

Longboard Truck Design Portfolio

By Jacob LaRue

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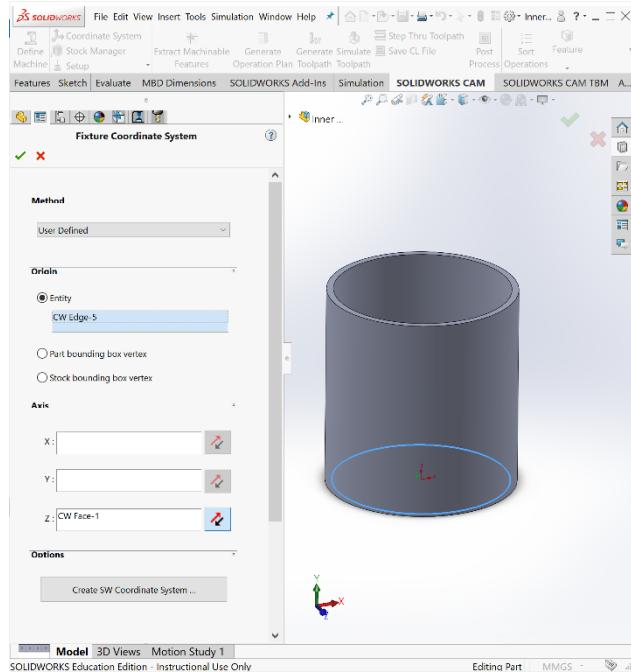
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- Hand Drawings
- Solidworks Drawings

Choice of Object – Longboard Truck

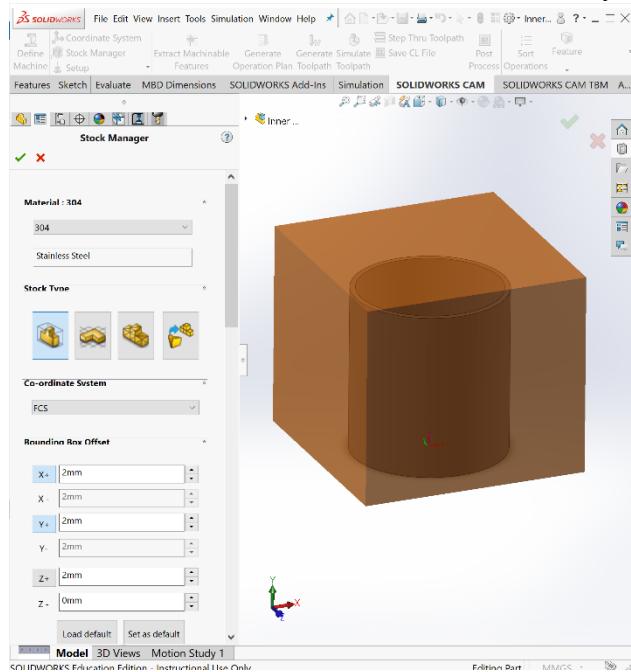


CNC Manufacturing Steps of Inner Metal Ring of Wheel

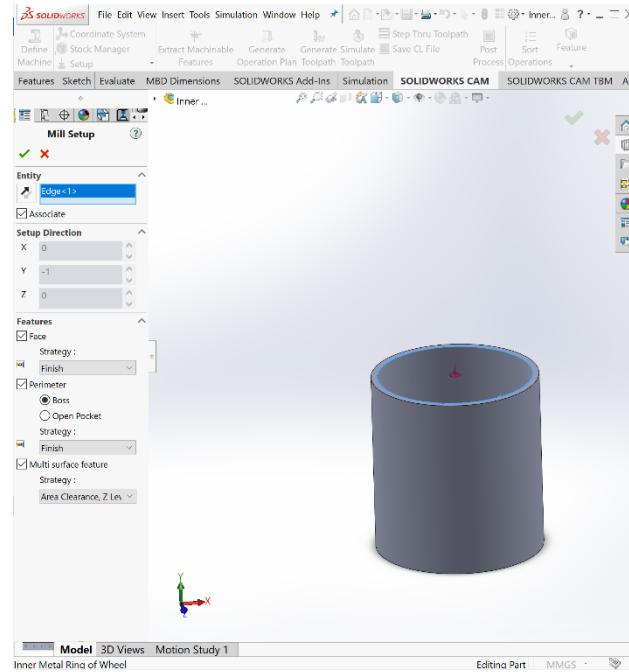
1. Click Define Machine – use 3-axis mill, with the metric system
2. Click Coordinate System – set the origin to the center of the cylinder at the bottom, align positive z-axis up through cylinder



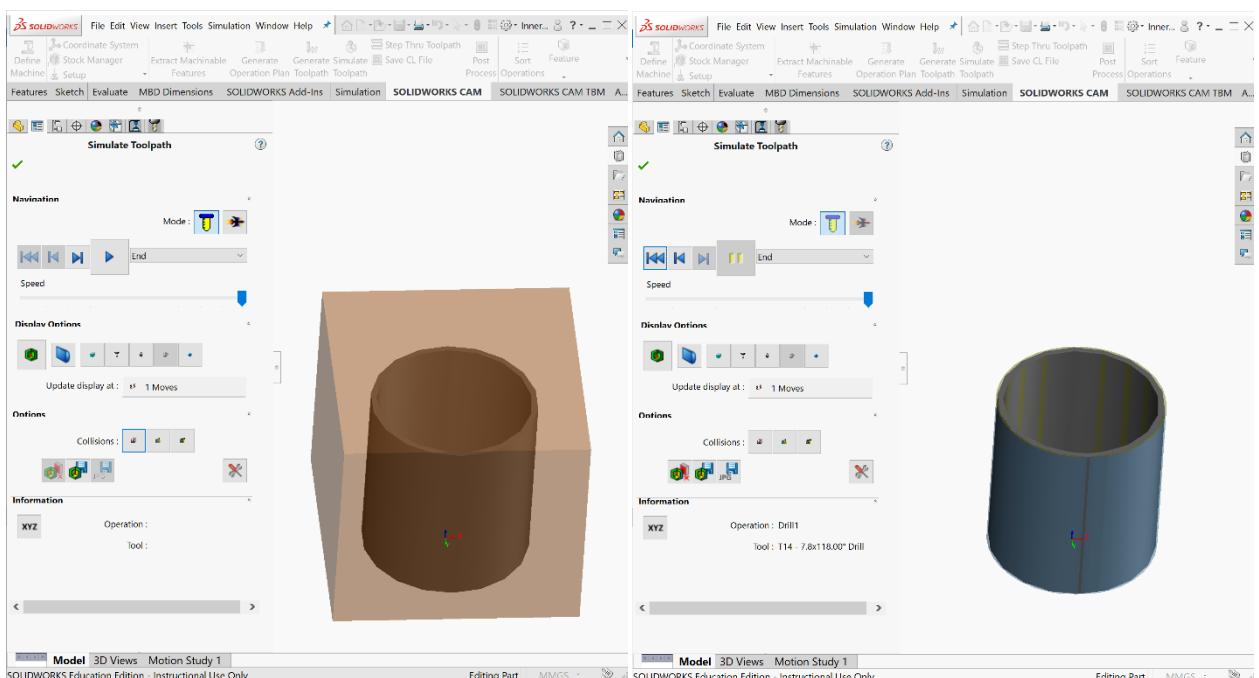
3. Define the stock material used for the part. This Part is SS AISI 440C, but Solidworks doesn't have this material, so a close option would be 304, which is also stainless steel. Make sure to use the user defined coordinate system from Step 2



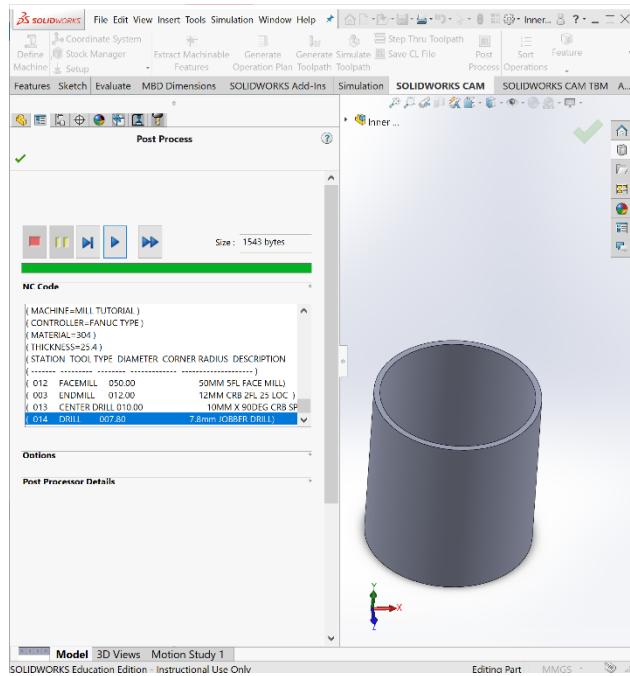
4. Click Setup -> Mill Setup – Set the mill starting position to the center of the cylinder, check the face, perimeter, and multi-surface features, with the finish option for the first two and area clearance, Z level for multi-surface.



5. Click Extract Machinable Features, then Generate Operation Plan, then Generate Toolpath.
 6. Simulate Toolpath – Under options, enable pause on collision for the tool holder and tool shoulder, ignore collision for tool. Run the simulation to check that the part is made with no collisions.

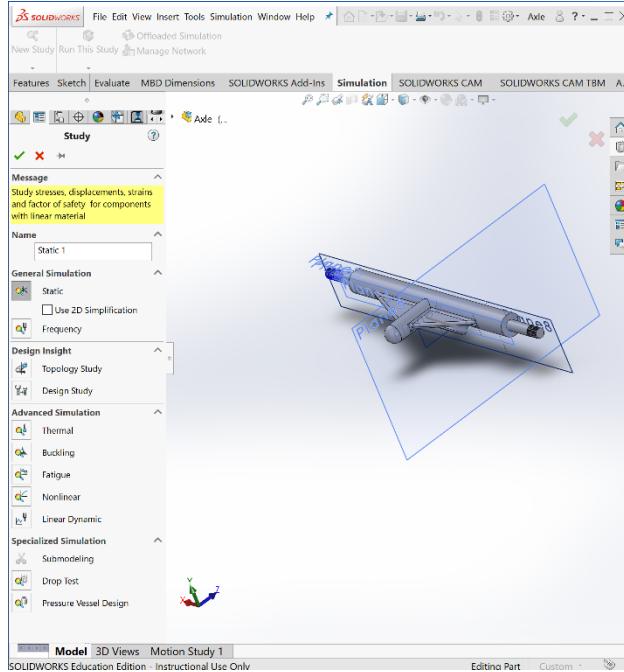


7. If there are collisions, adjust the tools used until no more collisions occur.
8. When the CAM software is fully functional, click post process and save the CAM file. Press play in the new window to generate the G-Code. Save all files.

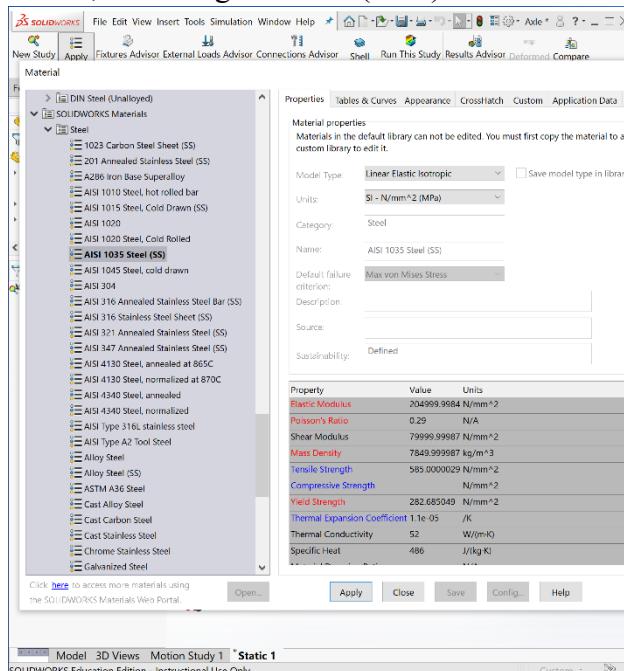


Force Load FEA Simulation Steps of Axle

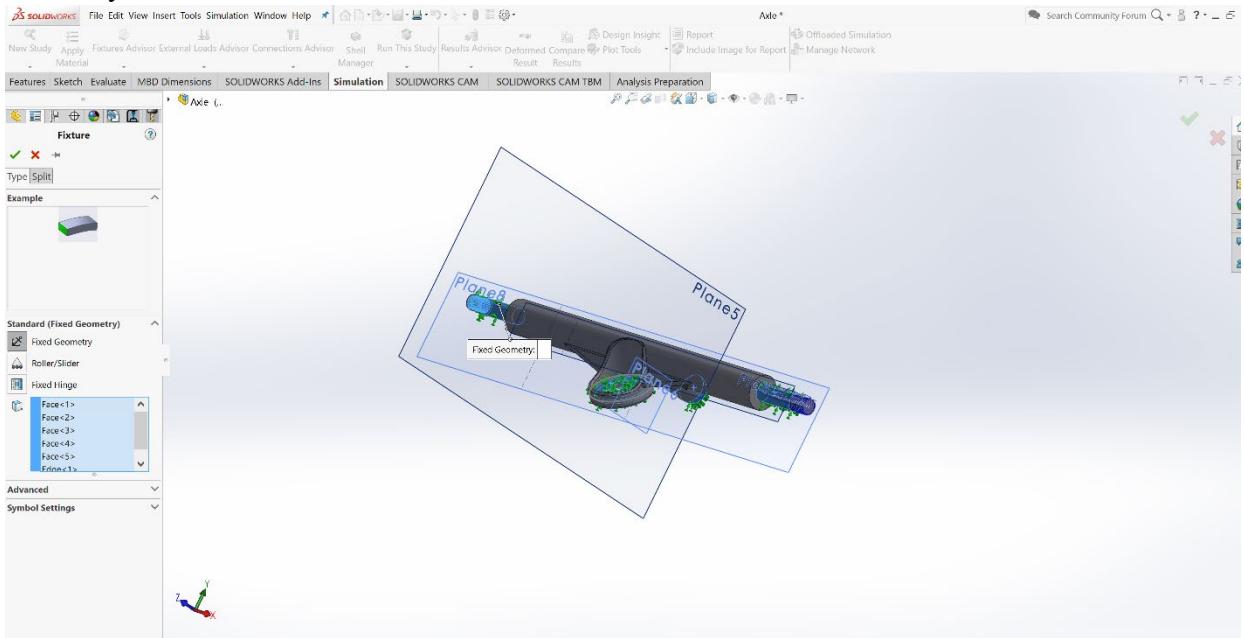
1. Click Simulation on the task bar with Feature, Sketch, Evaluate, etc. If its not there, go to Tools -> Add-ins, then check Solidworks Simulation.
2. Run a New Study, make sure it is a static study and give the study a name.



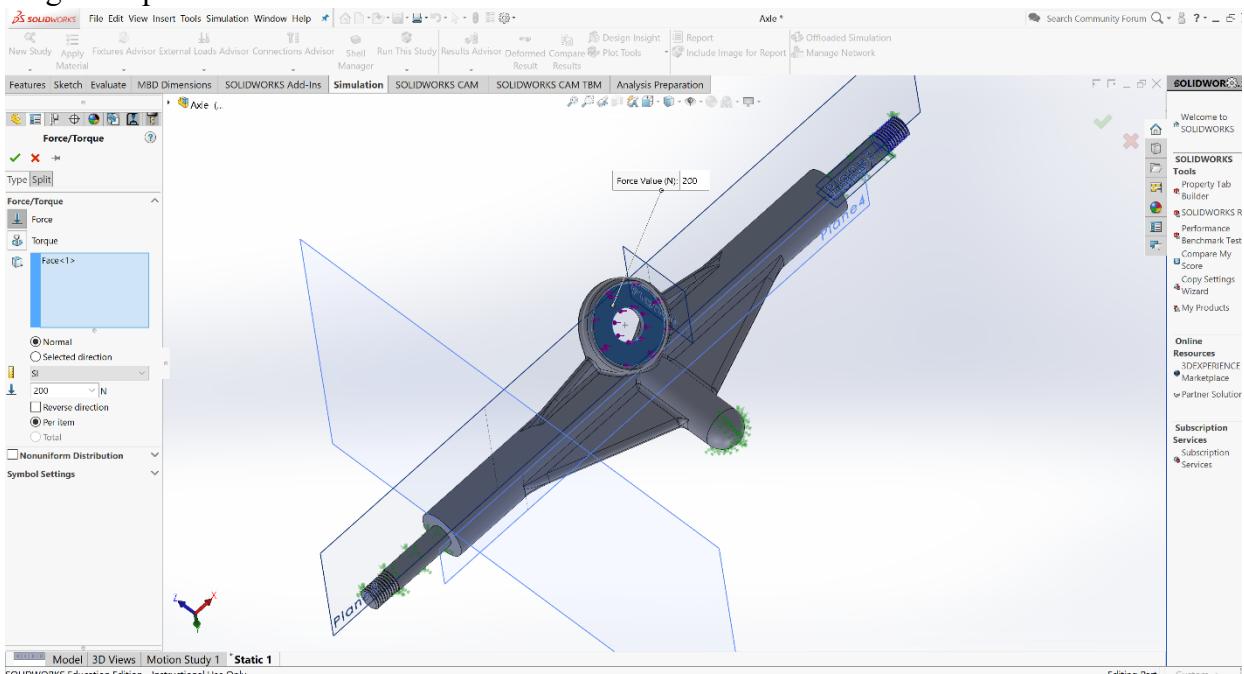
3. Click Apply Material, search for the part's material, I assumed the axle to be made of SAE/AISI 1040 Steel, choose the closest option, AISI 1035 Steel. Use units of your choice, I'm using N/mm^2 (MPa).



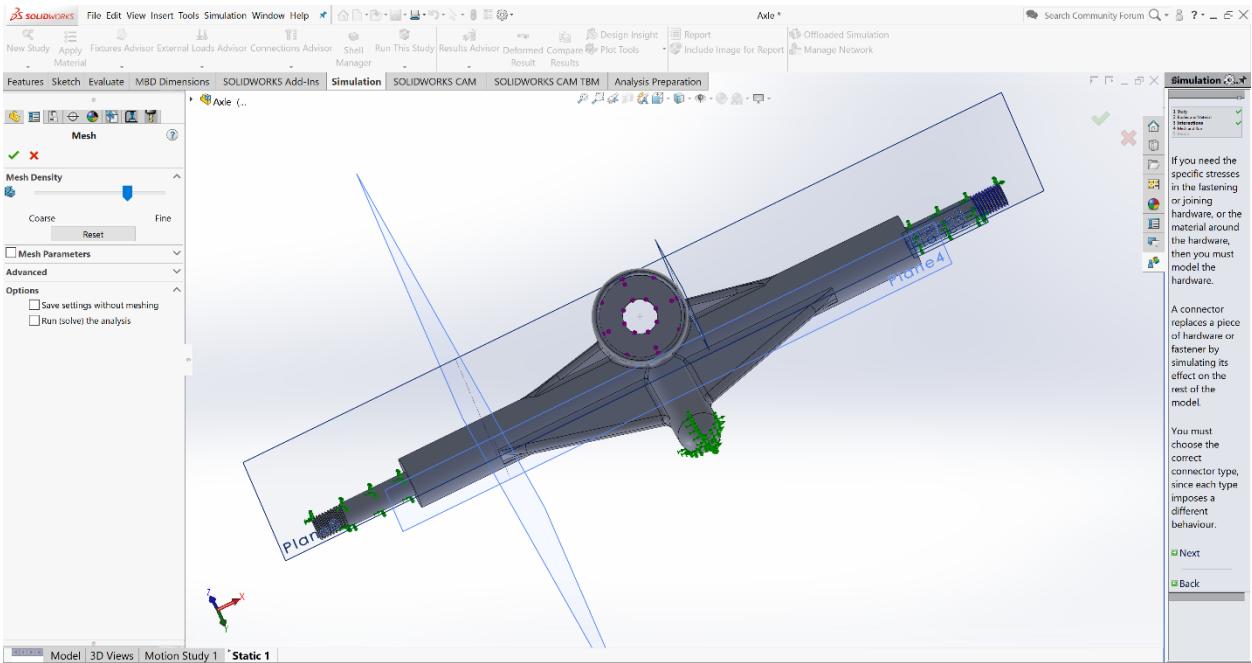
4. In the Feature Tree, right click on Fixtures and select what type of fixture you want to put on the part. I put Fixed Geometries at the axle's connecting points to the rest of the assembly.



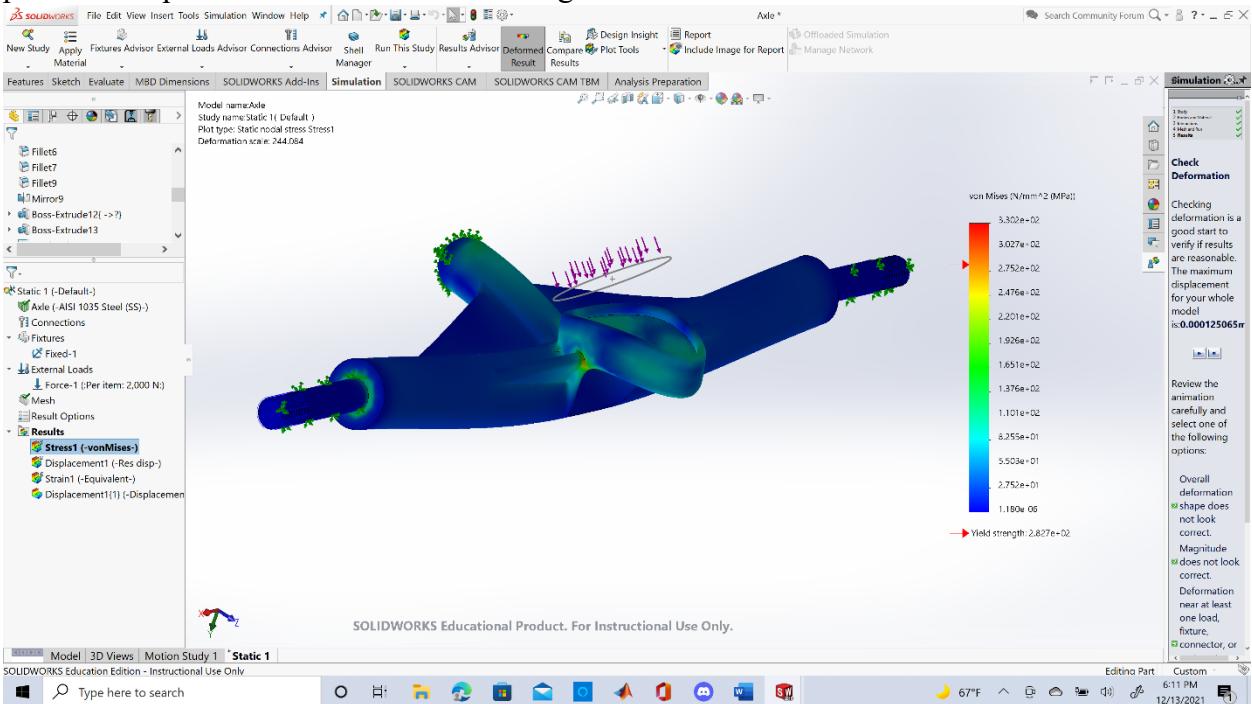
5. To add a force to the part, right click on External Loads in the Feature Tree, then click force. Determine a point or surface you want the force to act on, units, direction, and magnitude. I added a force acting on the surface shown here, where the weight of the longboard pushes down on it.



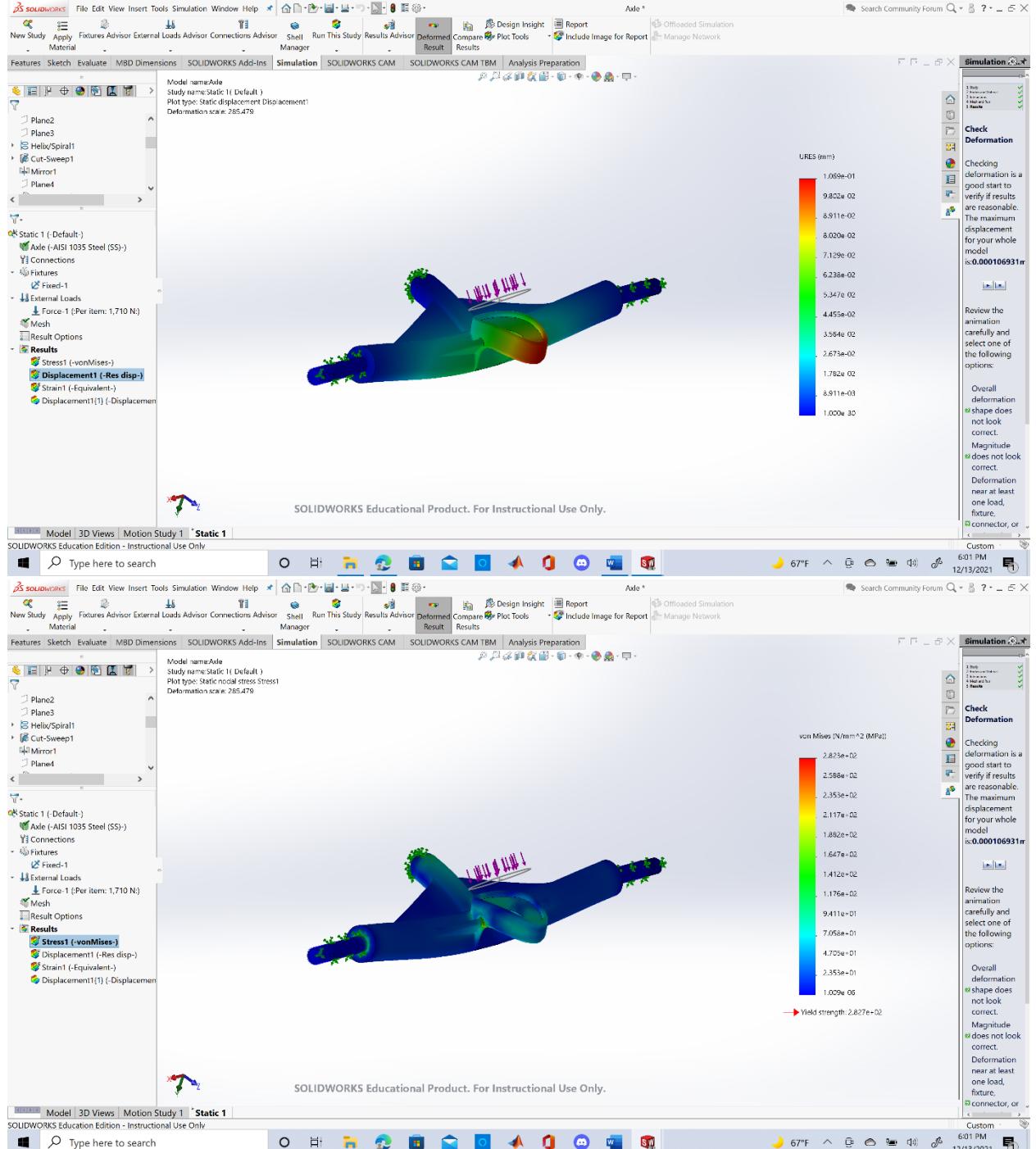
6. Now, click on the drop down menu for Run This Study in the top task bar, then click Create Mesh. You can choose how detailed you want the mesh to be using the slider, from coarse to fine.

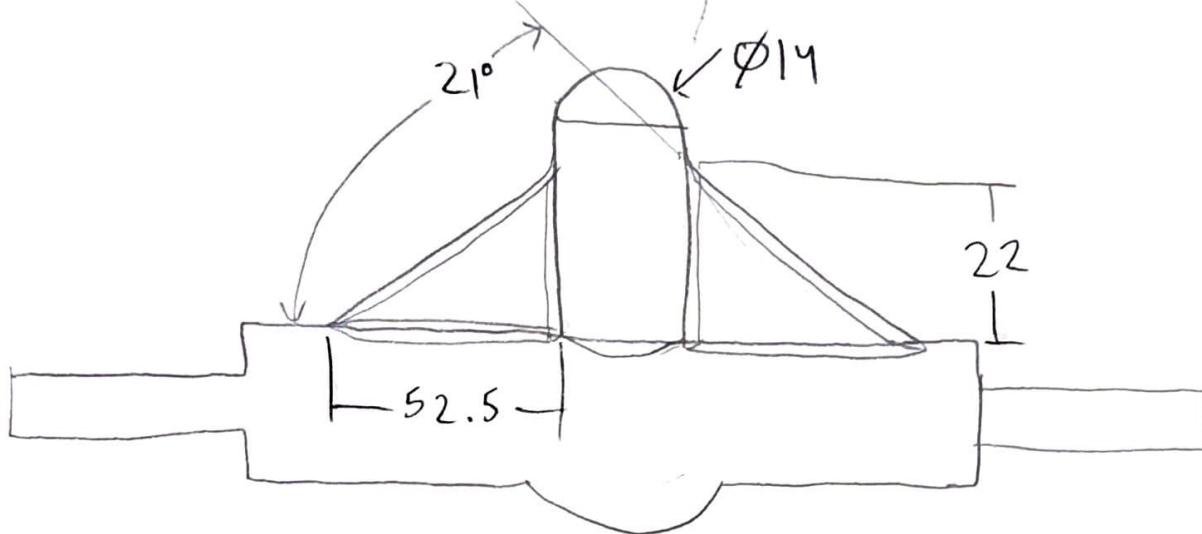


7. When the mesh is generated, you can now run the study, and observe the results of Stress, Displacement, and Strain. We were asked to find the max force to prevent permanent deformation. This is done by analyzing the Stress results. The colored chart on the right indicates the stress levels, and the red arrow is the yield strength. The yield strength is the point where permanent deformation will begin.



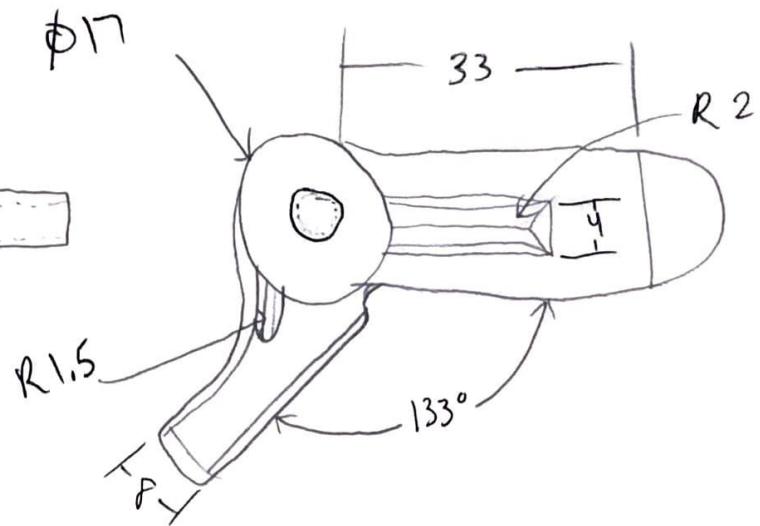
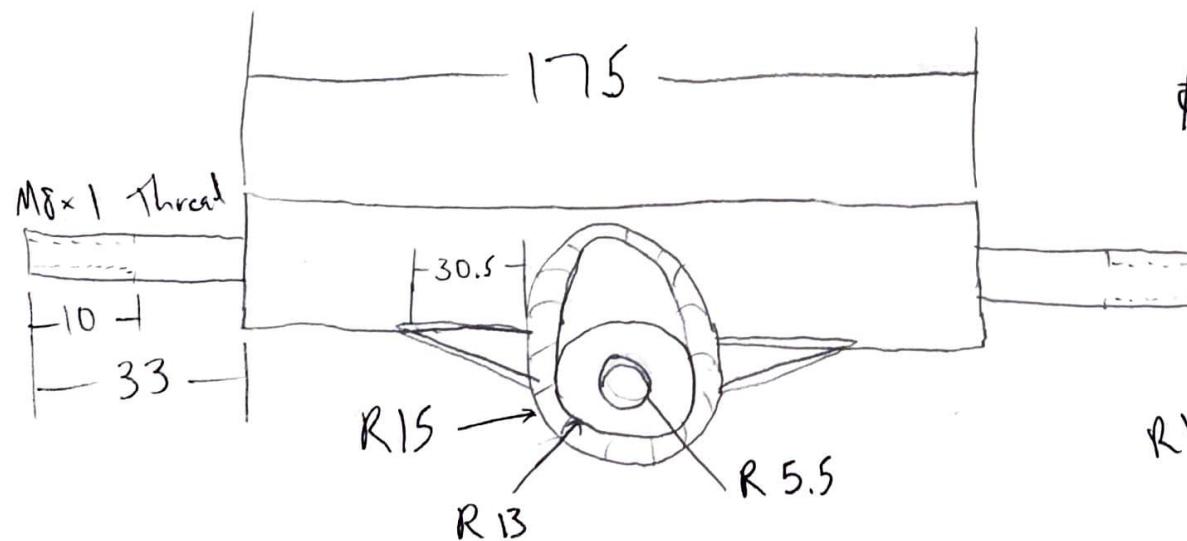
8. Adjust the force load and run the study again until no area of the part is above the yield strength. I found that value to be 1,710 N acting at each point of the surface. These are the displacement and stress results of the final study at 1,710 N. In other words, a human's weight would not be able to permanently deform this axis.



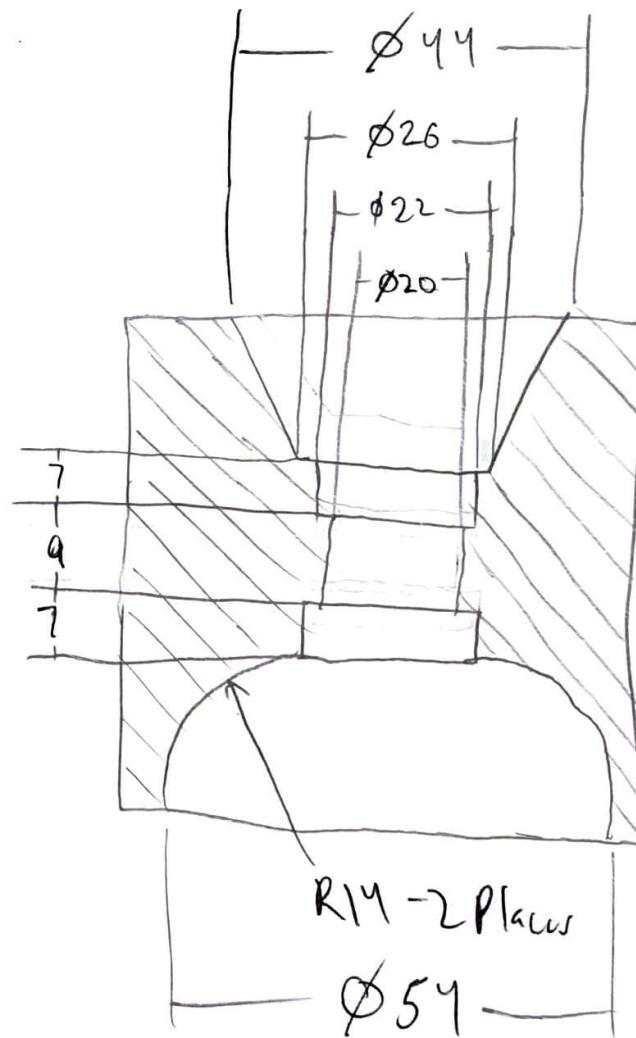
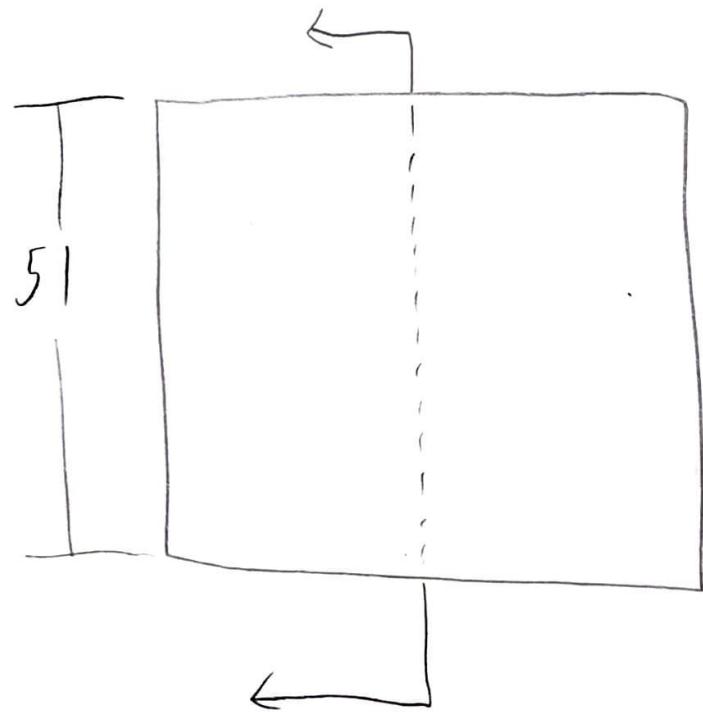


Units = mm

Axle

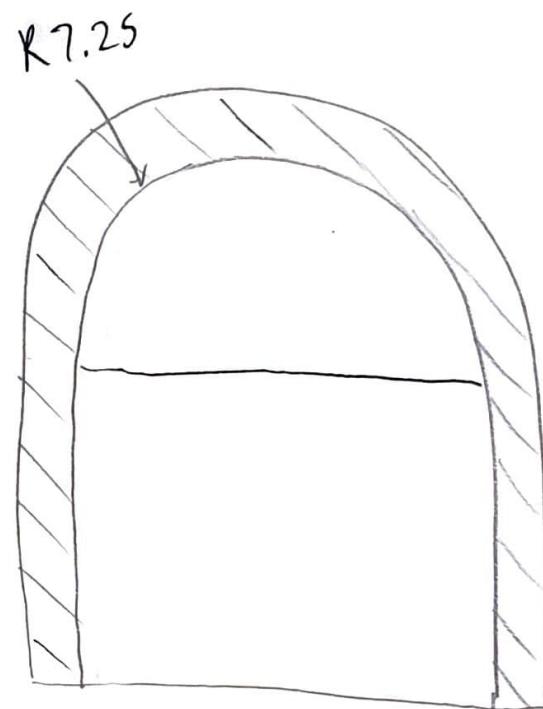
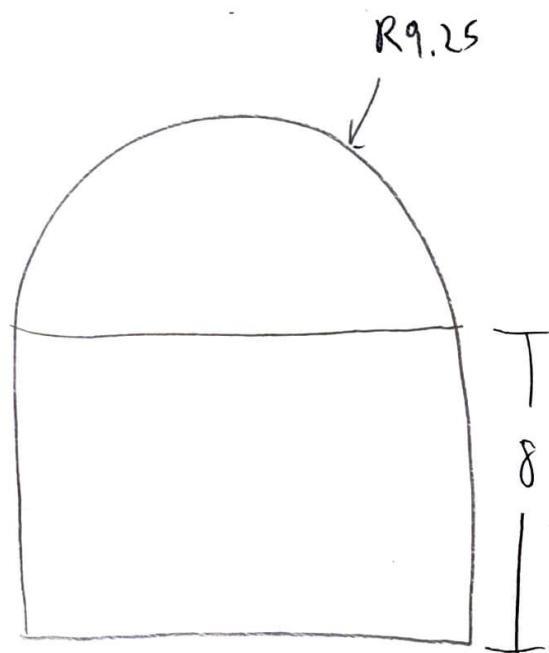


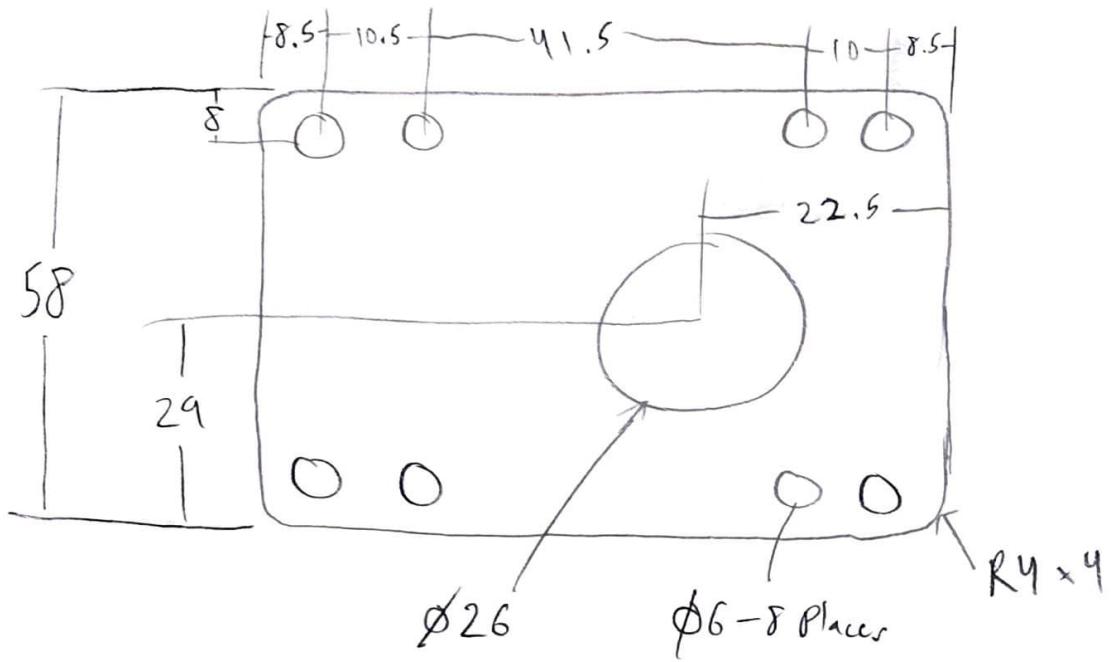
Units: mm Wheel



Units: mm

Rubber Fitting

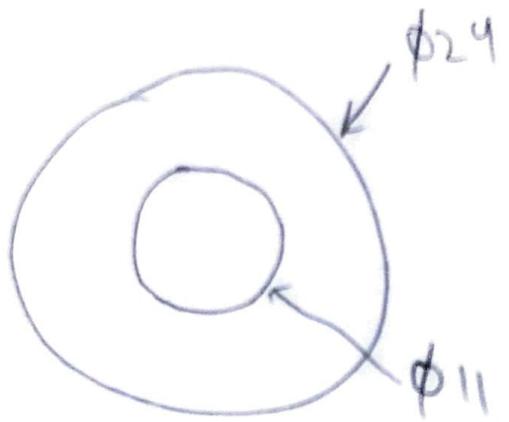




Units: mm

Rubber Base





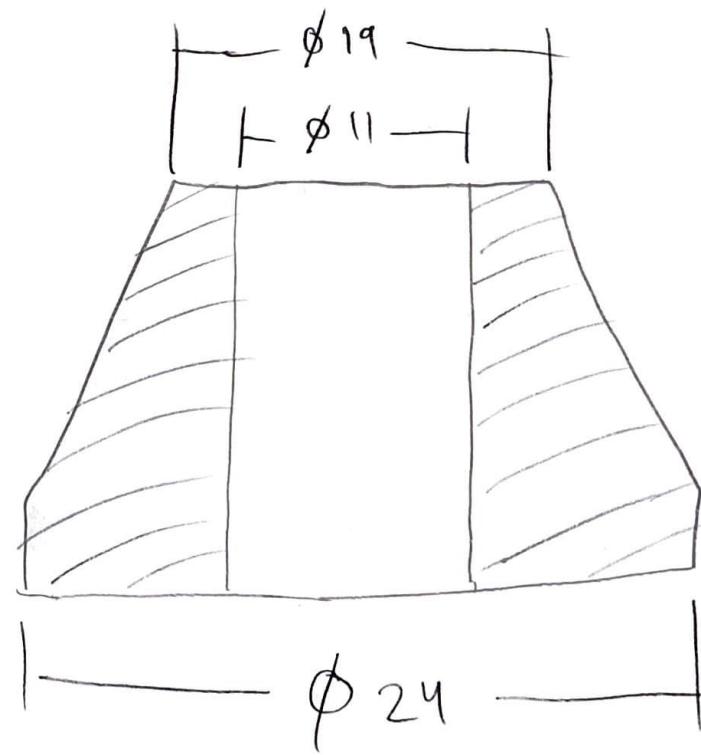
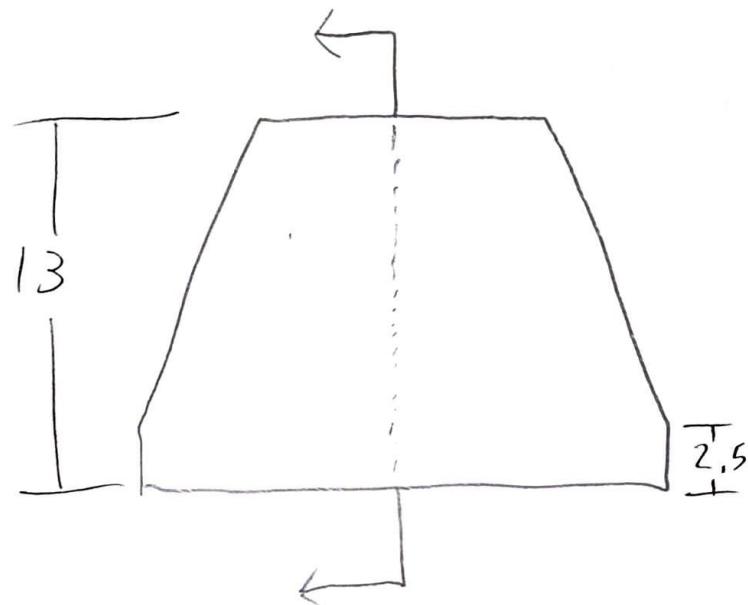
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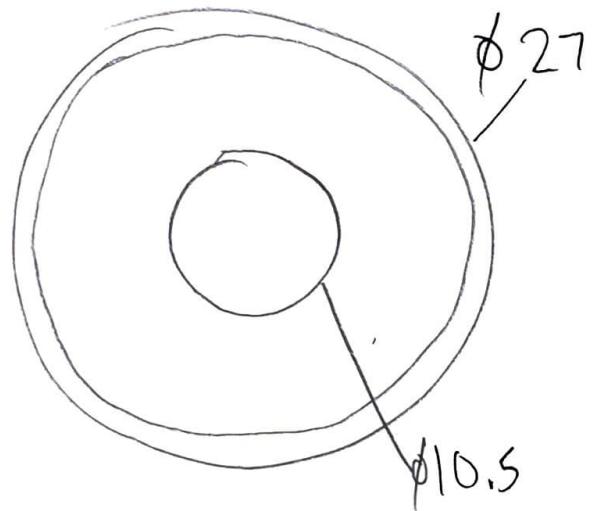
Rubber Cylinder



Units: mm

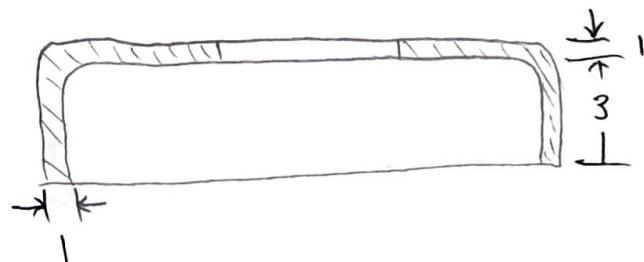
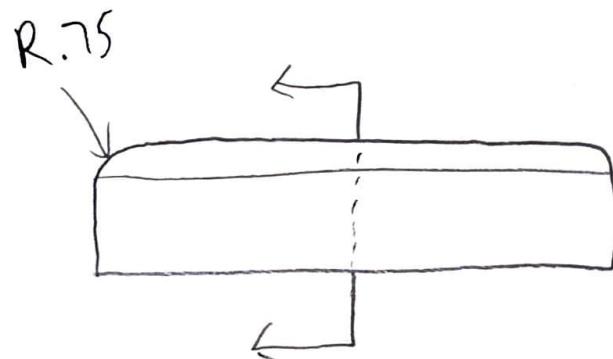
Slanted Rubber
Cylinder

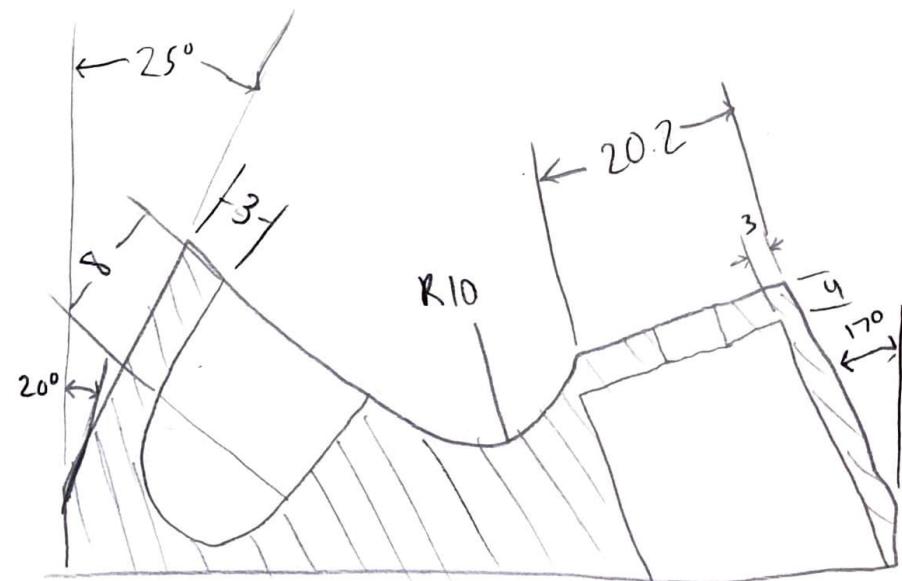
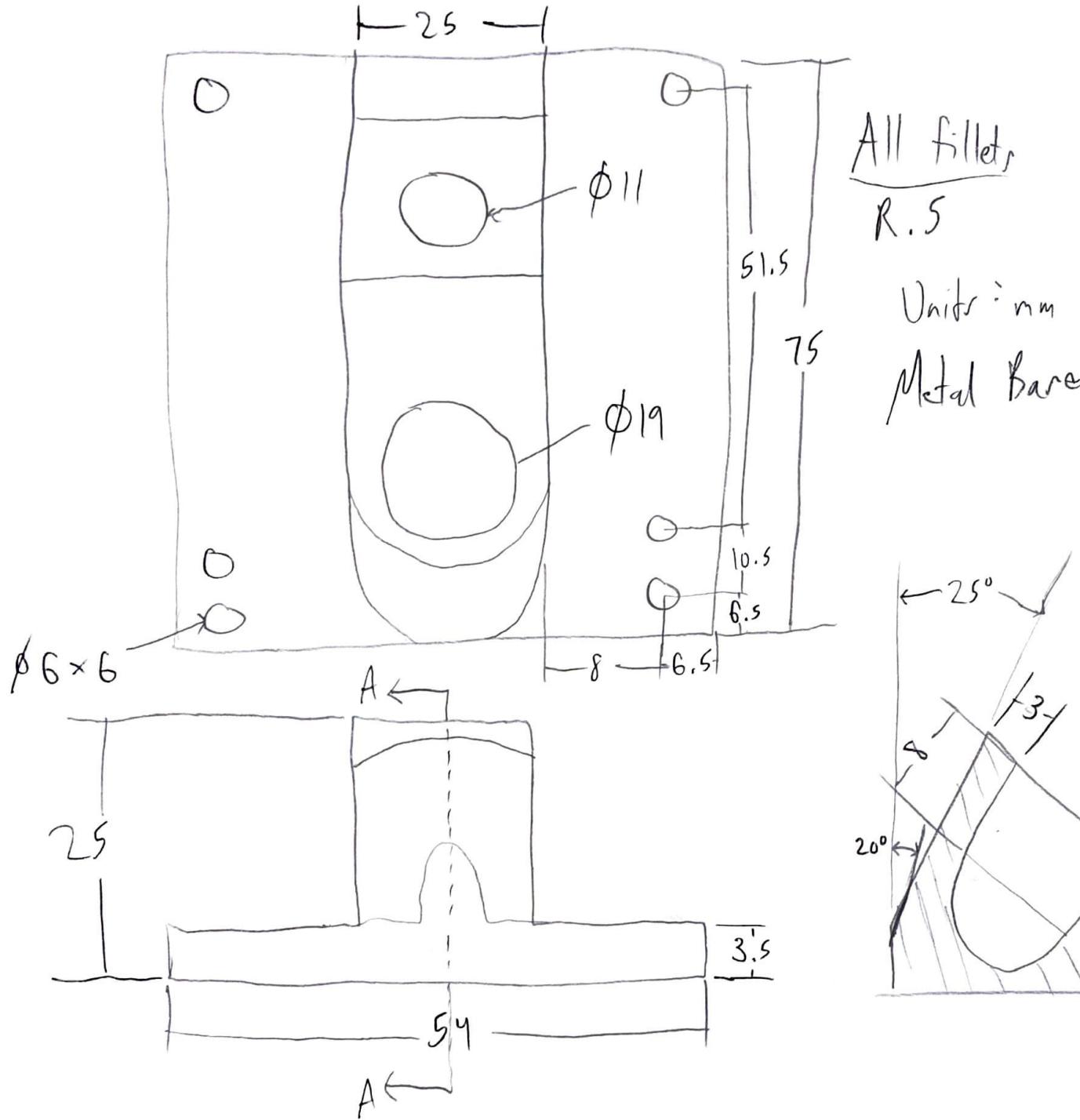


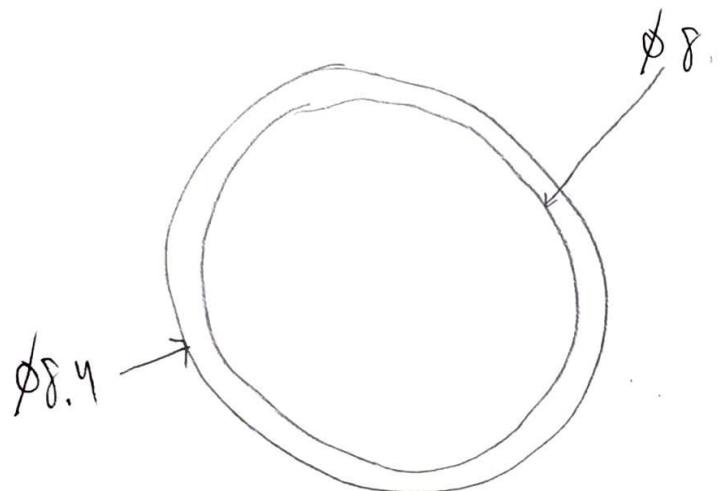


Units: mm

Larger Metal
Fitting

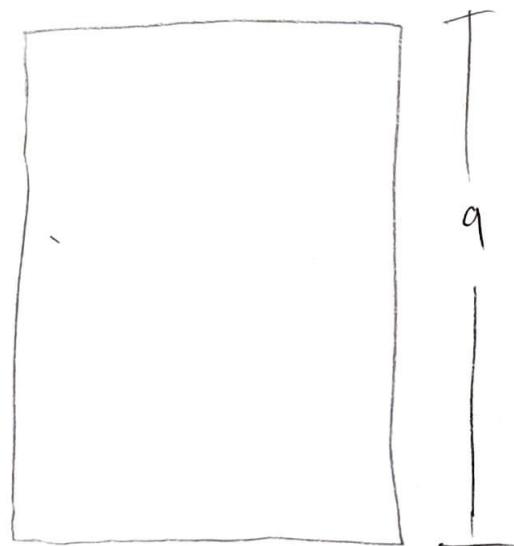


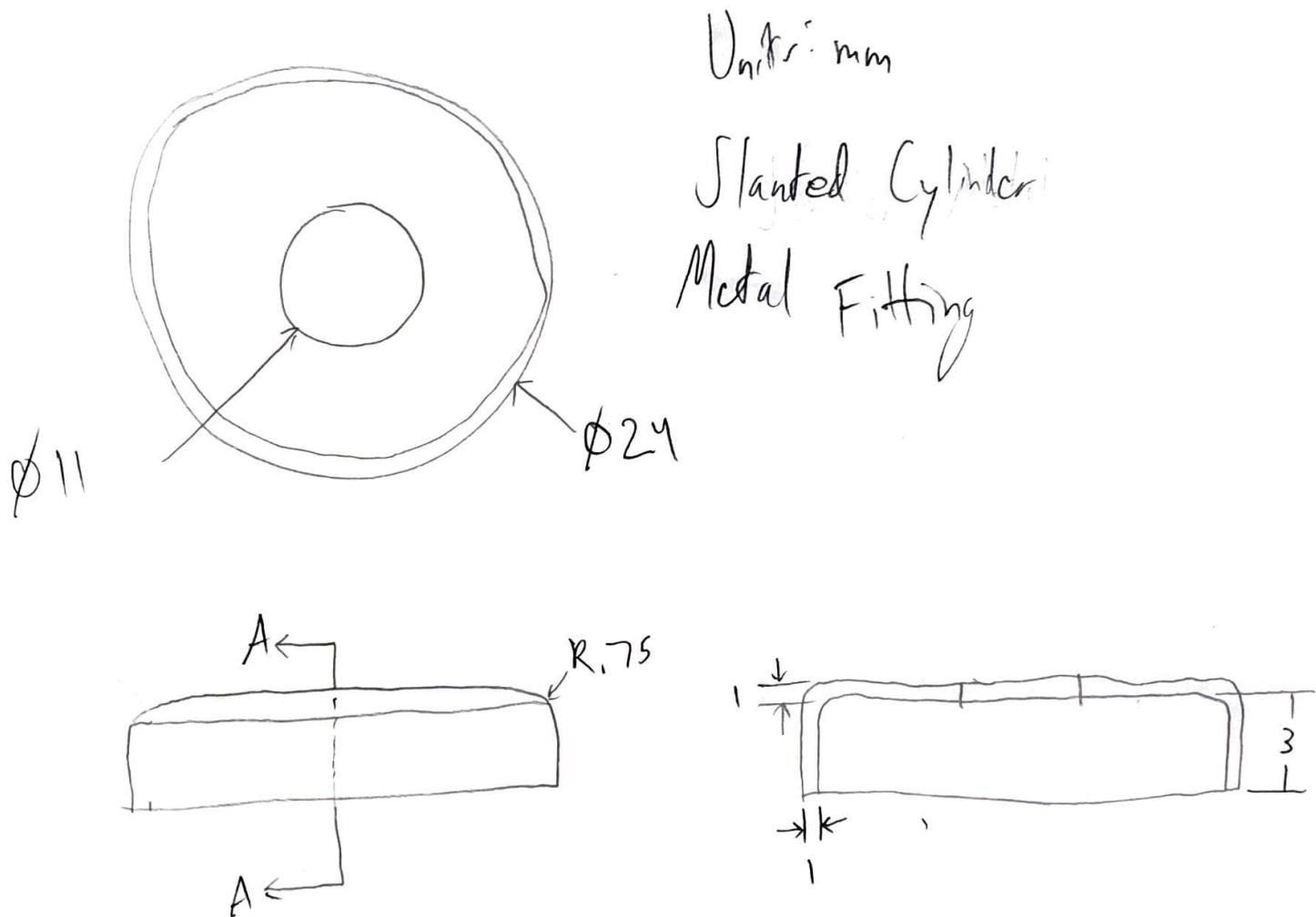




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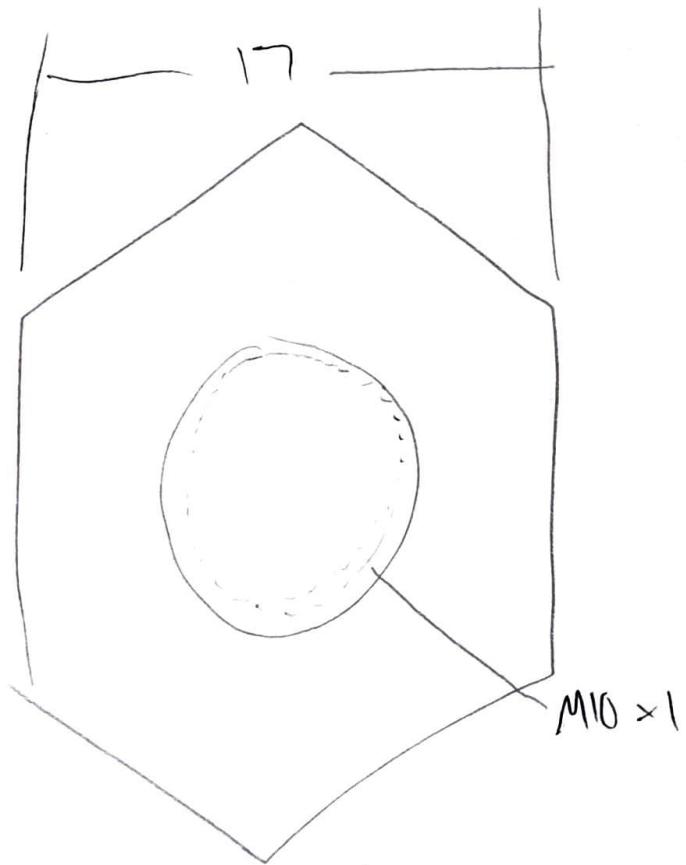
Center Ring
in Wheel



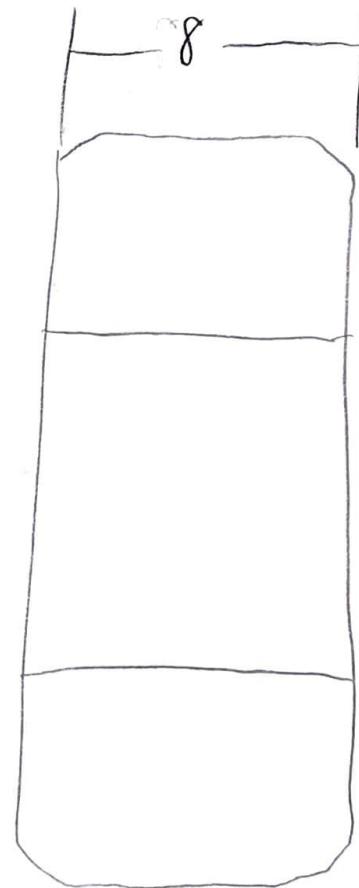


* Unique Threading in Middle

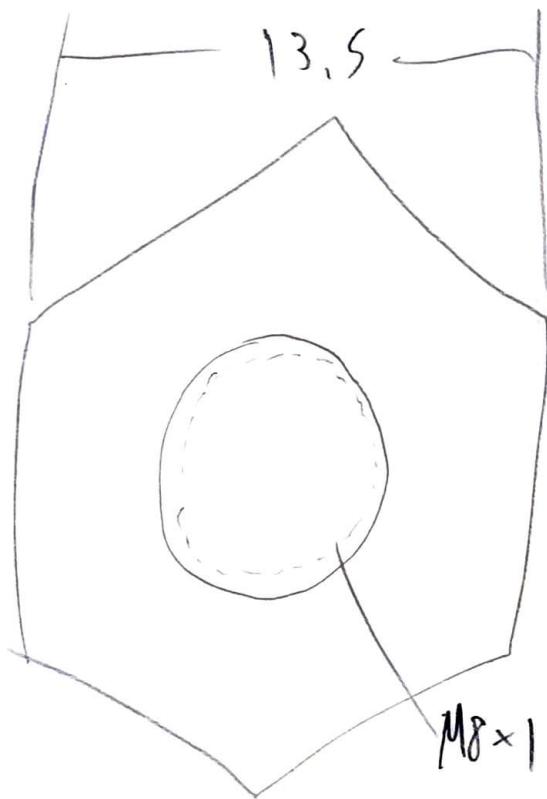
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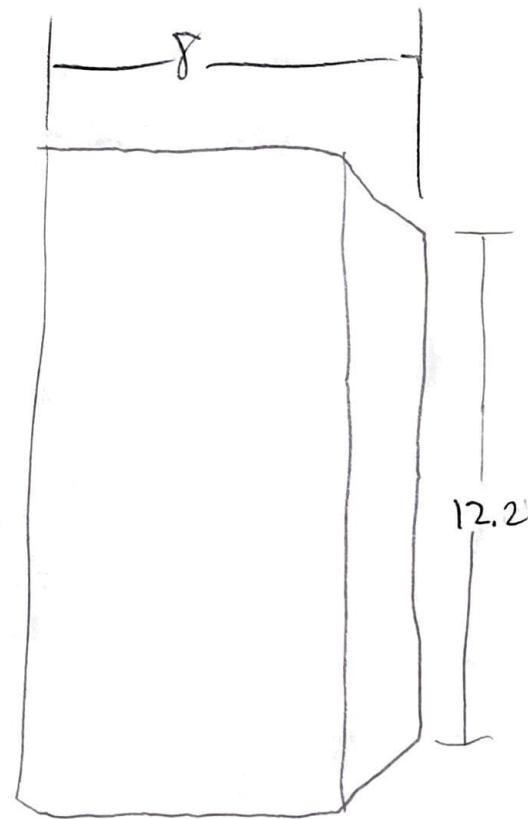
M10 Nut



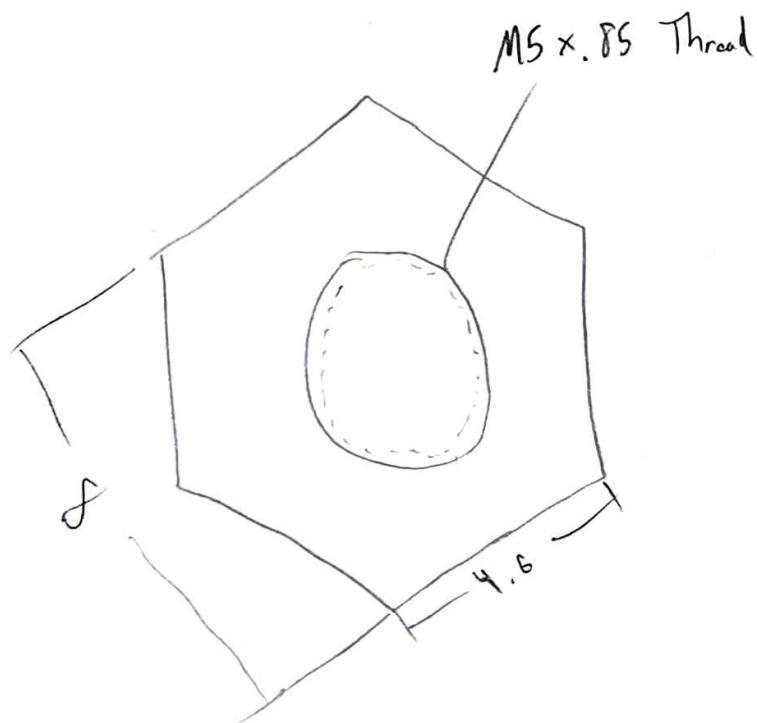
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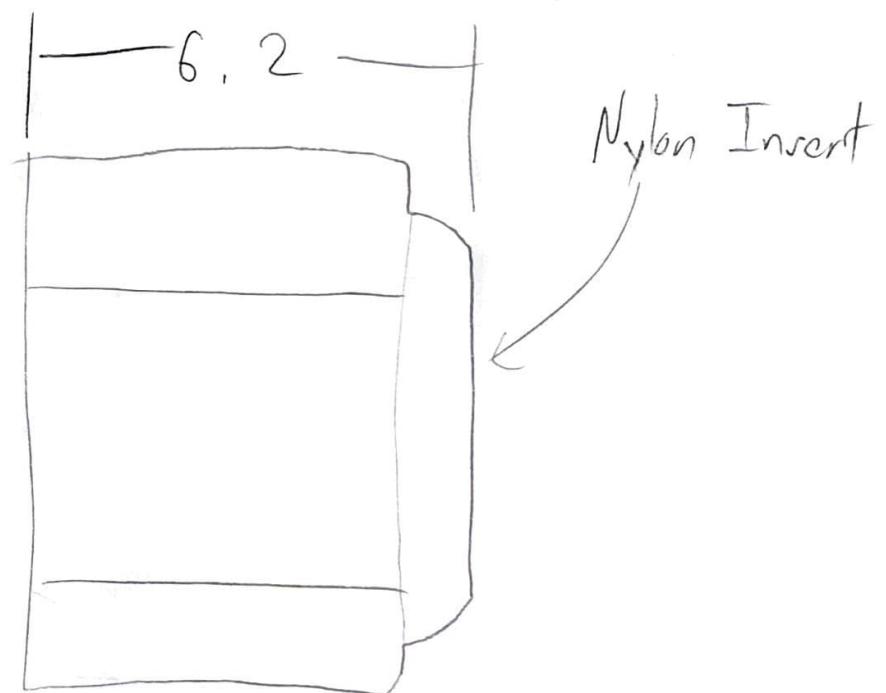
8M Nut



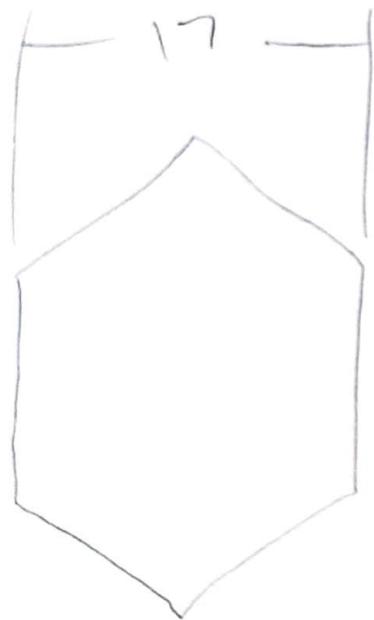
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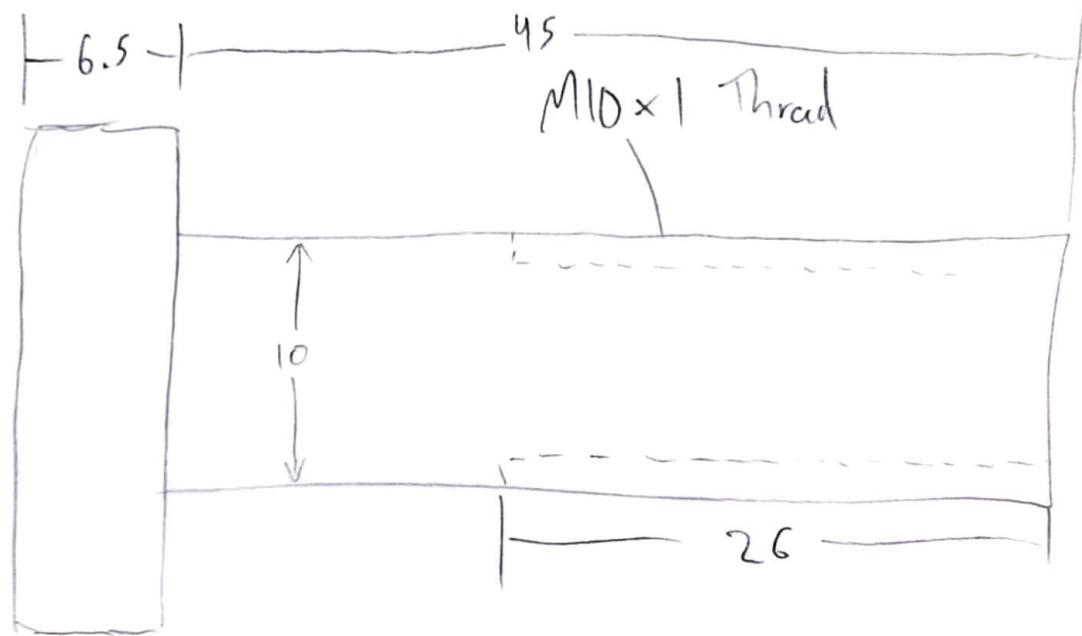
M5 Nut



Units: mm

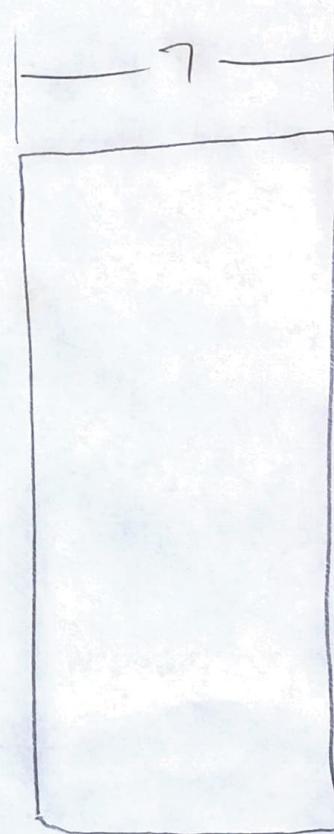
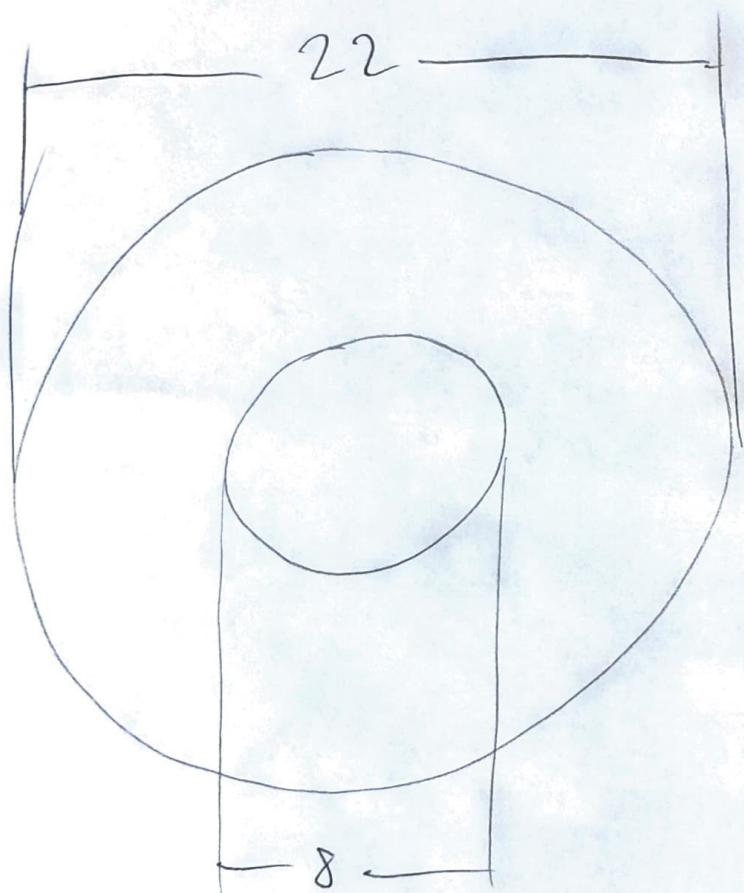


M10 Screw



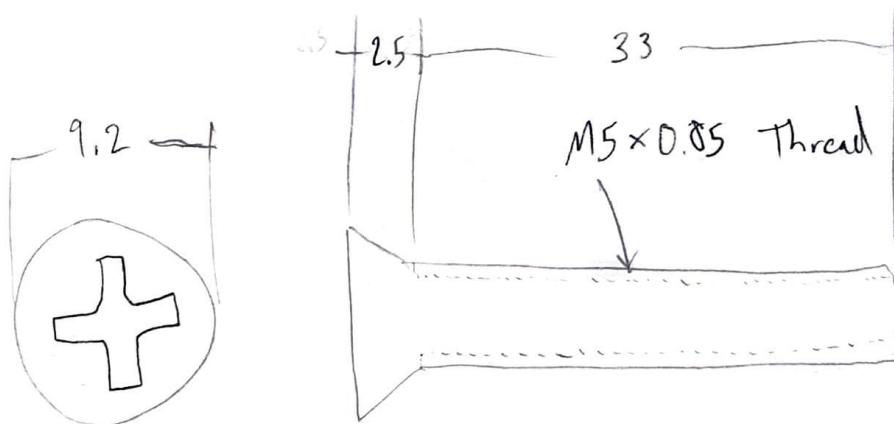
Units: mm

Ball Bearing



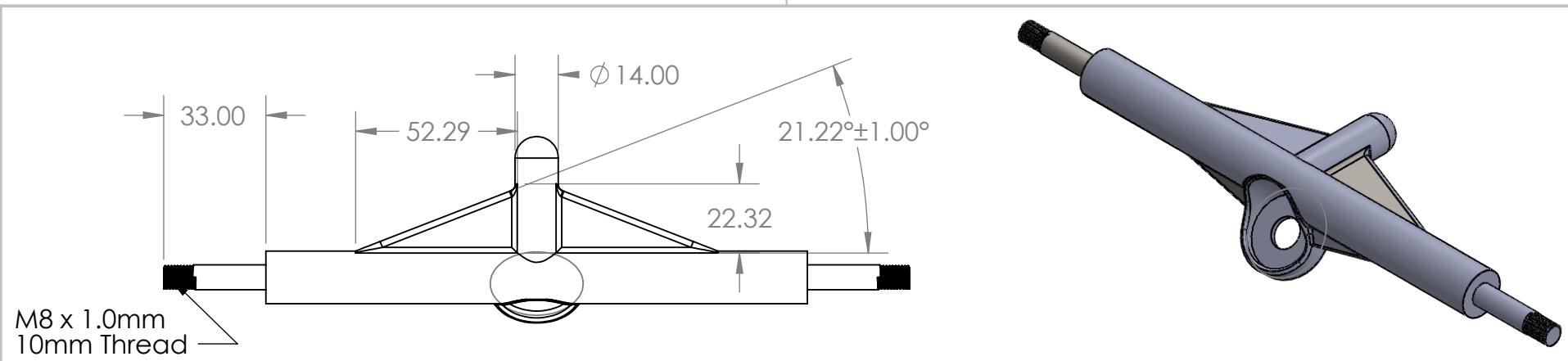
Units: mm

Flat Head Screw

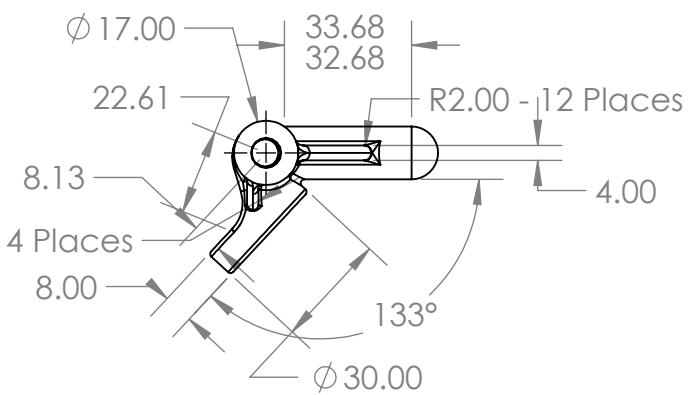


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All Fillets R1.00 Unless
Otherwise Specified



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NEXT ASSY	USED ON	SAE 1040 Steel		COMMENTS:				REV	
APPLICATION	FINISH								
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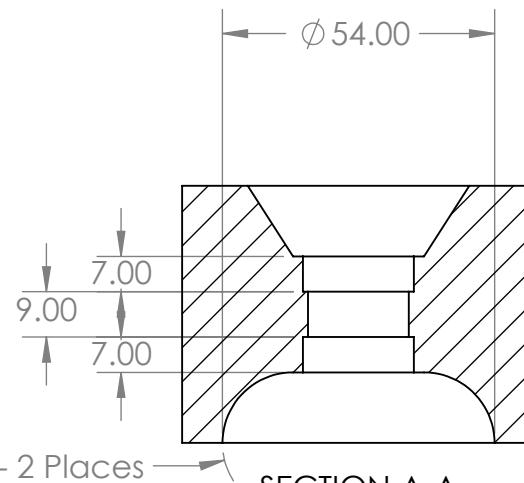
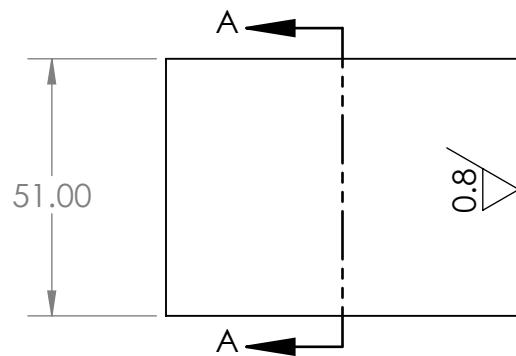
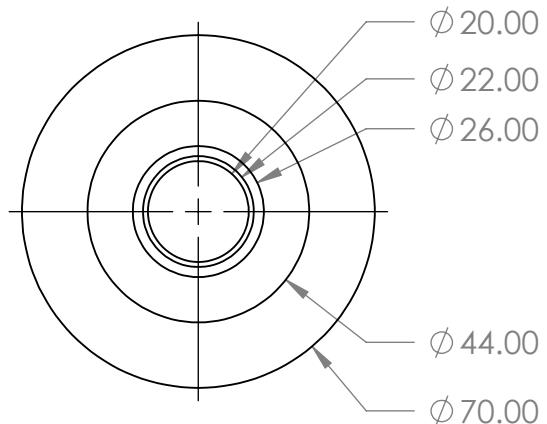
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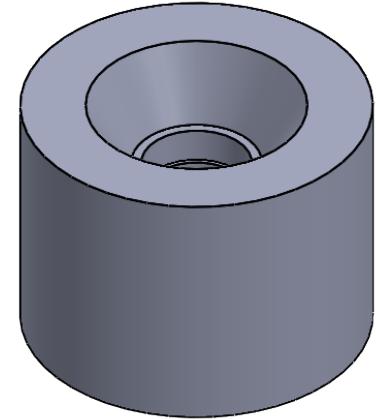


SECTION A-A
SCALE 1 : 1.5

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		ANGULAR: MACH $\pm .5$ BEND $\pm .5$		MFG APPR.	
		TWO PLACE DECIMAL $\pm .05$		Q.A.	
		THREE PLACE DECIMAL $\pm .005$		COMMENTS:	
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL			
		Polyurethane			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

1



University of Arizona

TITLE:

Wheels

SIZE	DWG. NO.	REV
A	Polyurethane Wheel	
SCALE: 1:2	WEIGHT:	SHEET 1 OF 1

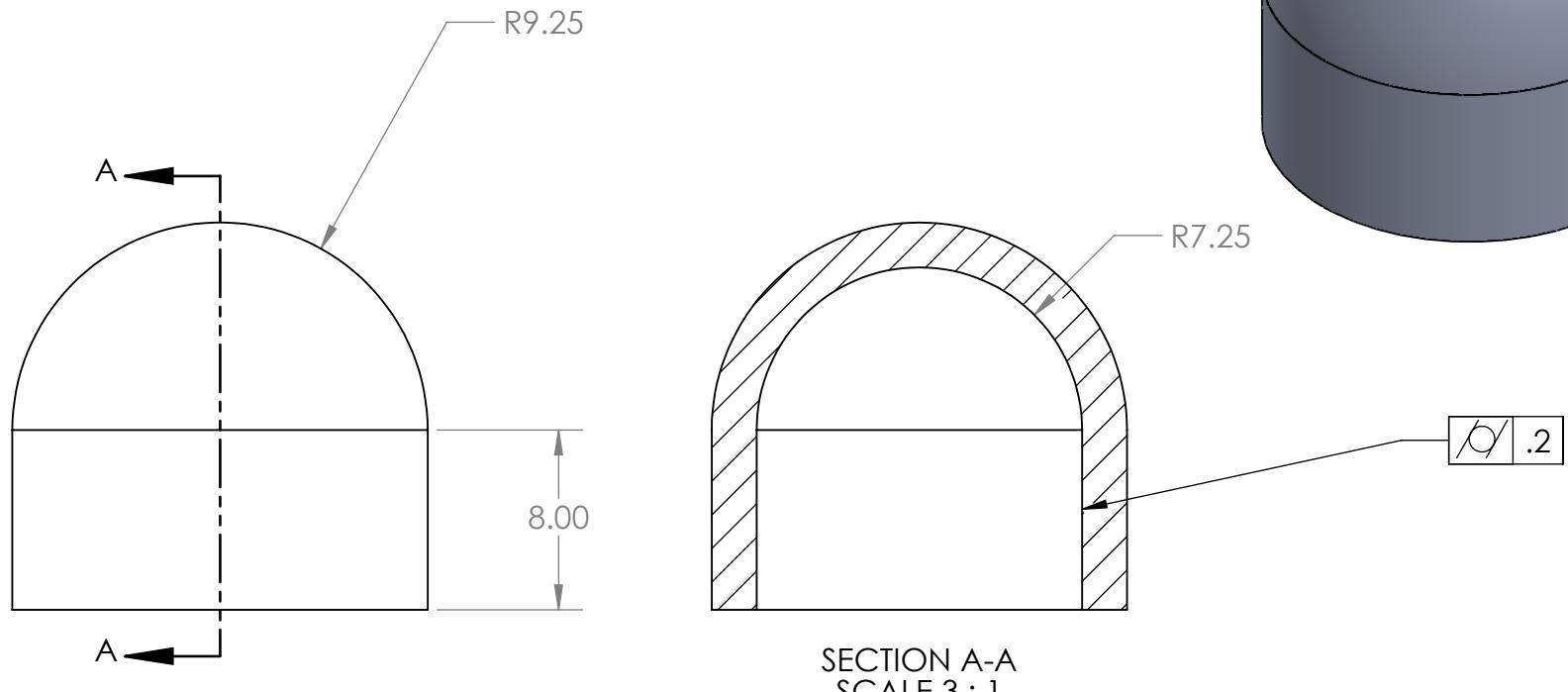
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		DIMENSIONS ARE IN MILLIMETERS	DRAWN	Jacob L	12-12-21
		TOLERANCES:	CHECKED		
		FRACTIONAL ±	ENG APPR.		
		ANGULAR: MACH ± .5 BEND ±	MFG APPR.		
		TWO PLACE DECIMAL ± .05	Q.A.		
		THREE PLACE DECIMAL ±	COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL			
		Laminated Rubber			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

University of Arizona

TITLE:

Rubber Fitting

SIZE	DWG. NO.	REV
A	Rubber Fitting	
SCALE: 3:1	WEIGHT:	SHEET 1 OF 1

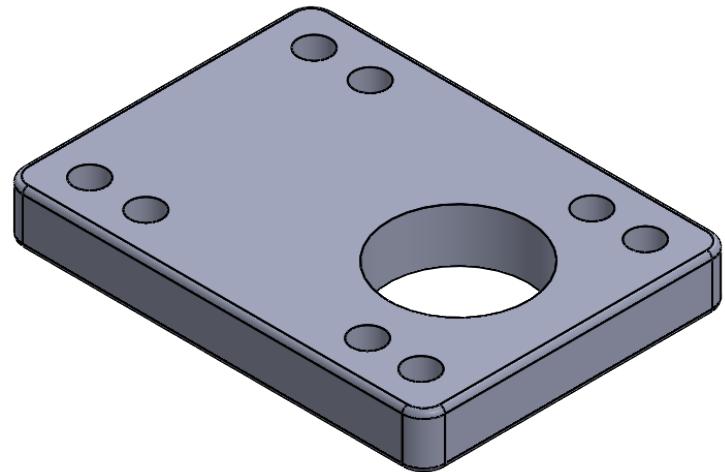
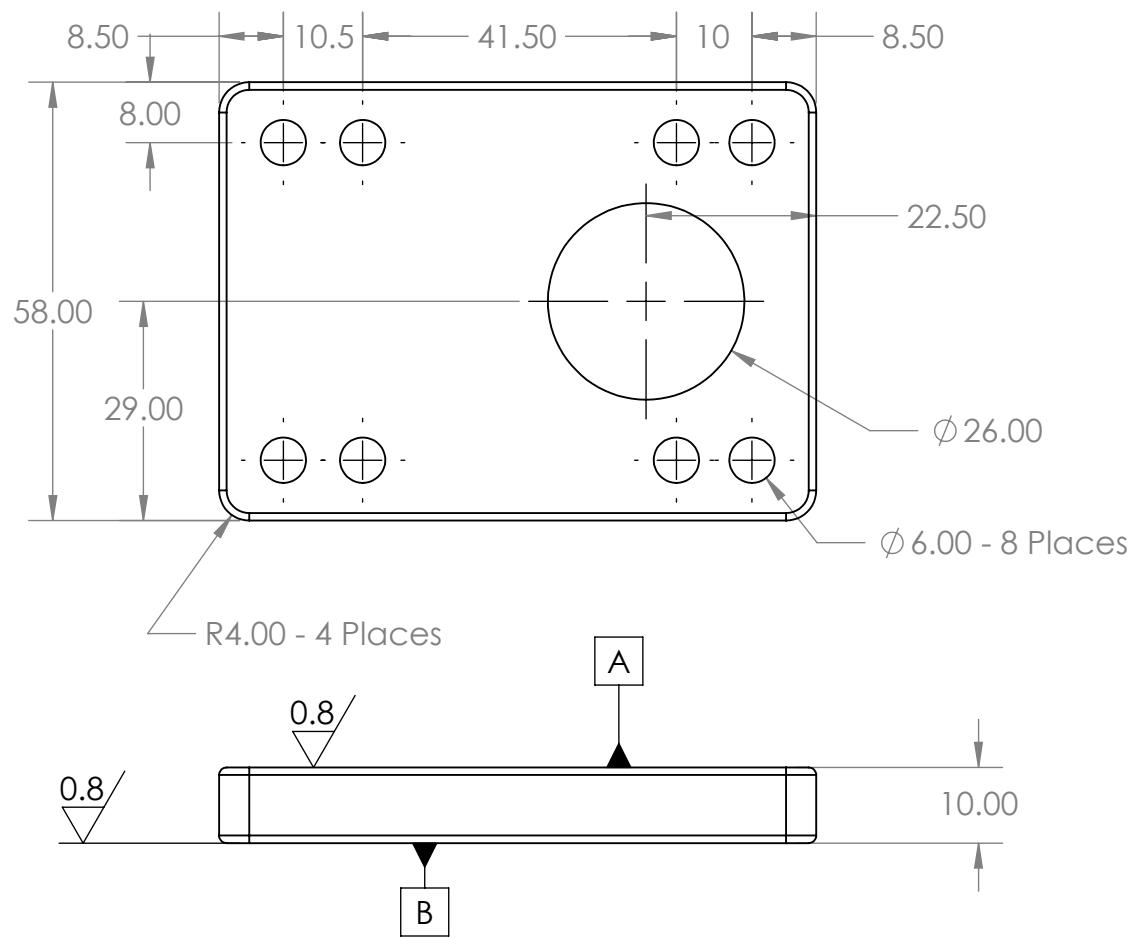
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All Fillets R1.0 Unless
Otherwise Specified

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A

A

		UNLESS OTHERWISE SPECIFIED:		DRAWN	NAME	DATE	University of Arizona TITLE: Rubber Base COMMENTS:				
		DIMENSIONS ARE IN MILLIMETERS TOLERANCES: FRACTIONAL \pm ANGULAR: MACH $\pm .5$ BEND \pm TWO PLACE DECIMAL $\pm .05$ THREE PLACE DECIMAL $\pm .005$									
		INTERPRET GEOMETRIC TOLERANCING PER:									
		MATERIAL Laminated Rubber									
NEXT ASSY	USED ON	FINISH									
APPLICATION		DO NOT SCALE DRAWING									
SIZE	DWG. NO.			REV							
A	Rubber Base										
SCALE: 1:1		WEIGHT:		SHEET 1 OF 1							

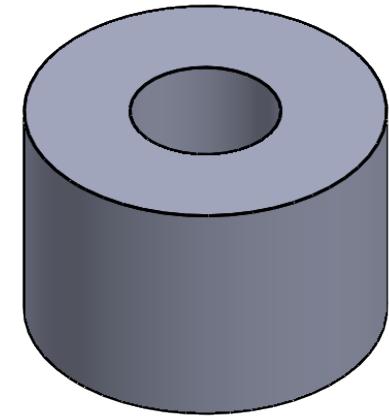
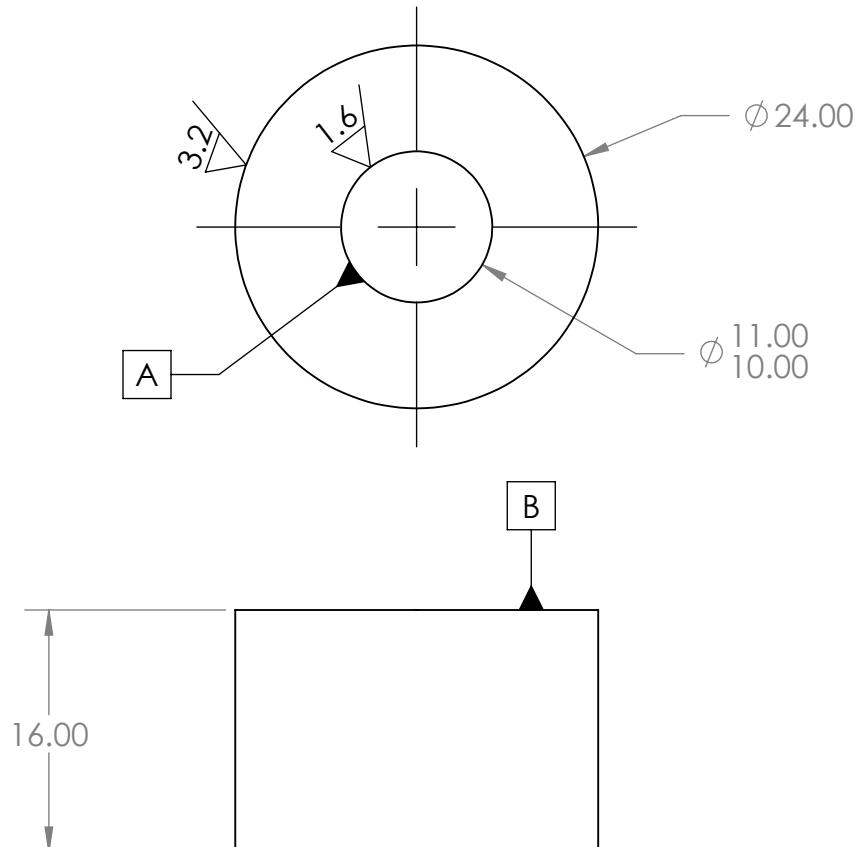
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		UNLESS OTHERWISE SPECIFIED:		NAME	DATE	University of Arizona TITLE: Rubber Cylinder	
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		FRACTIONAL ±		ENG APPR.			
		ANGULAR: MACH ± .5 BEND ±		MFG APPR.			
		TWO PLACE DECIMAL ± .05		Q.A.			
		THREE PLACE DECIMAL ±		COMMENTS:			
		INTERPRET GEOMETRIC TOLERANCING PER:					
		MATERIAL	Laminated Rubber				
NEXT ASSY	USED ON	FINISH					
APPLICATION		DO NOT SCALE DRAWING					

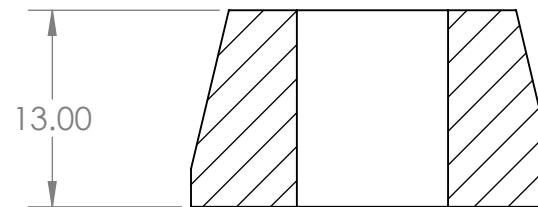
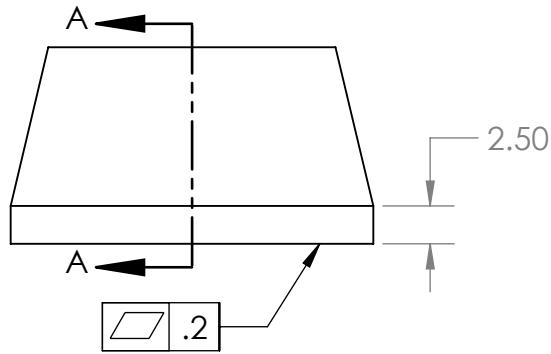
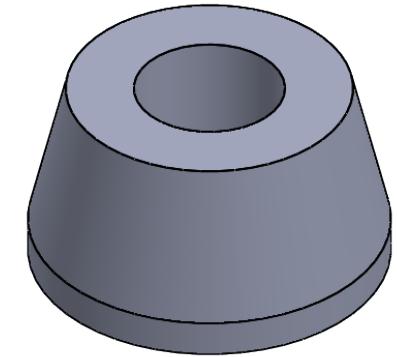
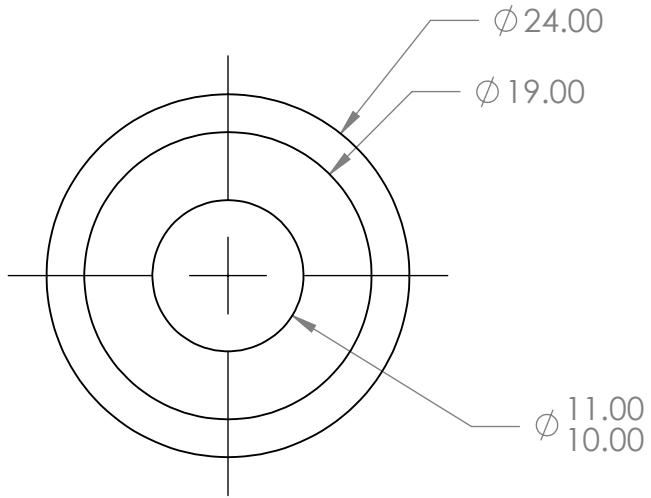
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2

1

2

1



SECTION A-A

		UNLESS OTHERWISE SPECIFIED:			
		DIMENSIONS ARE IN MILLIMETERS			
TOLERANCES: FRACTIONAL \pm ANGULAR: MACH $\pm .5$ BEND \pm TWO PLACE DECIMAL $\pm .05$ THREE PLACE DECIMAL $\pm .005$			DRAWN	Jacob L	12-12-21
			CHECKED		
			ENG APPR.		
			MFG APPR.		
			Q.A.		
		INTERPRET GEOMETRIC TOLERANCING PER:	COMMENTS:		
		MATERIAL Laminated Rubber			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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University of Arizona

TITLE:

Rubber Slanted Cylinder

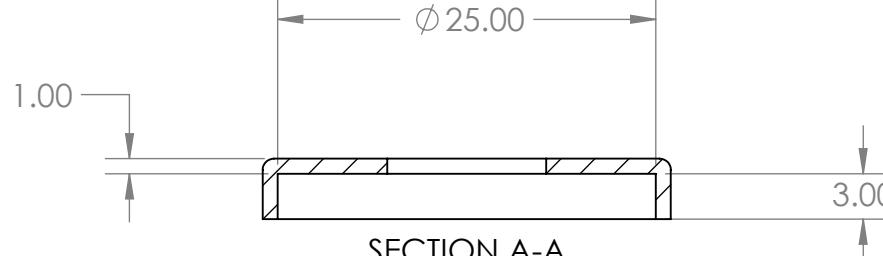
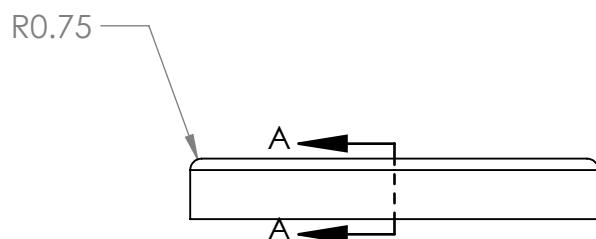
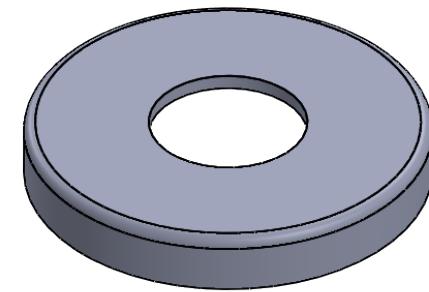
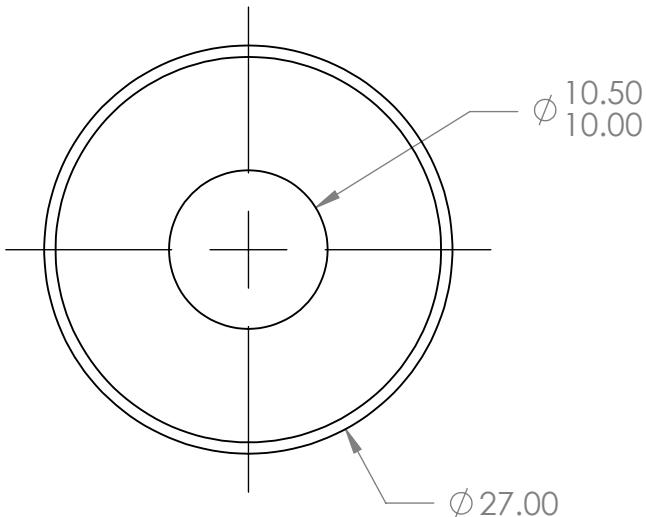
SIZE	DWG. NO.	REV
A	Rubber Slanted Cylinder	
SCALE: 2:1	WEIGHT:	SHEET 1 OF 1

2

1

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		TOLERANCES:	CHECKED		
		FRACTIONAL ±	ENG APPR.		
		ANGULAR: MACH ± .5 BEND ±	MFG APPR.		
		TWO PLACE DECIMAL ± .05	Q.A.		
		THREE PLACE DECIMAL ±	COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL			
		SAE 1040 Steel			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

University of Arizona

TITLE:

Cylinder Metal Fitting

SIZE	DWG. NO.	REV
A	Metal Fitting 1	
SCALE: 2:1	WEIGHT:	SHEET 1 OF 1

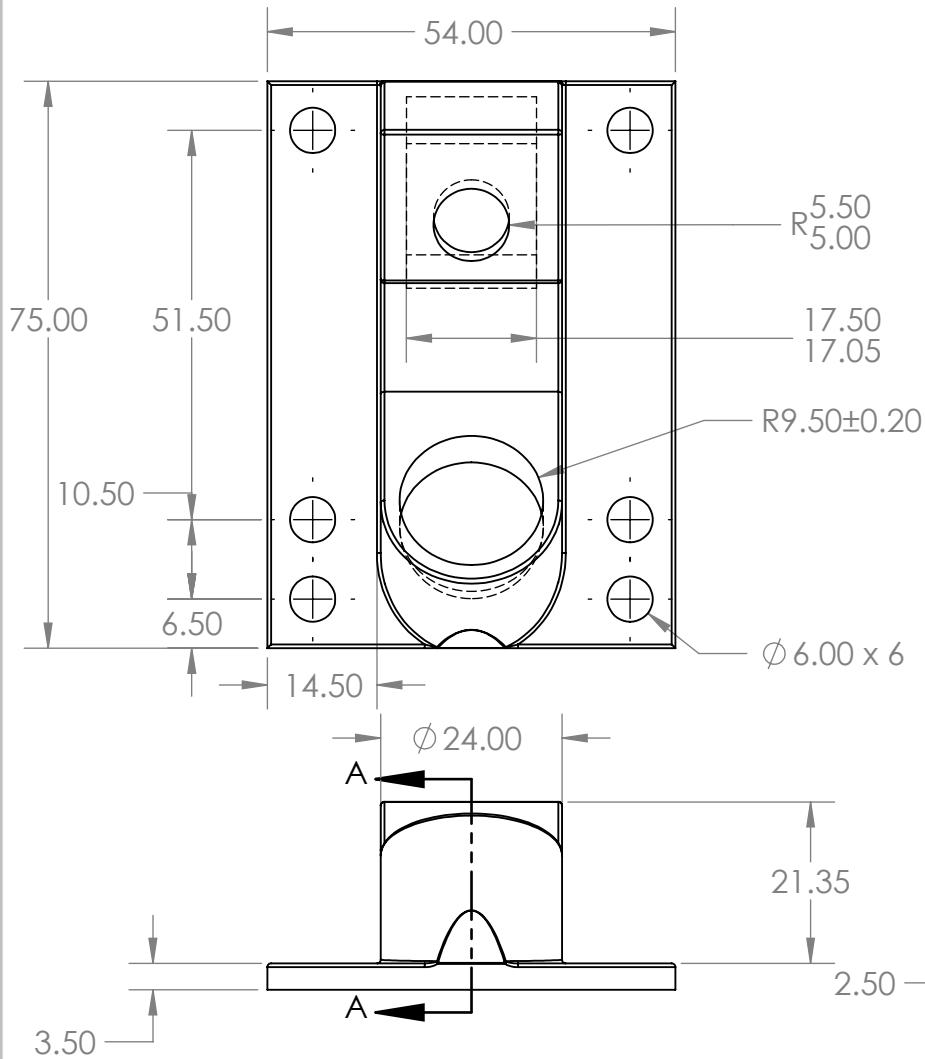
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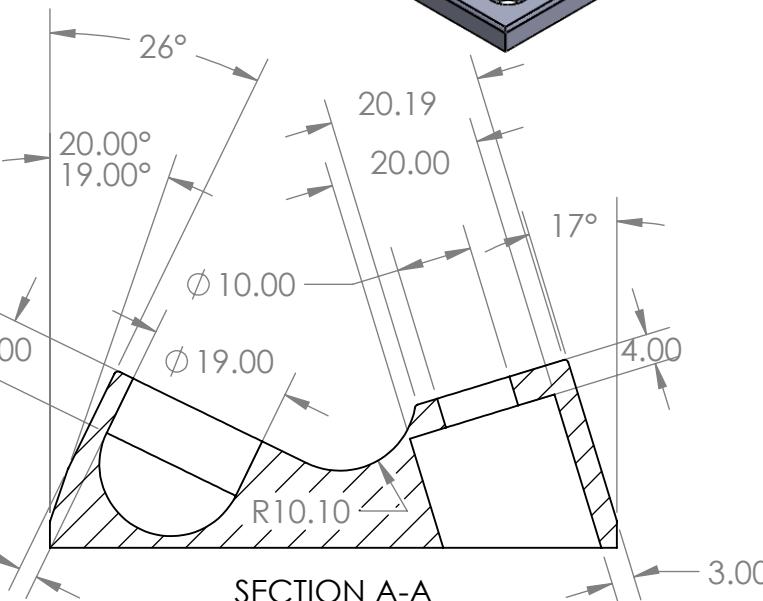
2

1

B



All Fillets are R0.50



University of Arizona

TITLE:

Metal Base

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TOLERANCES:		FRACTIONAL \pm		DRAWN	Jacob L
ANGULAR: MACH $\pm .5$		BEND \pm		CHECKED	12-12-21
TWO PLACE DECIMAL $\pm .05$		THREE PLACE DECIMAL \pm		ENG APPR.	
				MFG APPR.	
				Q.A.	
		INTERPRET GEOMETRIC TOLERANCING PER:		COMMENTS:	
		MATERIAL			
		SAE 1040 Steel			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

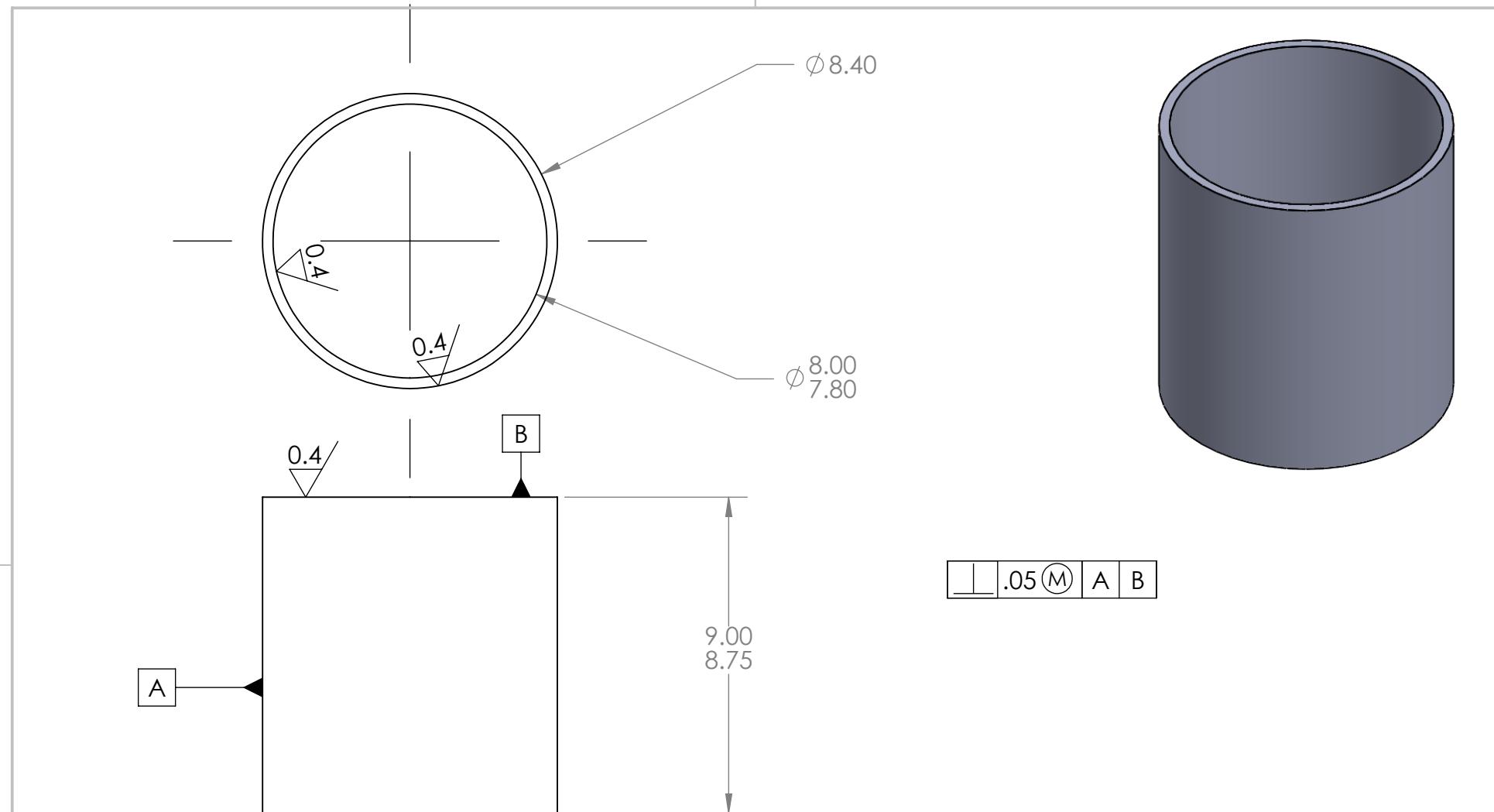
SIZE	DWG. NO.	REV
A	Metal Base	
SCALE: 1:1	WEIGHT:	SHEET 1 OF 1

2

1

2

1



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		DIMENSIONS ARE IN MILLIMETER TOLERANCES: FRACTIONAL \pm ANGULAR: MACH \pm .5 BEND TWO PLACE DECIMAL \pm .05 THREE PLACE DECIMAL \pm
		INTERPRET GEOMETRIC TOLERANCING PER:
		MATERIAL SS AISI 440C
NEXT ASSY	USED ON	FINISH
	APPLICATION	DO NOT SCALE DRAWING

Comments:
Fits loosely in
shaft of wheel

COMMENTS:
Fits loosely in
shaft of wheel

University of Arizona

TITLE:

Shaft Bearing of Wheel

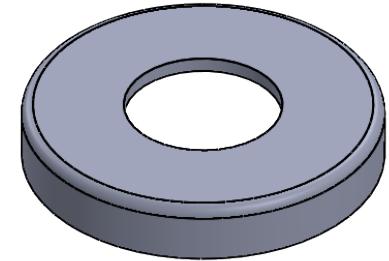
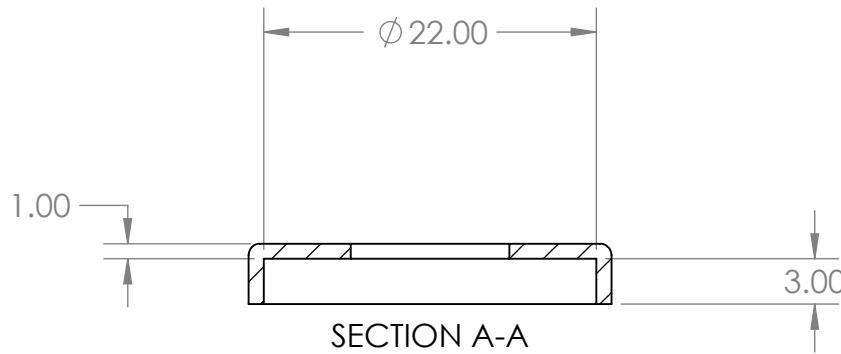
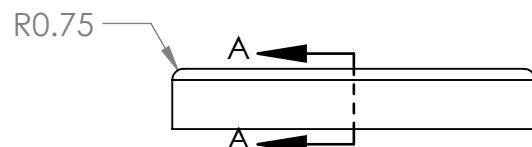
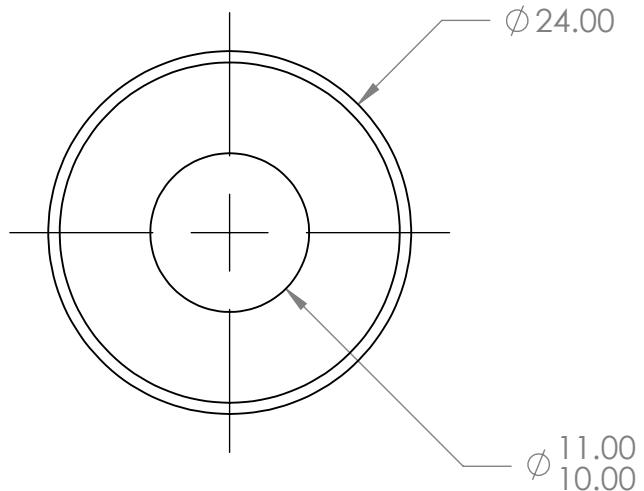
SIZE	DWG. NO.	REV
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A Inner Metal Ring

SCALE: 6:1 WEIGHT: SHEET 1 OF 1

2

1



B

B

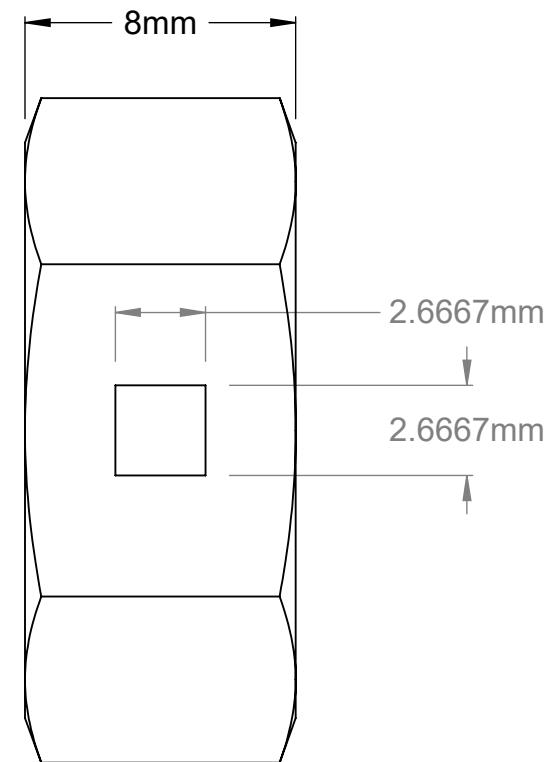
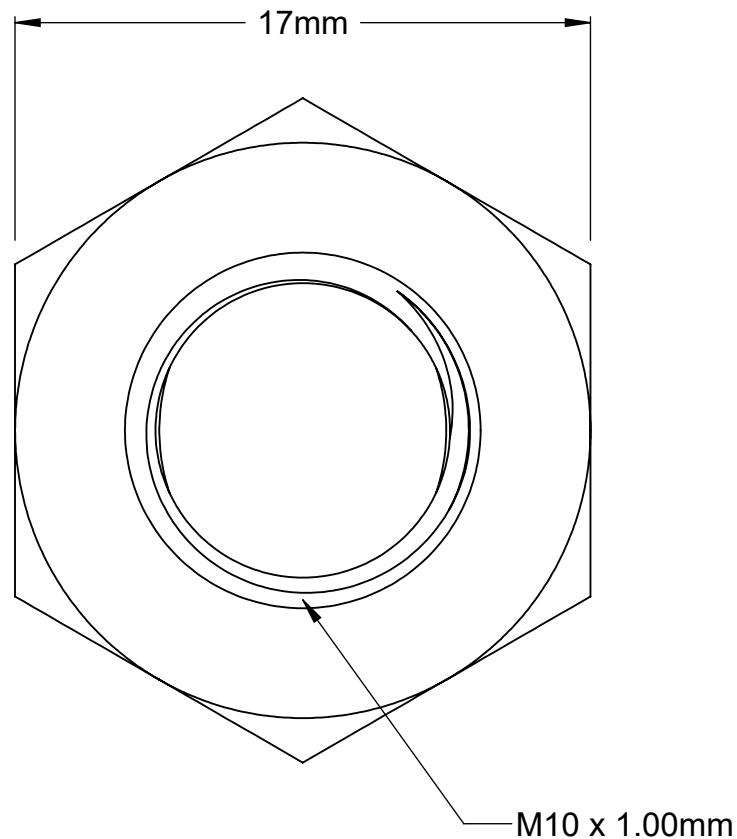
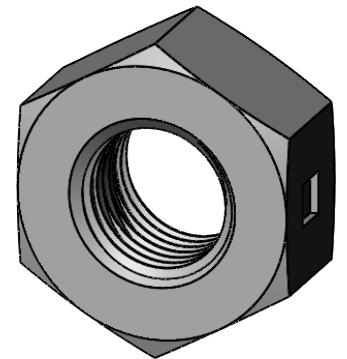
		UNLESS OTHERWISE SPECIFIED:		NAME	DATE	University of Arizona
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		TOLERANCES:		CHECKED		
		FRACTIONAL \pm		ENG APPR.		
		ANGULAR: MACH $\pm .5$ BEND \pm		MFG APPR.		
		TWO PLACE DECIMAL $\pm .05$		Q.A.		
		THREE PLACE DECIMAL \pm		COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:				
		MATERIAL				
		SAE 1040 Steel				
NEXT ASSY	USED ON	FINISH				
APPLICATION		DO NOT SCALE DRAWING				
SIZE	DWG. NO.					REV
A	Metal Fitting 2					
SCALE: 2:1		WEIGHT:		SHEET 1 OF 1		

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2

1

A



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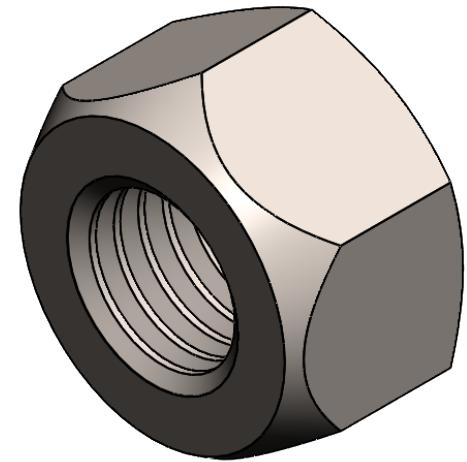
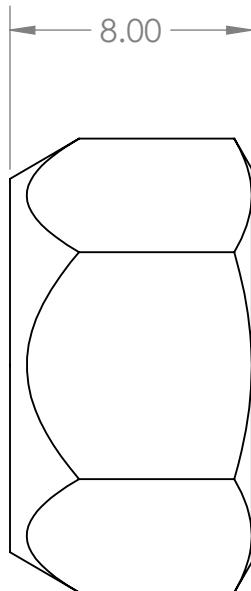
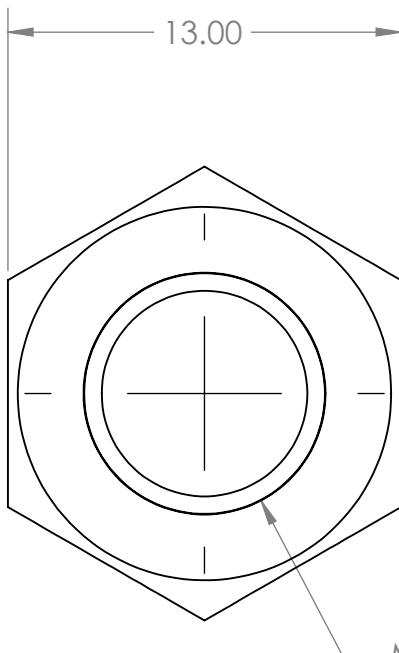
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PART NUMBER **92048A180**

Center-Lock Distorted-
Thread Locknuts

2

1



B

B

A

A

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		TOLERANCES:	CHECKED		
		FRACTIONAL \pm	ENG APPR.		
		ANGULAR: MACH \pm BEND \pm	MFG APPR.		
		TWO PLACE DECIMAL \pm	Q.A.		
		THREE PLACE DECIMAL \pm	COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL 18-8 Stainless Steel			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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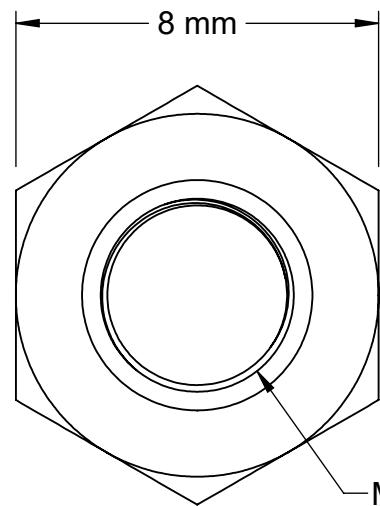
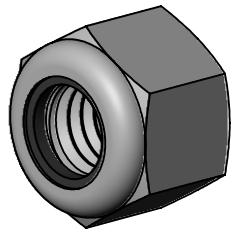
TITLE:

8M x 1 Nut

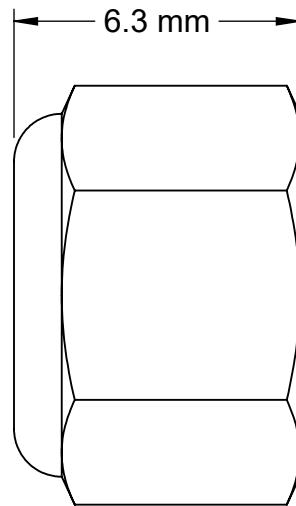
SIZE	DWG. NO.	REV
A	8M Hex Nut	
SCALE: 4:1	WEIGHT:	SHEET 1 OF 1

2

1



M5 x 0.8 mm Thread



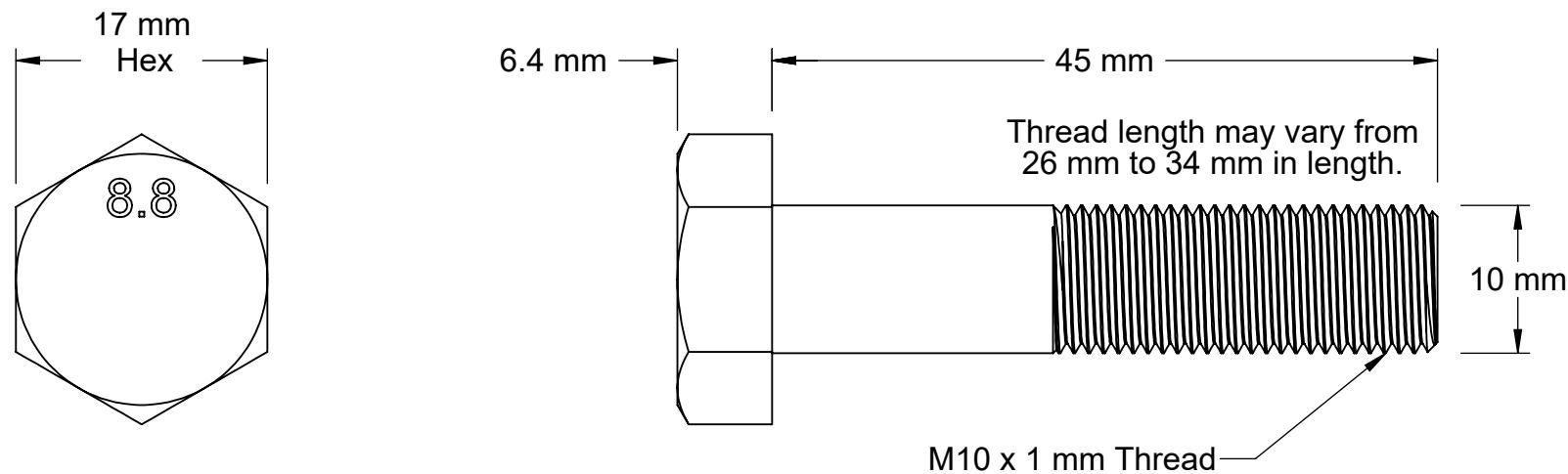
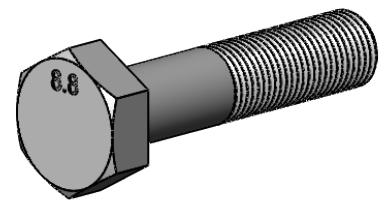
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PART NUMBER **97131A120**

Medium-Strength Nylon-
Insert Locknut



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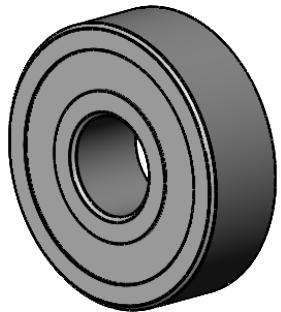
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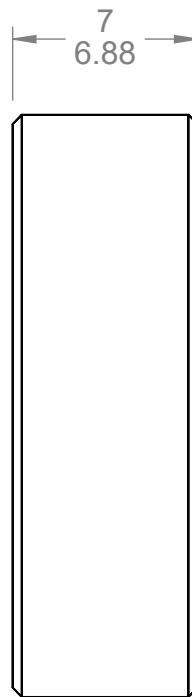
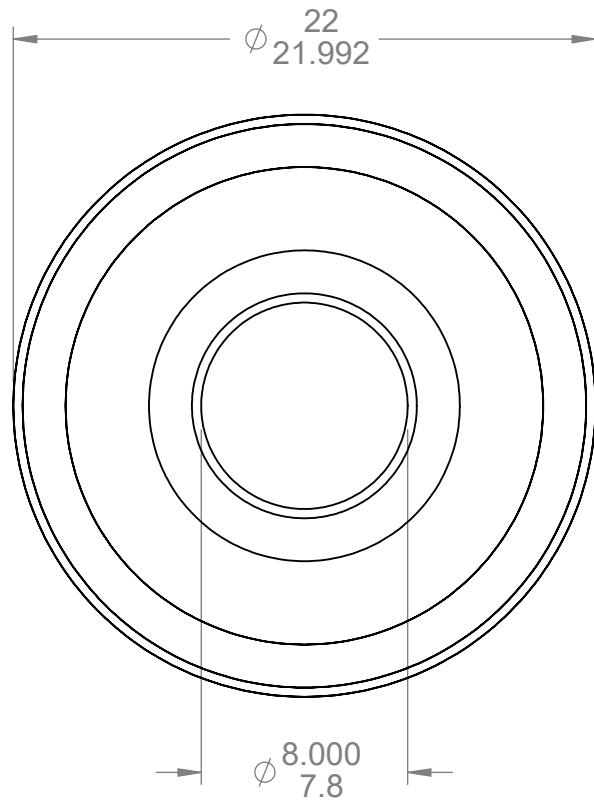
PART NUMBER **91180A622**

Medium-Strength Class 8.8
Steel Hex Head Screw

Units: mm



Trade Number: 608-2Z



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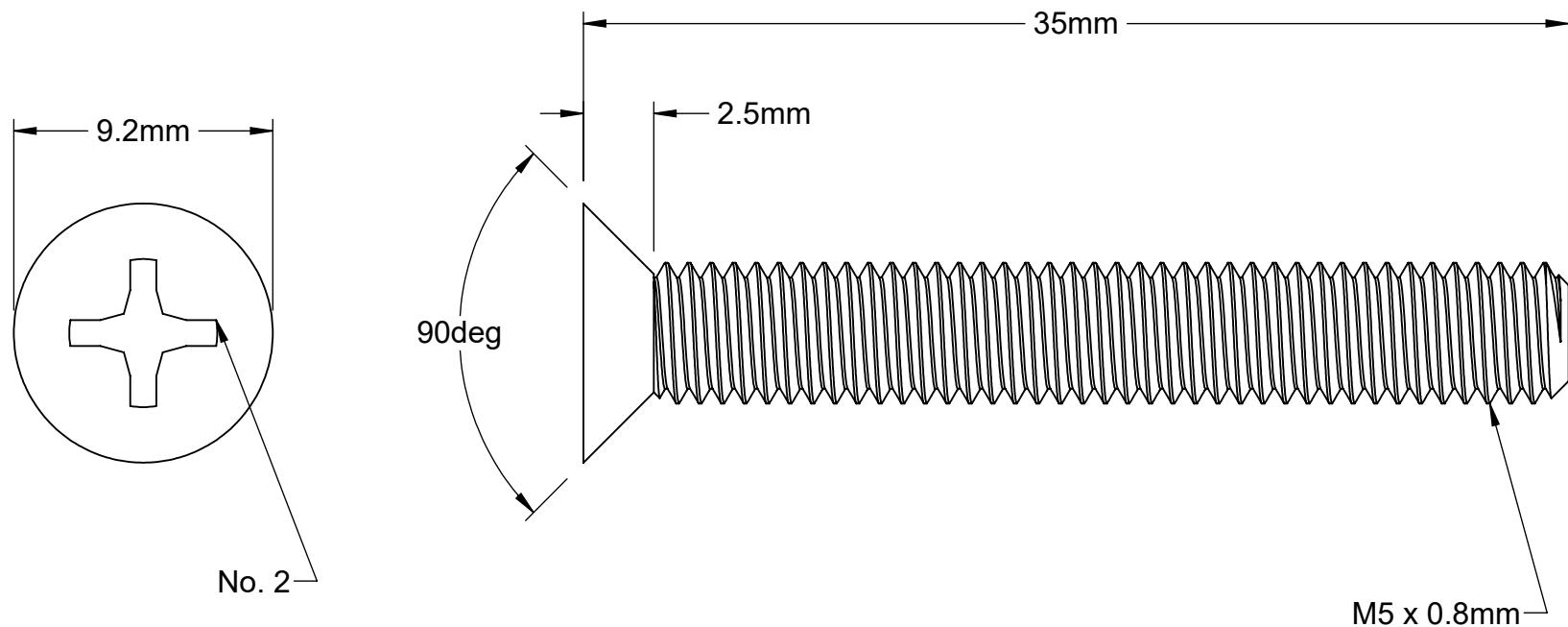
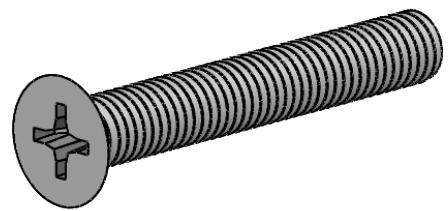
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PART
NUMBER

7487N66

Precision Stainless
Steel Ball Bearing



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PART NUMBER **92010A340**

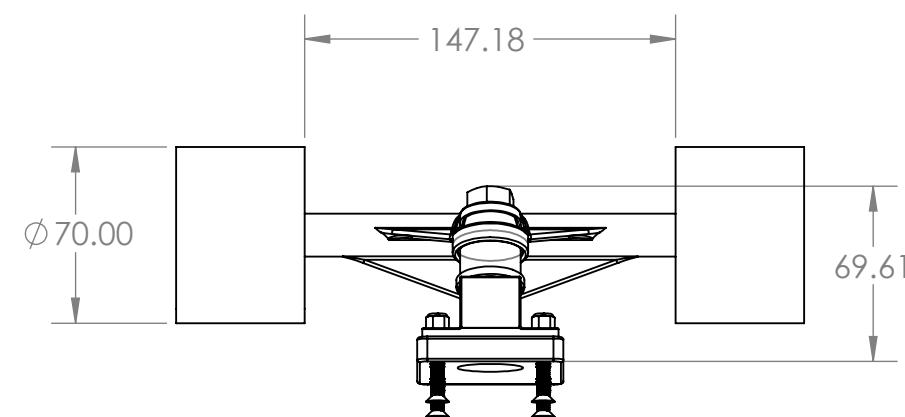
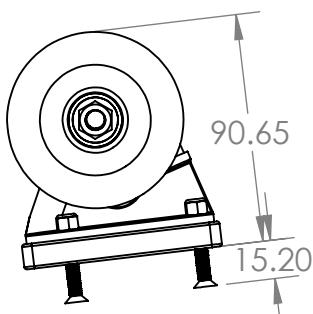
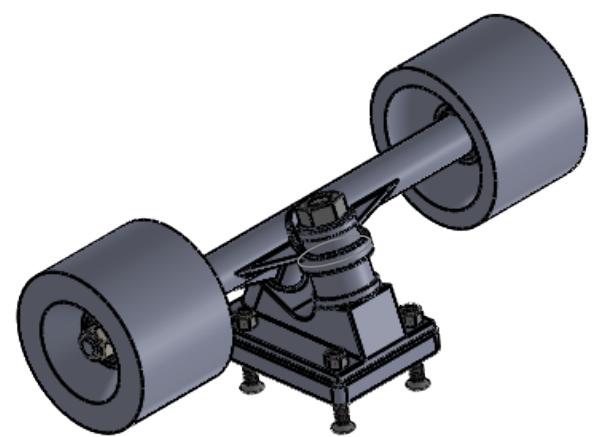
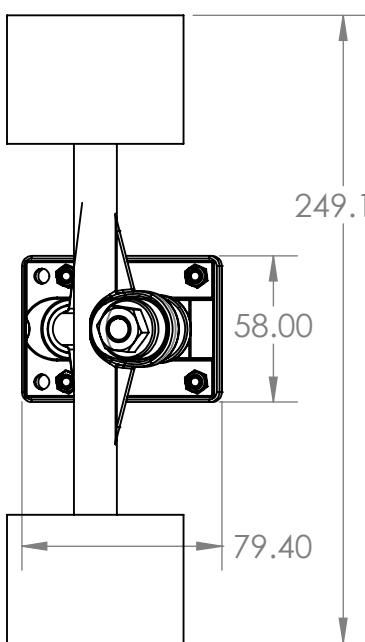
Passivated 18-8 Stainless Steel
Phillips Flat Head Screw

4

3

2

1



PART NAME	FILE NAME	MATERIAL	QTY.	MASS (g)	COST
Inner Metal Ring of Wheel	Inner Metal Ring of Wheel	SS AISI 440C	2	4	\$0.09
Metal Base	Metal Base	SAE 1040 Steel	1	98	\$0.49
Rubber Base	Rubber Base	Laminated Rubber	1	112	\$1.12
Rubber Cylinder Metal Fitting	Rubber Cylinder Metal Fitting	SAE 1040 Steel	1	4	\$0.02
Rubber Cylinder	Rubber Cylinder	Laminated Rubber	1	2	\$0.02
Rubber Fitting	Rubber Fitting	Laminated Rubber	1	1	\$0.01
Rubber Slanted Cylinder Metal Fitting	Rubber Slanted Cylinder Metal Fitting	SAE 1040 Steel	1	3	\$0.02
Rubber Slanted Cylinder	Rubber Slanted Cylinder	Laminated Rubber	1	1	\$0.01
Ball Bearing	Stainless Steel Ball Bearing	SS AISI 440C	4	90	\$57.56
Axle	Axle	SAE 1040 Steel	1	243	\$1.22
Longboard Wheel	Wheel	Polyurethane	2	460	\$12.20
10M x 1 Hex Head Screw	10M Hex Head Screw	Class 8.8 Steel	1	255	\$1.14
10M x 1 Distorted Thread Locknut	10M Center Lock Hex Nut	Class 8 Steel	1	12	\$1.99
8M x 1 Nut	8M Hex Nut	18-8 SS	2	13	\$1.59
5M x .8 Nylon-Insert Locknut	5M Nylon-Insert Locknut	Zinc-Plated Class 8 Steel	4	6	\$0.25
5M x .8 Phillips Flat Head Screw	5M Phillips Flat Head Screw	Passivated 18-8 SS	4	104	\$1.18

Total: \$78.91

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TITLE:
**Longboard Truck
and BOM**

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		ANGULAR: MACH \pm BEND \pm	MFG APPR.					
		TWO PLACE DECIMAL \pm	Q.A.					
		THREE PLACE DECIMAL \pm	COMMENTS:					
		INTERPRET GEOMETRIC TOLERANCING PER:						
		MATERIAL						
		FINISH						
NEXT ASSY	USED ON							
APPLICATION		DO NOT SCALE DRAWING						
						SCALE: 1:3	WEIGHT:	SHEET 1 OF 1
						B	Assem1	REV

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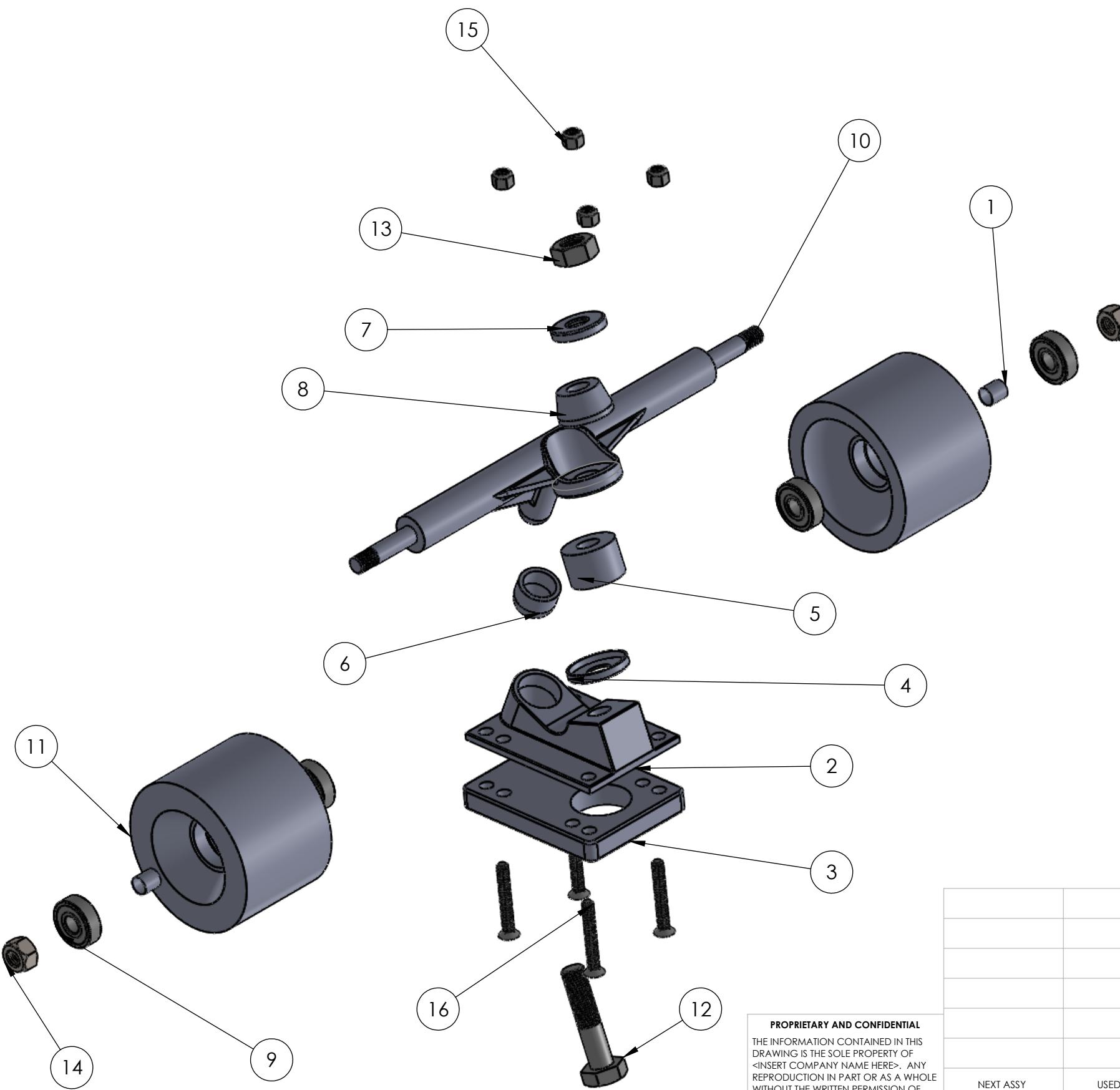
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B

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		TWO PLACE DECIMAL \pm THREE PLACE DECIMAL \pm			
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		MATERIAL			
		NEXT ASSY	USED ON	FINISH	
		APPLICATION		DO NOT SCALE DRAWING	
				COMMENTS:	
SIZE	DWG. NO.			REV	
B		Assembly2			
SCALE: 1:2		WEIGHT:		SHEET 1 OF 1	

University of Arizona
Exploded Assembly