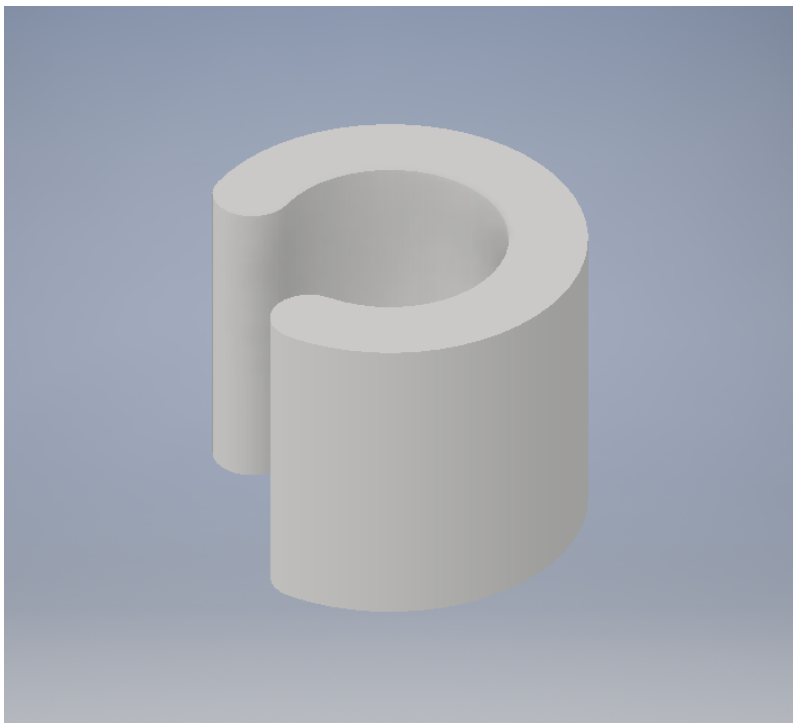
IRONMECHS 99157A

THE VEX CLIP-ON SPACER

2019 Make It Real CAD Engineering Challenge

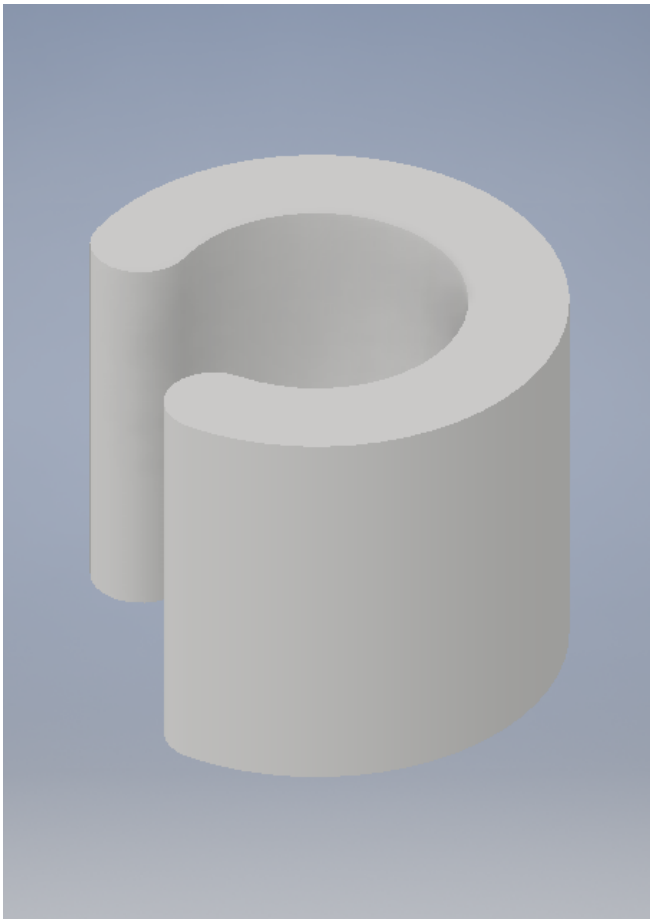


THE PROBLEM

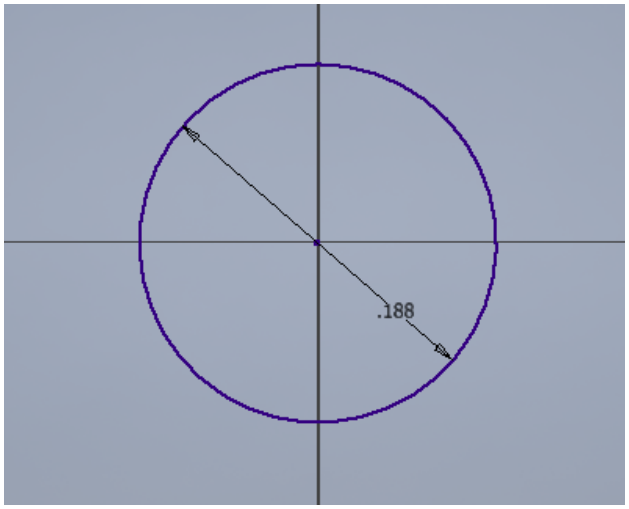
Building a robot is a time consuming process. Teams need every second they can get to improve and test their creation. A major problem that teams face is the issue of inserting spacers into tight corners or crevices. This scenario is all to familiar to many: You've been working on getting a particularly stubborn spacer on an axle. You're getting very close until... the whole axle falls out of your grip and you are back to square one. This struggle takes up valuable time that creators could be using doing other things, like programming or designing other parts. Our team has lived this scenario countless of times and is why we came up with this solution:

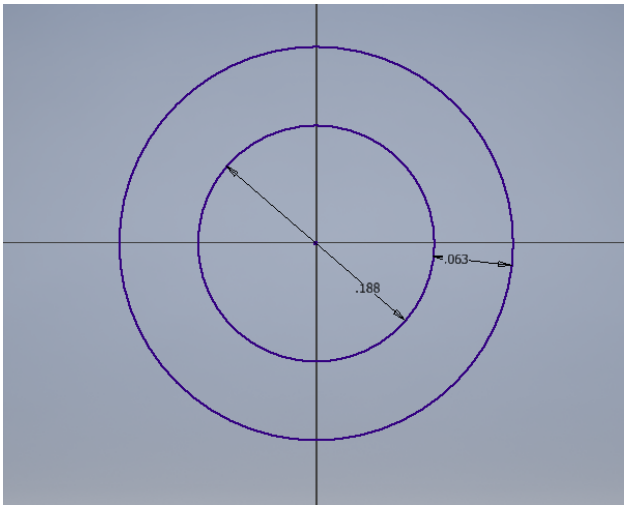
THE VEX CLIP-ON SPACER

This simple, yet innovative spacer can be slipped on without removing the axle from the part. No more having your entire gear assembly fall off the axle while you are trying to fit on a sixteenth! The "C" shape allows the spacer to be snapped on easily. At the same time, this shape prevents the spacer from falling of - even from vigorous shaking. This spacer can come in a variety of sizes, from 1/32" all the way up to 1".



BUILDING PROCESS





STEP 1

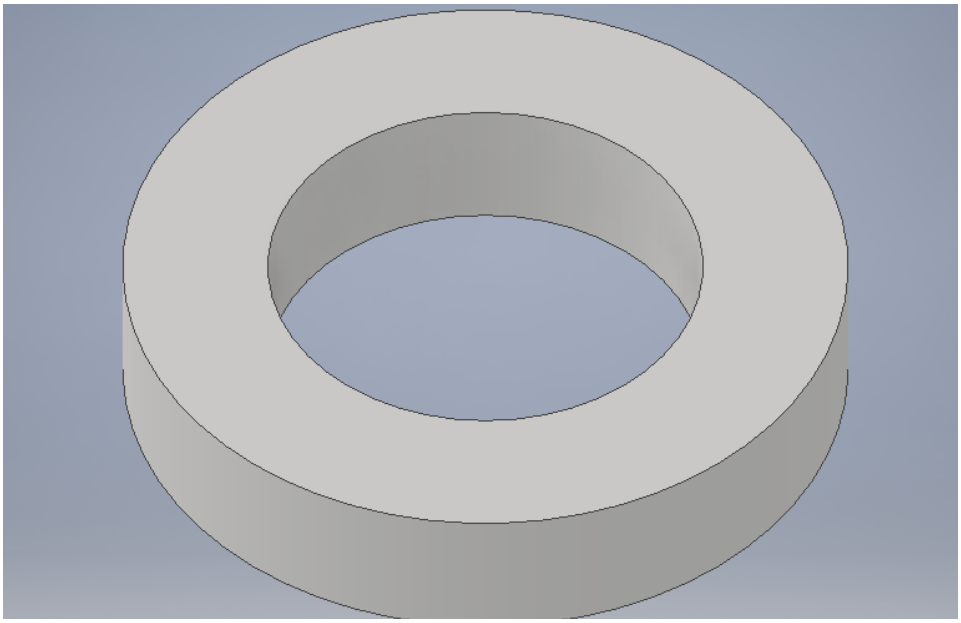
Create inner circle for the axle and outer circle for extrusion

We used Autodesk Inventor Professional 2019 to create the VEX Clip-On Spacer

We started out by creating a sketch and using the Circle tool to create a inner circle. Its dimensions are the size of the VEX Shaft (1/8 or .125") plus 1/16" so the axle can slide in easily

After creating the inner circle, we made another outer circle. This circle is a 1/16" away from the inner circle. These circles will be used to extrude the shape of the spacer

BUILDING PROCESS CONT.

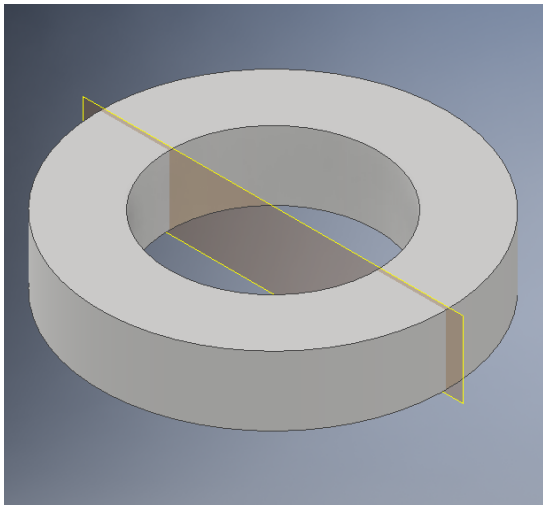


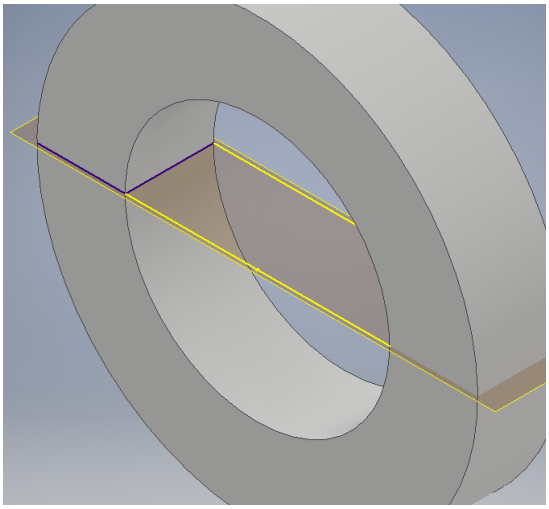
STEP 2

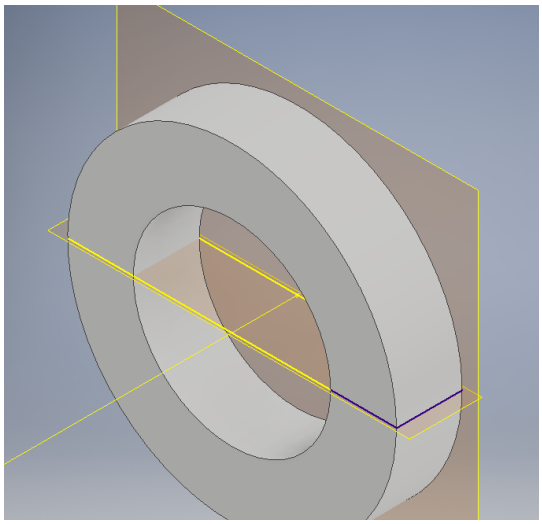
Extrude sketch to desired spacer length

In the upper tab, under the 3D Model tab, we used the Extrude tool and selected the sketch we made in the previous step. We then extruded the sketch to 1/16". This value can be changed to match the needs of a specific design.

BUILDING PROCESS CONT.







STEP 3

Create cutout so the spacer can be snapped onto axle

STEP 3 CONT.

To create the cutout so the spacer could be snapped onto an axle, I went to the sidebar, clicked on the Origin drop-down, right-clicked on YZ Plane and enabled visibility.

I then started a new sketch on this plane. In the sketch, I created a rectangle that outlined the place where the spacer and YZ plane intersected.

After, I went to the Point tool and selected Center Point of Loop of Edges. Using this tool, I created a point that was in the center of the hole of the spacer.

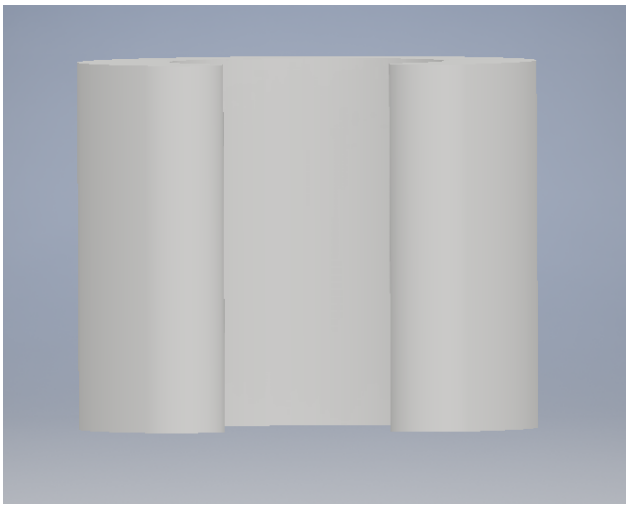
Next, I went to the Origin folder and instead right-clicked on the XZ plane and enabled visibility.

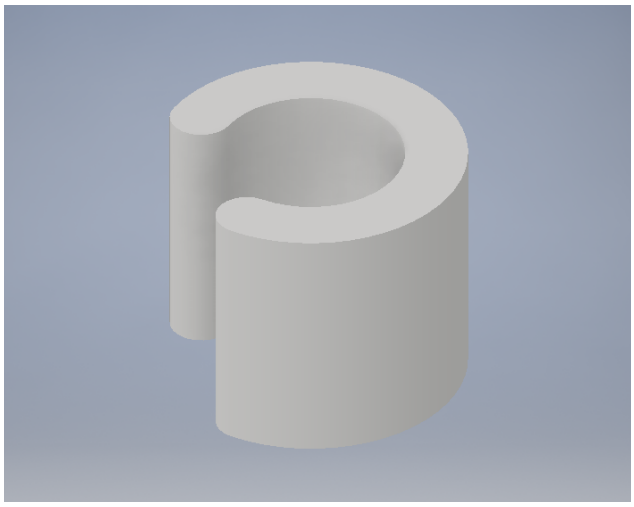
In the axis tool, I selected Normal to Plane through Point and made an axis through the point and the XZ Plane. This axis is through the center of the spacer.

I went to the upper tab and clicked revolve. I selected the rectangle for the Profile and the axis that sent through the spacer. In the Extents box, I selected Angle and typed in 60 degrees.

This cut out a section of the spacer. Using the Fillet tool, I clicked on the edges of the cut and used a 1/32 fillet.

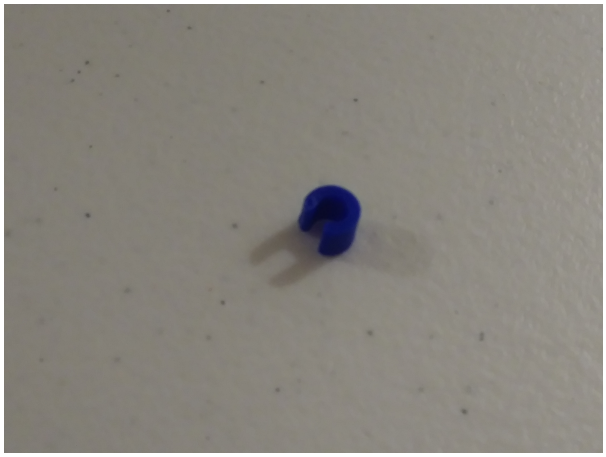
FINAL PRODUCT

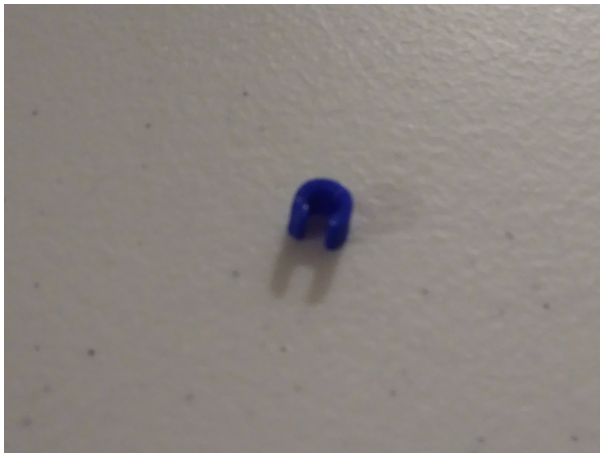




3D PRINTED PROTOTYPE

Our team was able to test our design with a 3D printed prototype. We printed our part using the Flashforge Finder 3D printer. Below are some images of our prototype:





CONCLUSION

At the beginning of designing this part, we thought it was going to be very easy to build. We were proven wrong as many factors affected the quality of the spacer. The angle of the clip opening was a difficult part to get right. Often times, our opening would be too big and the spacer would fall off. Also, the print settings also affected how the spacer worked. A spacer that was printed with thinner layers on a raft (platform) worked better than a spacer that was printed with thicker layers on no raft. If this part were to be manufactured, these problems would be eliminated because of the uniform mold.

The skills gained in making this part are invaluable, we have learned so much about Autodesk Inventor. These skills will definitely help us in the future, both on our robotics team and in our careers.