0.25in

Process Families Needed to Complete Part:

Cutting	Milling	CNC Milling	Sanding
Polishing			

Tools Needed for Machining Operations:
Horizontal Band Saw
Vertical Mill
Lathe
Sandpaper (120 to 3000 grit)
Polishing and buffing wheel, with jeweler's rouge

Cutting with the horizontal band saw:

1. Obtain the raw stock. Raise the saw blade so that it will clear the piece of raw stock.
2. Insert the raw stock into the saw clamps and use a ruler to measure $5 \frac{1}{8}$ of the stock to cut.
3. Ensure the saw blade is above the raw stock and not touching it.
4. Set the horizontal band saw to speed 3, clamp the raw stock into place (double checking that it's still cutting $5 \frac{1}{8}$ in), and turn on the bandsaw.
5. Cut the piece, remove all burrs.

Squaring on the vertical mill:

1. Ensure the vice is secure and trammed by checking the tightness of the screws and using a dial indicator to determine if the vice is squared on the mill table.
2. Using parallels, align the part in the vice so that about $\frac{1}{2}$ in is protruding from the side of the vice. This will be the edge that is cut, so make sure it is one of the edges that is NOT the machined/extruded edge of the raw stock.
3. Mount a $\frac{3}{4}$ in diameter end mill with a collet in the spindle, and set the speed to run at 1100 RPM.
4. Carefully touch the edge of the tool to the side of the part. Set the x axis to 0.
5. Position the end mill to make a conventional cut, of no more than 0.03in in depth. Lock the x down at this position, turn on the mill, and perform the cut, supplying soluble oil.
6. Set the x to 0 after performing this cut, and set the end mill up to perform a climb cut of no more than 0.005in.
7. Perform the climb cut while supplying soluble oil.
8. Repeat this same process on the other side of the part, cutting it to the appropriate length of 5in +/- 0.06in. Leave room for a final climb cut!

Finishing processes:

1. Sand the part down, removing all manufacturing marks made in the forming process of the raw stock using the 150 grit sandpaper, then sanding it down to 3000 grit. Don't forget to sand all sides.
2. Polish the part using jeweler's rouge and a buffing/polishing wheel.

CNC Machining:

1. Write the G-code for the desired design using MasterCam, and save it to a flash drive.
2. Insert the flash drive containing the G-code into the slot in the CNC mill.
3. Check to make sure the vice is trammed, then use parallels to clamp the part in.
4. Touch off the x and y axis with the edge finder in the CNC, running at 600rpm, and set the part x and y axes to 0.
5. Mount the $\frac{1}{4}$ in ball end mill into the CNC milling machine.

6. To set the $z = 0$, place a piece of paper on the surface of the part and lower the end mill until it catches on the paper, then set the z to 0.
7. Close the doors to the CNC and run the program. It's a good idea to pause it and check the spindle is approaching the first cut in the right place so that the part doesn't get machines incorrectly. That way the G-code can be fixed before CNCing if necessary.
8. When the CNC is done, blast away excess coolant with compressed air and remove the part. Congrats! You have a trivet!
9. Finish the part by making felt circles as feet and sticking them to the bottom of the trivet, in all four corners.