AUTODESK®
INVENTOR®

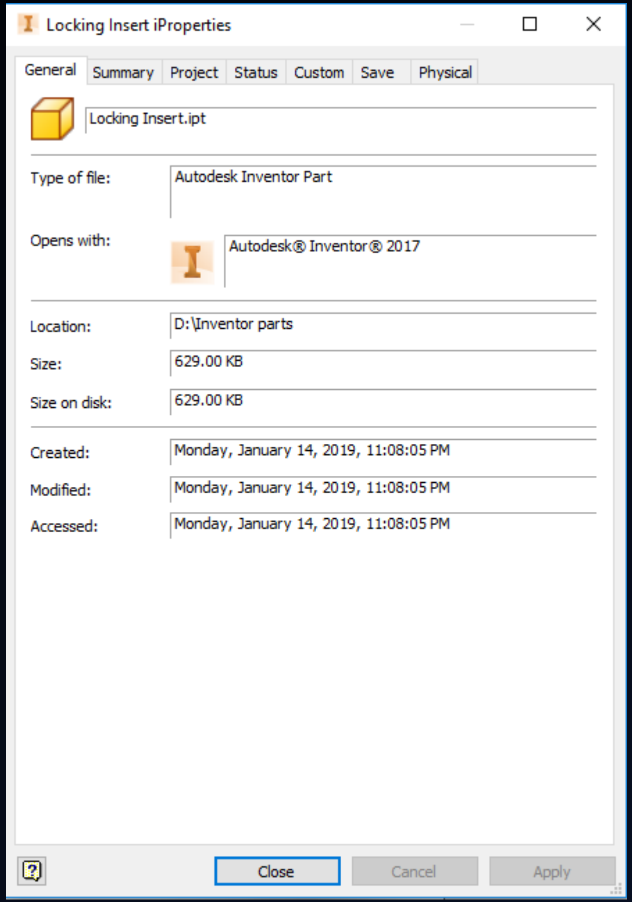
790X

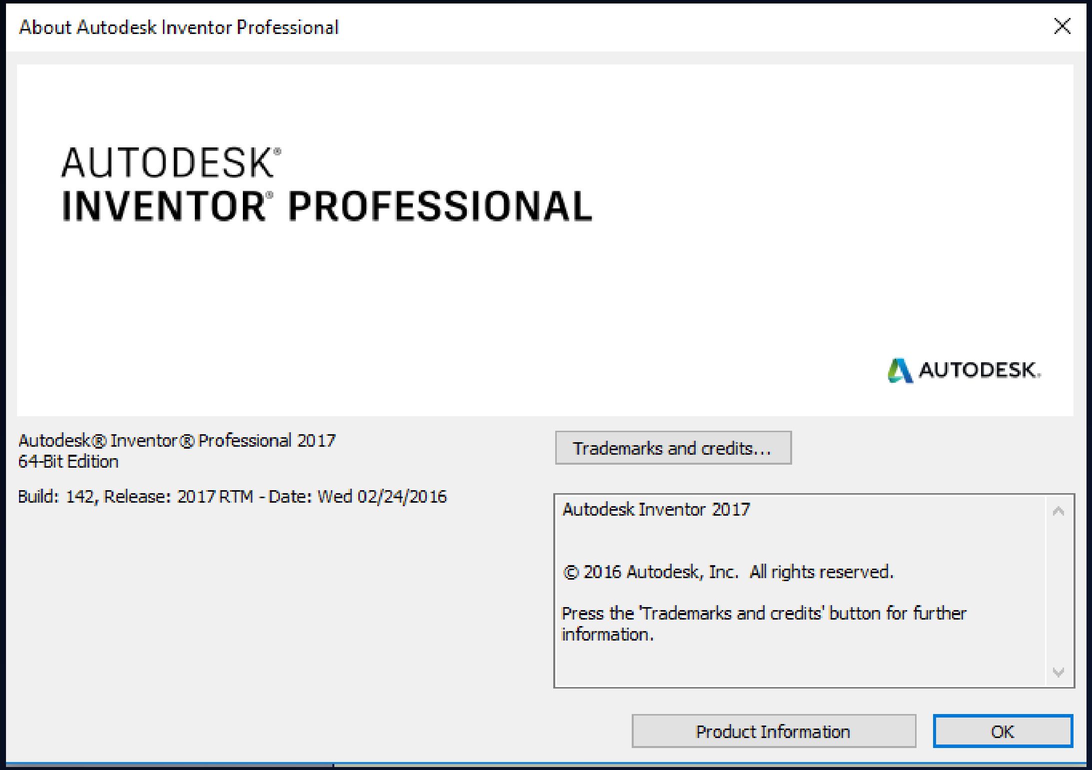
LOCKING GEAR INSERT

VEX ROBOTICS

AUTODESK

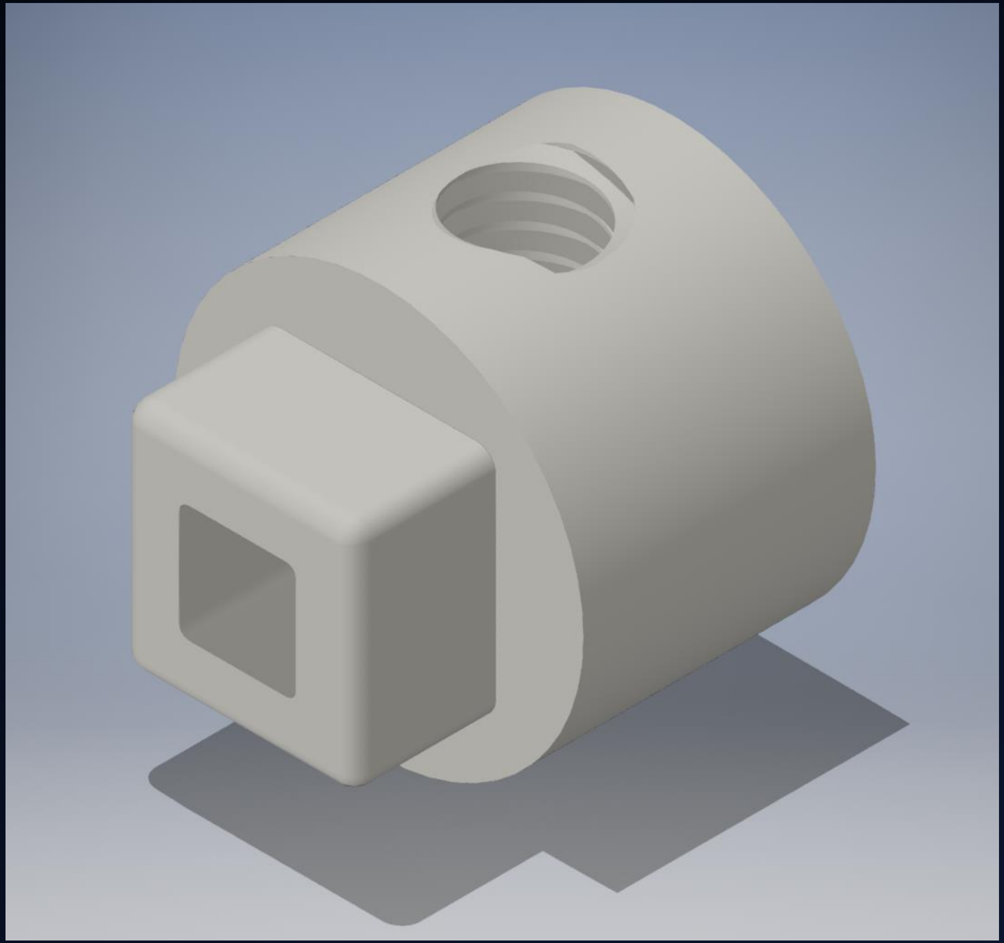
VERSION INFORMATION





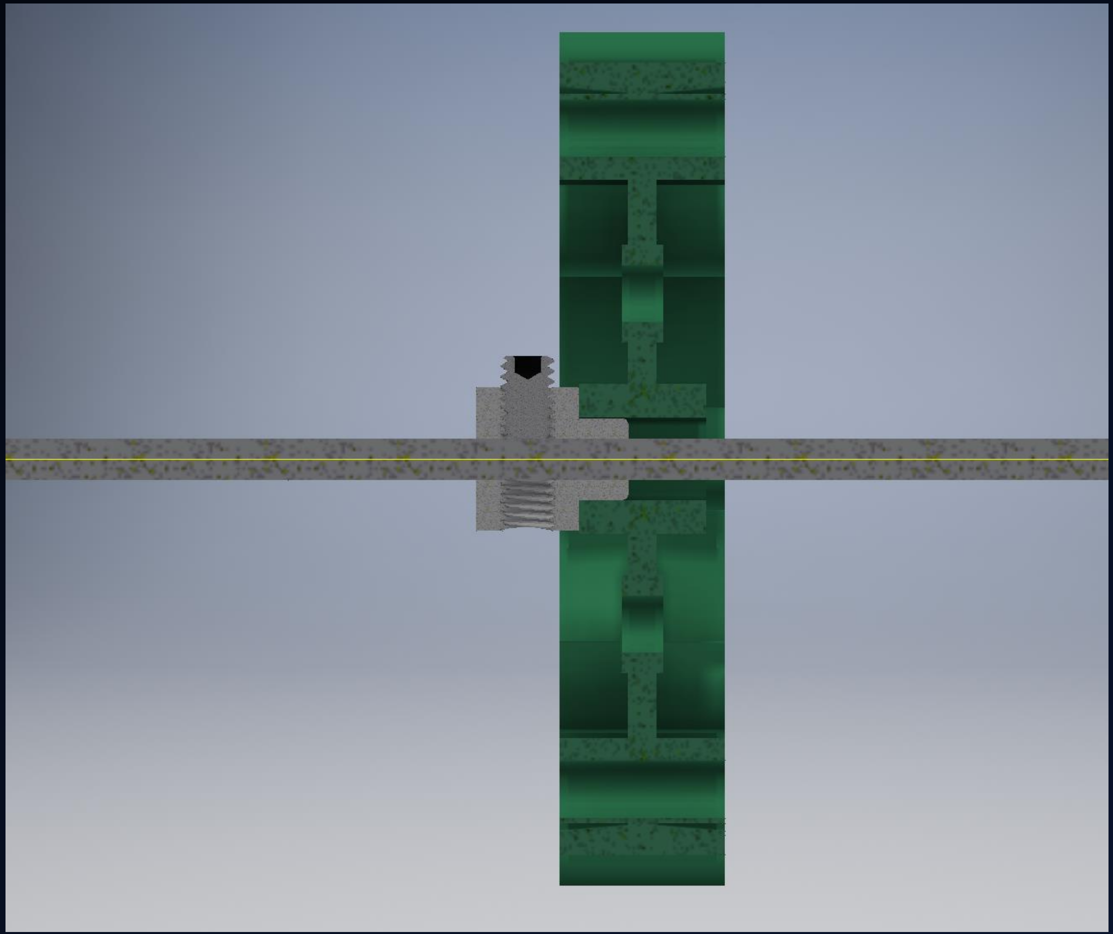
PART OVERVIEW

- The part we created is, essentially, a combination of two existing vex products, combined to make a more concise, efficient, simpler part. In short, it is a lock collar with a head that allows it to be inserted into any VEX gear or sprocket system. Once inserted into a gear or sprocket, any axle passing through can be locked into place by #8-32 screws placed on either side. This keeps the gear in place, and prevents it from moving around on the axle.



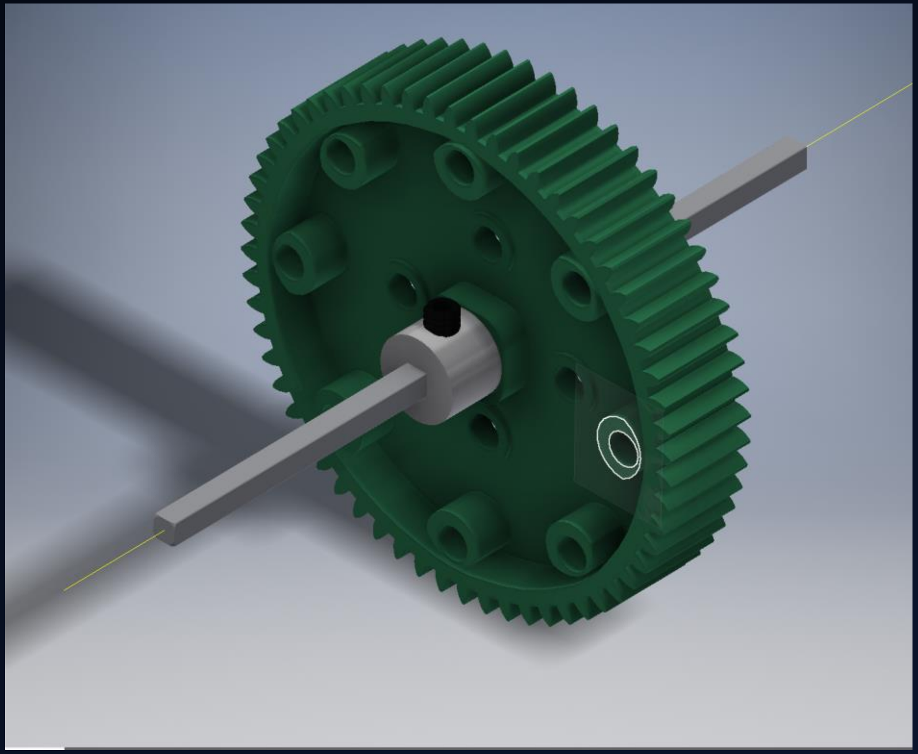
WHY?

- One problem we noticed when designing our robots was gears and sprockets consistently moved around on axles, and required shaft collars to keep them in place.
- Our part combines the inserts that are already placed inside the gear, with the shaft collars needed to keep them in place. This means only one part would be needed where two once were.



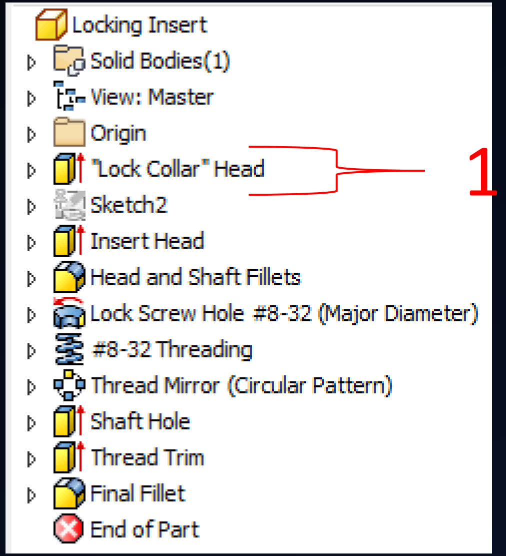
BENEFITS

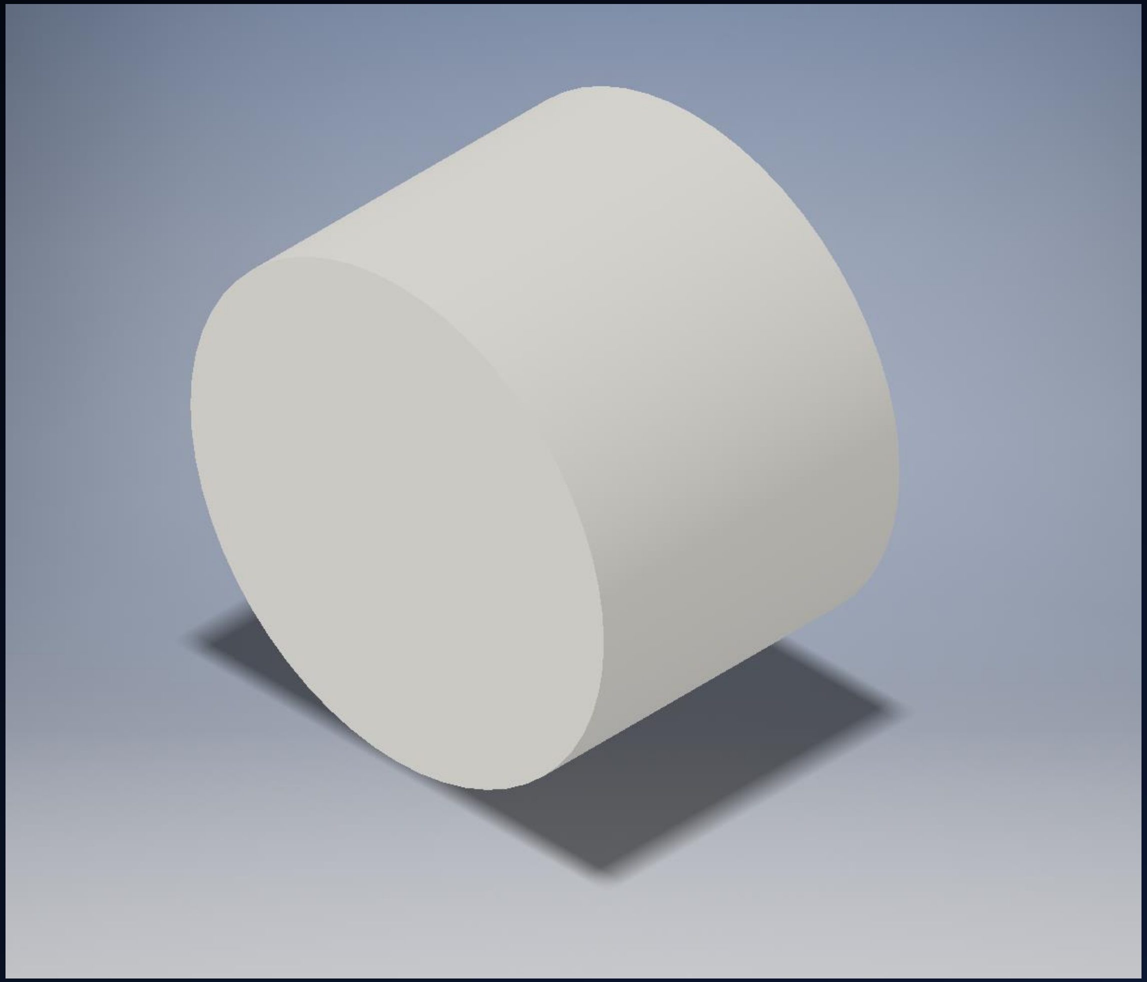
- By attaching the shaft collar to the gear or sprocket, it will ensure the two stay together. Previously, the two parts would manage to wiggle themselves apart and end up sliding around over time. This means more maintenance is required on a robot, and with dozens of shaft collars on robots, valuable time is wasted. Keeping the two fixed together solves this problem.
- Since the part utilizes the existing dimensions for both the shaft collars and gear insets, the manufacture of this new part would be a simple switch.
- Furthermore, only one part would need to be manufactured, as opposed to 2, since the Locking Gear Inserts can be used as normal Lock Collars as well.



HOW WAS THE PART CREATED?

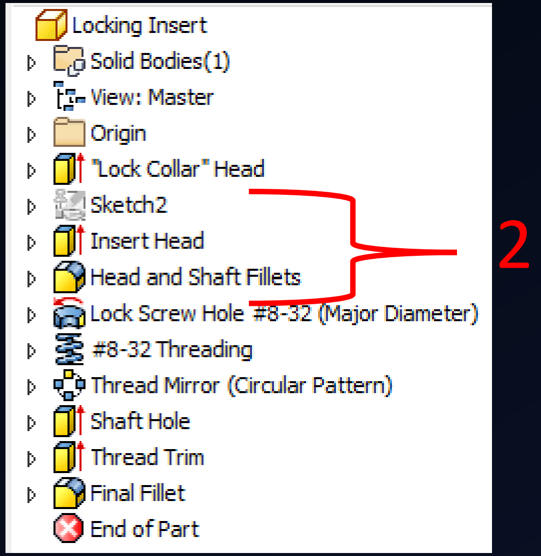
- 1) First, a simple cylinder was made as the base. This part is dimensionally identical to existing VEX lock collars, with a .05" more added to the thickness to account for spacing with the gear.

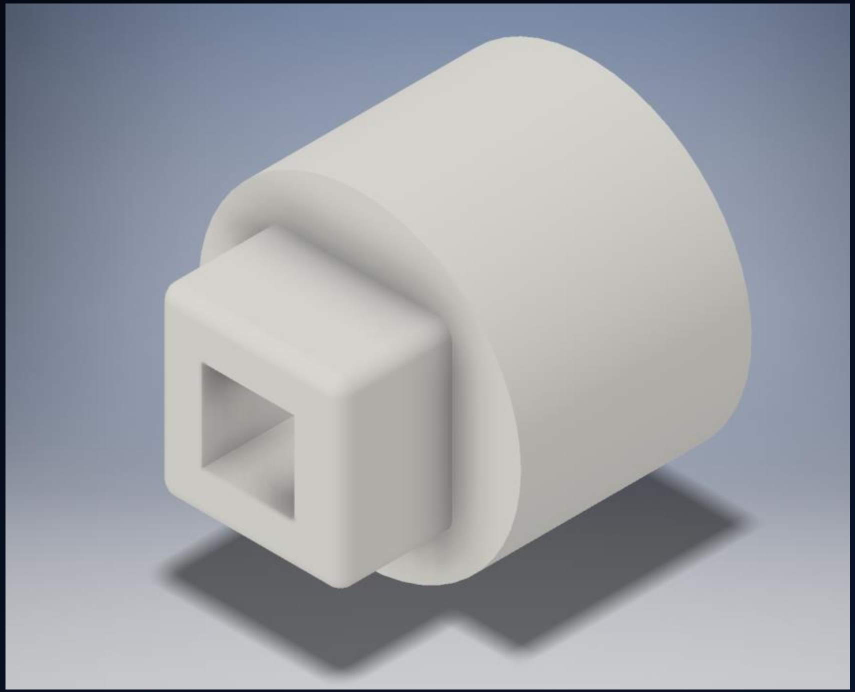




HOW WAS THE PART CREATED?

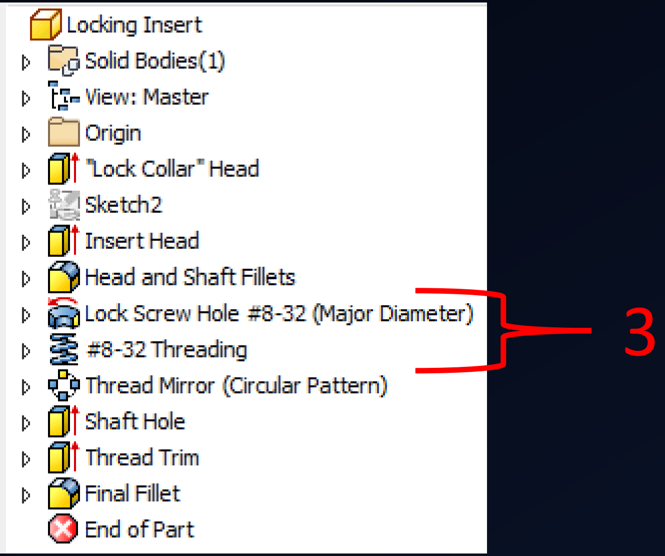
- 2) Next, a nub was extruded from the cylinder. This is the part that would be inserted into the gear or sprocket. Fillets are added on the edges to allow for easy insertion.

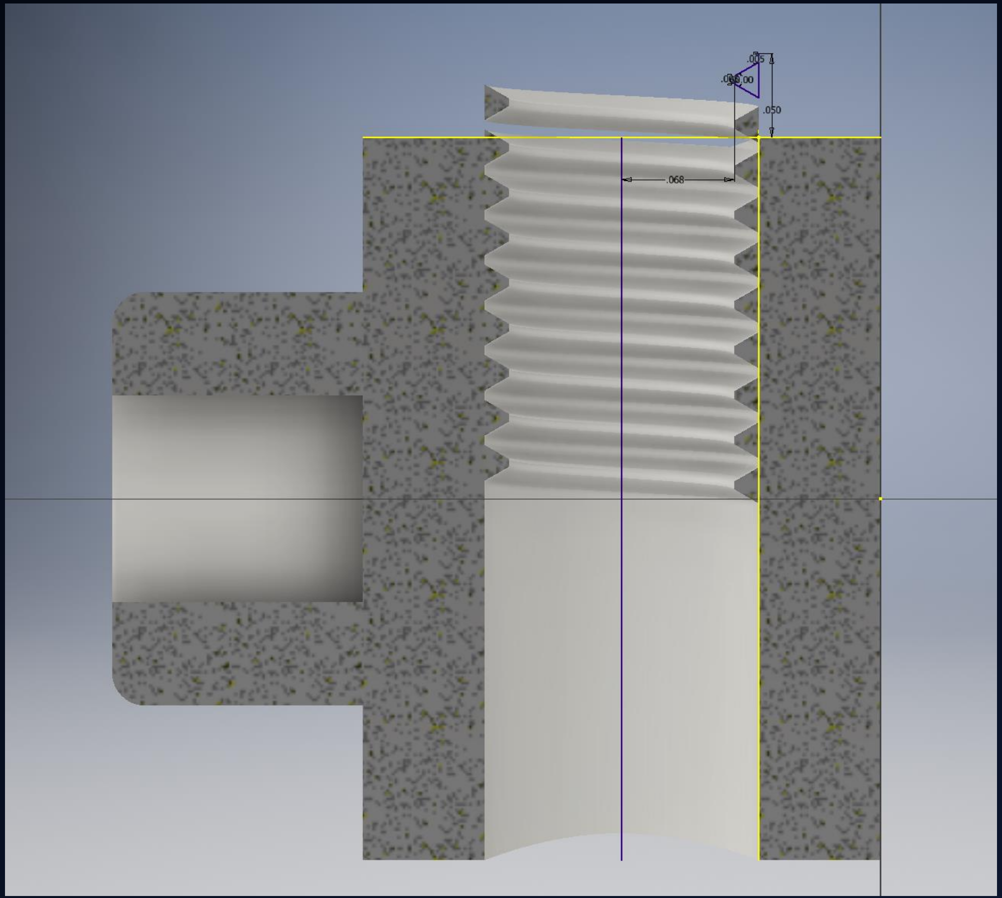




HOW WAS THE PART CREATED?

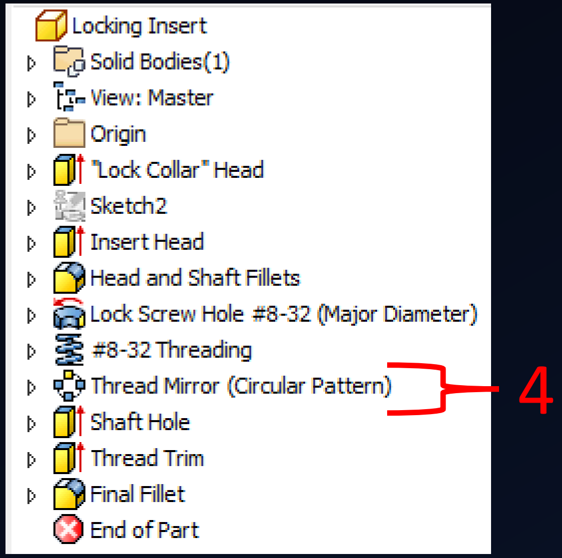
- 3) Following, a hole was drilled through the center of the cylinder for either single or dual #8-32 screws to sit in. The threads were created by drawing out a single thread in accordance to UNC guidelines, and using a coil to wrap them along the cylinder's walls. Extra threads were added to the top to be trimmed off later for a flush fit.

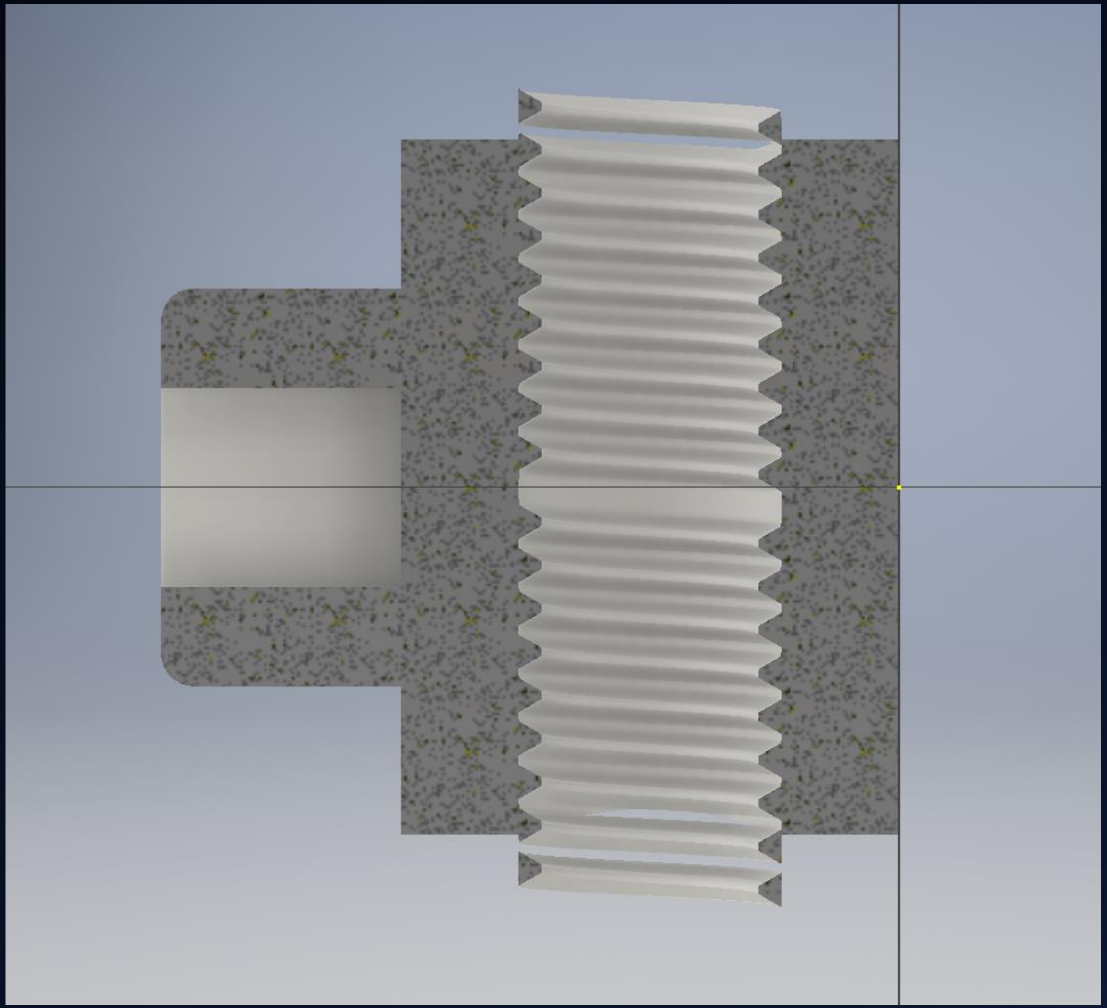




HOW WAS THE PART CREATED?

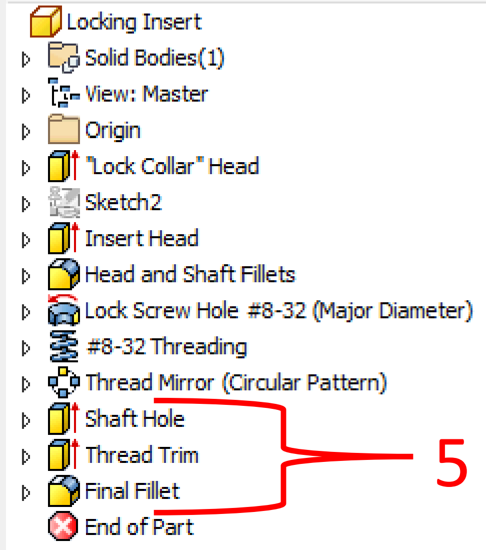
- 4) The threads of the screw need to be placed on the other side of the hole. However, simply extending the threads all the way through, or mirroring the threads will result in one side having screws spin counter-clockwise. As a result, a circular pattern is used. This allows both sides to put screws in clockwise.

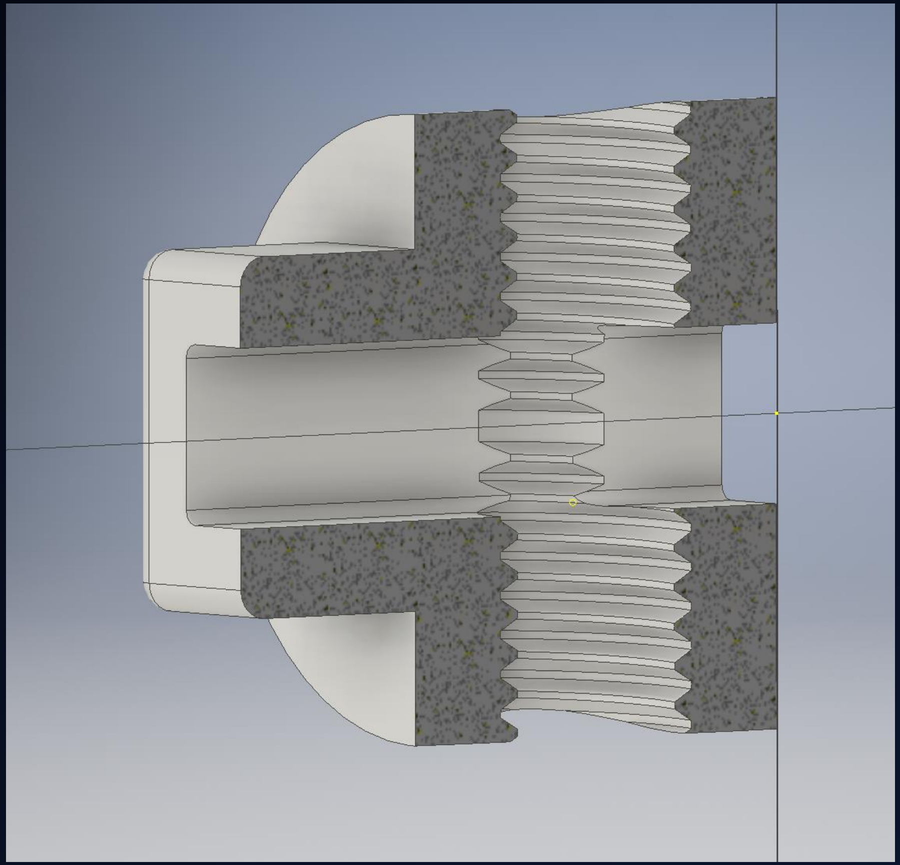




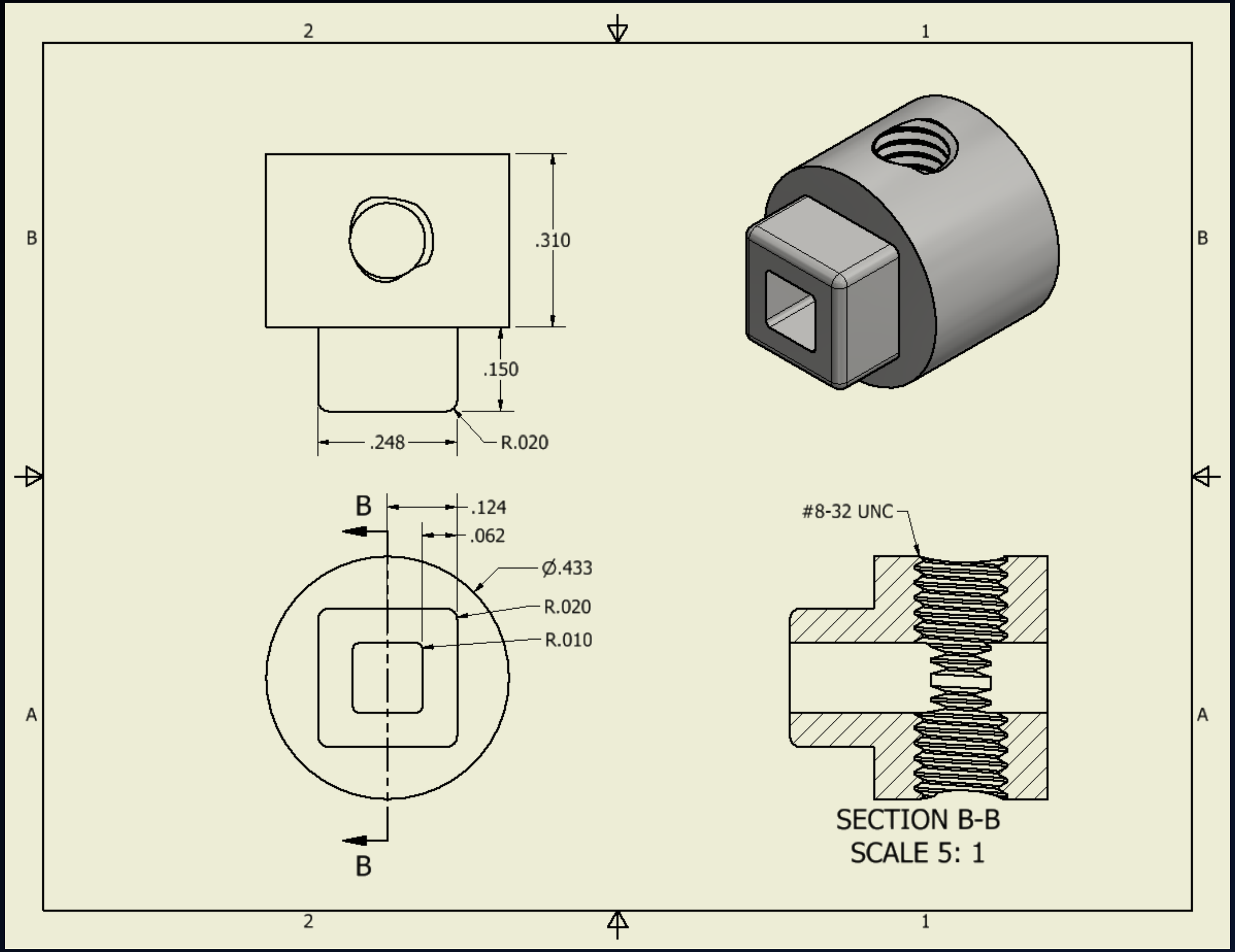
HOW WAS THE PART CREATED?

- 5) In the final steps, the hole for the shaft is extended all the way through the part. The excess threads on the outside of the cylinder are shaved off, making the threads flush against the rounded edges. Small fillets are also added to the inside of the shaft hole.



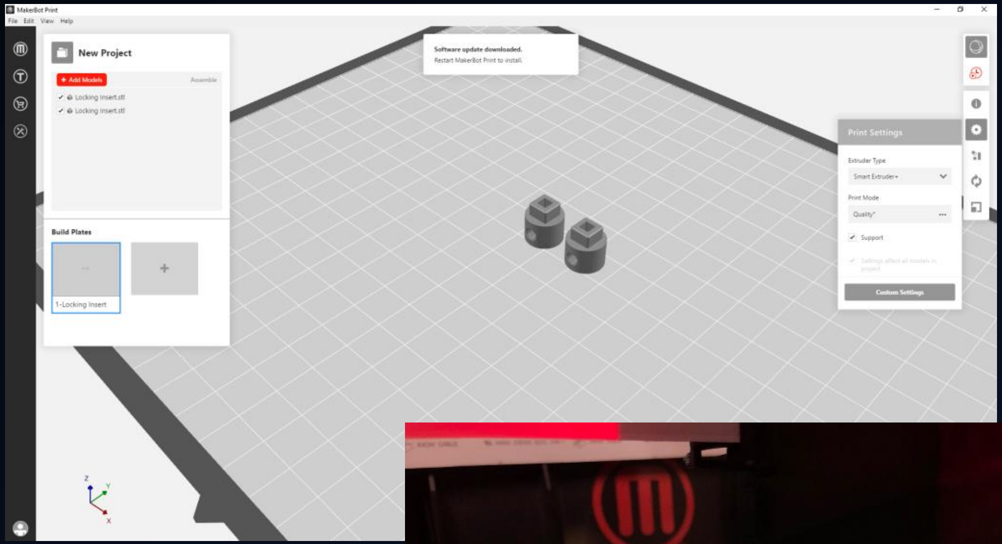


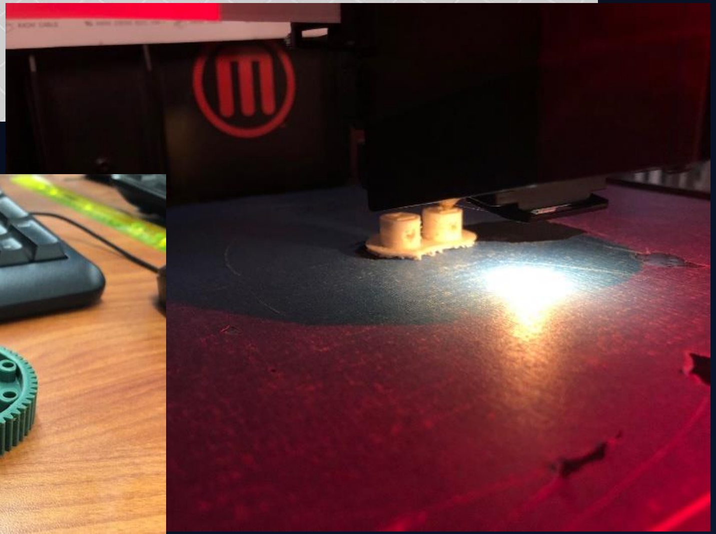
FINAL DRAWING



3D PRINTING

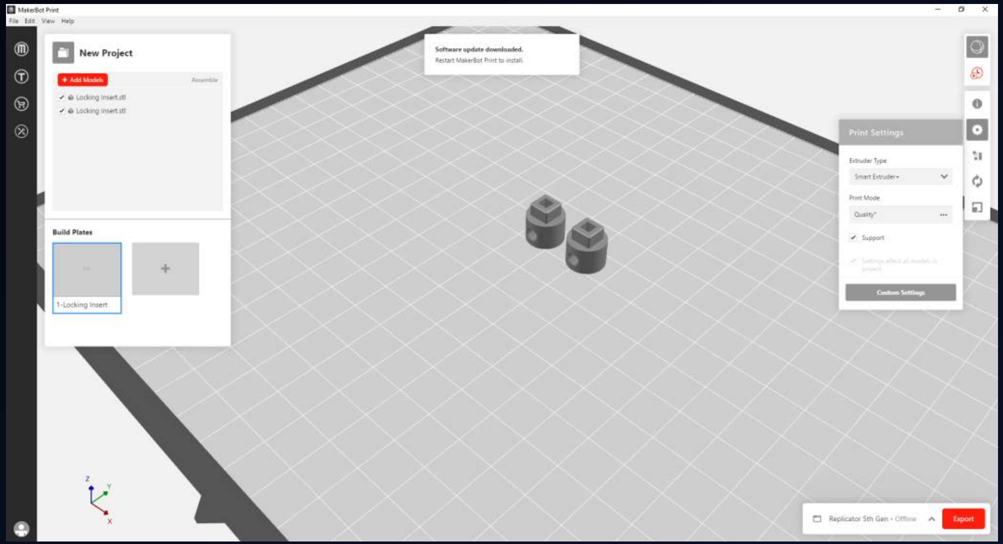
- After the part was drawn in Inventor, we exported it as an STL. Using the STL file, we placed, and arranged the parts in Makerbot Print, to allow us to print on our Makerbot Replicator 5th Gen. We set the settings to have smaller layer heights and thicker infill to allow the small walls of the part to have as much detail and reinforcement possible.





PART FUNCTIONALITY

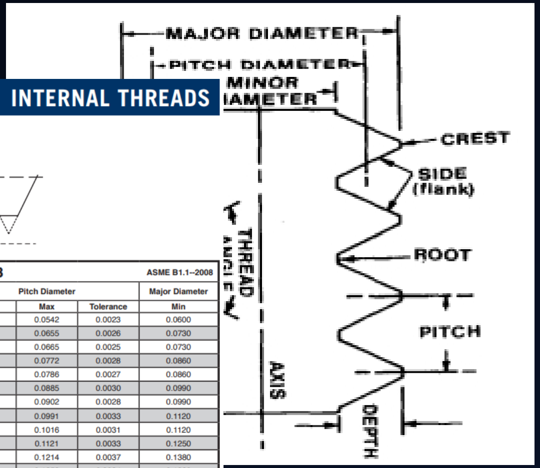
- The 3D part worked well as a rough prototype. The axles and screws had some issue being placed in the part, due to the limits of the 3D printer's precision. Normally, a large scale manufactured part would be much more precise, and the fitting issues wouldn't be a problem. 3D Printing is an incredibly useful tool nonetheless, especially in robotics. It allows someone to rapidly prototype a part in a short period. It only took around 45 minutes for us to create a fully working prototype of our lock collar. In the future, ideas for parts, or even temporary replacement parts, could be quickly taken from the drawing board to reality, through the use for CAD software and 3D printers.

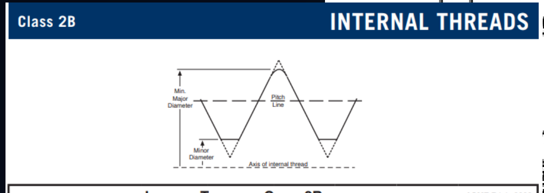


VEX ROBOTICS

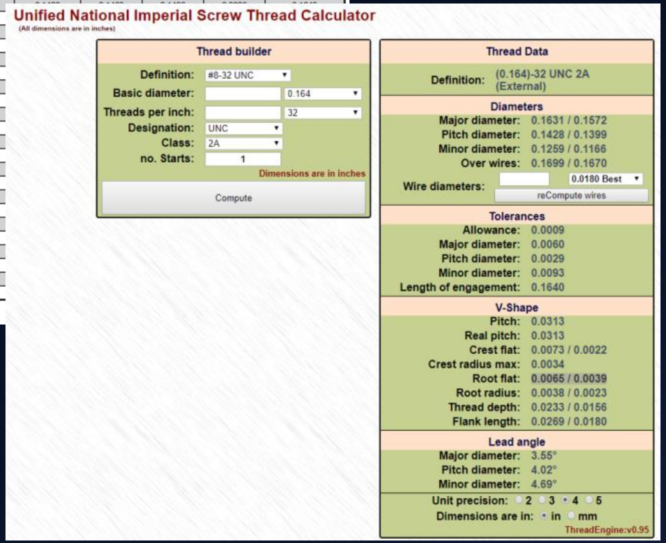
WHAT WE LEARNED

- To create this part, we wanted to make realistic 3D threading, so when the part was printed, the threads could be used. In order to do so, we needed to learn to read UNC charts, and use the dimensions and information given to recreate threads. We learned that the Major and Minor diameters are the uppermost and lowermost extremes of the threads. We also learned what each number in a UNC chart means (Ex: in #8-32, refers to the size of the screw, and the 32 means there are 32 threads per inch). This information will be useful in an engineering career, as making nearly anything requires the use of screws, nuts, and bolts. Knowing how to create threading, and read and understand measurements on technical documentation, is a critical skill needed to succeed in an engineering field.





INTERNAL THREADS - CLASS 2B							ASME B1.1--2008
Nominal Size & Threads per Inch	Series Designation	Minor Diameter		Pitch Diameter			Major Diameter
		Min	Max	Min	Max	Tolerance	Min
0-80	UNF	0.0465	0.0514	0.0519	0.0542	0.0023	0.0600
1-64	UNC	0.0561	0.0623	0.0629	0.0655	0.0026	0.0730
1-72	UNF	0.0580	0.0635	0.0640	0.0665	0.0025	0.0730
2-56	UNC	0.0667	0.0737	0.0744	0.0772	0.0028	0.0860
2-64	UNF	0.0691	0.0752	0.0759	0.0786	0.0027	0.0860
3-48	UNC	0.0764	0.0845	0.0855	0.0885	0.0030	0.0990
3-56	UNF	0.0797	0.0865	0.0874	0.0902	0.0028	0.0990
4-40	UNC	0.0849	0.0939	0.0958	0.0991	0.0033	0.1120
4-48	UNF	0.0894	0.0968	0.0985	0.1016	0.0031	0.1120
5-40	UNC	0.0979	0.1062	0.1088	0.1121	0.0033	0.1250
6-32	UNC	0.104	0.114	0.1177	0.1214	0.0037	0.1380
6-40	UNF	0.1110	0.1190	0.1218	0.1252	0.0034	0.1380
8-32	UNC	0.130	0.139	0.1437	0.1475	0.0038	0.1640
8-36	UNF	0.1340					
10-24	UNC	0.145					
10-32	UNF	0.156					
12-24	UNC	0.171					
1/4-20	UNC	0.196					
1/4-28	UNF	0.211					
5/16-18	UNC	0.252					
5/16-24	UNF	0.267					
3/8-16	UNC	0.307					
3/8-24	UNF	0.330					
7/16-14	UNC	0.360					
7/16-20	UNF	0.383					
1/2-13	UNC	0.417					
1/2-20	UNF	0.446					
9/16-12	UNC	0.472					
9/16-18	UNF	0.502					
5/8-11	UNC	0.527					
5/8-18	UNF	0.565					
3/4-10	UNC	0.642					
3/4-16	UNF	0.682					
7/8-9	UNC	0.755					
7/8-14	UNF	0.798					



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