

# CNC MACHINING

With the design set and analyses run on the Solidworks files I moved onto the machining of a final prototype. The CAM was done using a HSMworks plugin for Solidworks with all the toolpaths being designed and built by me. I started with a 3" x 5" block of 3003 Aluminum that I split in two for the lower reservoir and the main reservoir. The top cap was milled from a 2" cube of aluminum.

## BOTTOM RESERVOIR

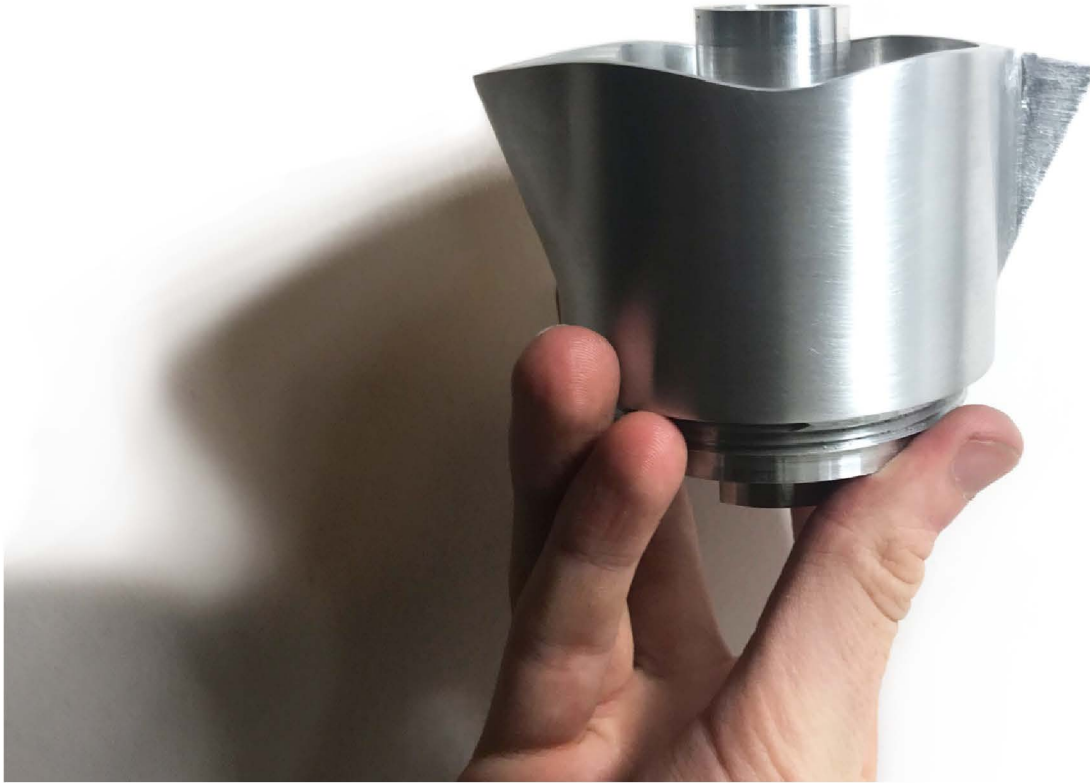
The water reservoir holds a high-temperature silicon o-ring used to seal at pressures up to 9 bar. Milled with a 1/2" flat endmill, 1/8" flat endmill, 3/8" ball endmill, and a 0.372" thread mill. The lower section of stock left on the water reservoir was used for work holding and will be turned down on a lathe.

*(see next page)*



## UPPER RESERVOIR

The upper section that the coffee percolates through was then milled (underside shown on the left). The main body is cylindrical with a spout extrusion on one side and a fixture point for a handle on the other. Threads are cut to match those in the bottom reservoir at 14 tpi. These tight threads help to create a strong seal for what essentially is a pressure vessel.



## UPPER RESERVOIR cont.

Both the bottom and top of the main body had to be CNC milled. This required an accurate coordinate system that could ensure that both cuts lined up perfectly even after the stock was flipped.

In order to achieve this, two flat edges were milled into the underside of the main body (see above), allowing for the block to be flipped and clamped in place before the second side was milled. The stock left at the bottom of the first cut was used to zero the x and y axes and ensured that the two cuts would align perfectly, giving even wall thicknesses around the piece.



Even though the cuts lined up nearly perfectly, there was still finishing work necessary to remove tool marks and inconsistencies. This was done with a hand file before moving onto sandpaper and abrasive pads.

## FINISHING BOTTOM RESERVOIR

As seen previously, the rectangular stock was left on lower reservoir before being turned down on a lathe. This process could have easily been completed on the CNC machine however I chose to go the more hands-on approach to finish the part.

## THE HANDLE

The handle design was iteratively prototyped in order to allow for easy pouring and an ergonomic form (foam prototypes not pictured). The handle pictured below was formed out of a scrap of cherry and takes the place of the final handle before a plastic replacement can be cast.



## BORING OUT THE CENTER

The center of the main body needed to be bored out completely to allow water to flow through, this was not done initially so I put it back on the CNC and bored out the channel, space for the coffee grounds, as well as threaded the top of the opening.



## FINAL CAP

The final cap was milled to catch any spray out at the top of the percolation chamber. With threads matching the top of the chamber it screws into place and forces the brewed coffee out of holes in the side of the main body.

