Design Report 3

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Group 1B

7/26/2026

EML2322L - Summer 2026

Concept Description

The food mixer uses the provided compressed air engine assembly (Item 24) to rotate an Oster-style mixing blade inside a standard wide-mouth mason jar (Item 22). The air engine remains mounted to the Modified Air-Engine Base (Item 7), which is manufactured from 6061-T6 aluminum and fastened to the Main Base (Item 1) through the added mounting holes and associated fasteners. The Main Base supports the Stepped Drive Shaft (Item 2), belt-tensioner assembly, and H-Block (Item 3) while maintaining alignment between the modified air-engine flywheel and the mixing mechanism.

The main Base is machined from 6061-T6 aluminum to provide a rigid and corrosion-resistant support structure. A ½" sealed ball bearing (Item 10) is seated in the Base counterbore and supports the lower end of the Shaft. Four locating pockets position the legs of the H-Block and help maintain alignment between the upper and lower shaft bearings. Four ¼-20 socket head screws (Item 9) pass through the main Base and thread into the H-Block, clamping the support structure together. Eight hex nuts (Item 20) are arranged in four stacked pairs beneath the Base to act as feet and provide clearance for the lower tensioner hardware.

Power is transmitted from the Modified Air-Engine Flywheel (Item 5) to the Shaft through a ¼" wide flat belt (Item 21). The flywheel is manufactured from mild steel and includes a machined outer belt-contact surface. The Shaft incorporates two pulley diameters, allowing the user to select between two speed ratios. To change mixing speed, the user loosens the belt tensioner, moves the belt to the desired pulley diameter, and retightens the tensioner.

The belt tensioner is positioned on the slack side of the belt and uses two ¼" shielded ball bearings (Item 11) to provide rolling contact with the belt. The tensioner also includes a four-arm grip knob (Item 12), four washer shims (Item 8), three thin hex jam nuts (Item 17), one thick flat washer (Item 18), and one two-arm through grip knob (Item 19). The washer shims provide clearance so the bearings rotate freely, while the jam nuts establish and lock the bearing-stack height. The upper grip knob applies the clamping force, the lower grip knob secures the assembly beneath the Base, and the thick washer distributes the load. A slot in the Base allows the tensioner to be repositioned by hand to establish the required belt tension.

The drive Shaft is machined from low-carbon steel to withstand the radial loading generated by the belt and the torsional loading required to rotate the mixing blade. The Shaft is supported by two ½" sealed ball bearings (Item 10), with one bearing located in the Main Base and the second located in the H-Block. This arrangement maintains shaft alignment, limits deflection, and reduces rotational wobble. A threaded hole at the upper end of the Shaft accepts the Oster square drive pin (Item 15). The drive pin engages the Oster blade shaft (Item 13), transferring torque from the Shaft to the Oster blade assembly. The blade shaft rotates within the Oster blade housing (Item 14), positioning the mixing blades at the center of the mason jar.

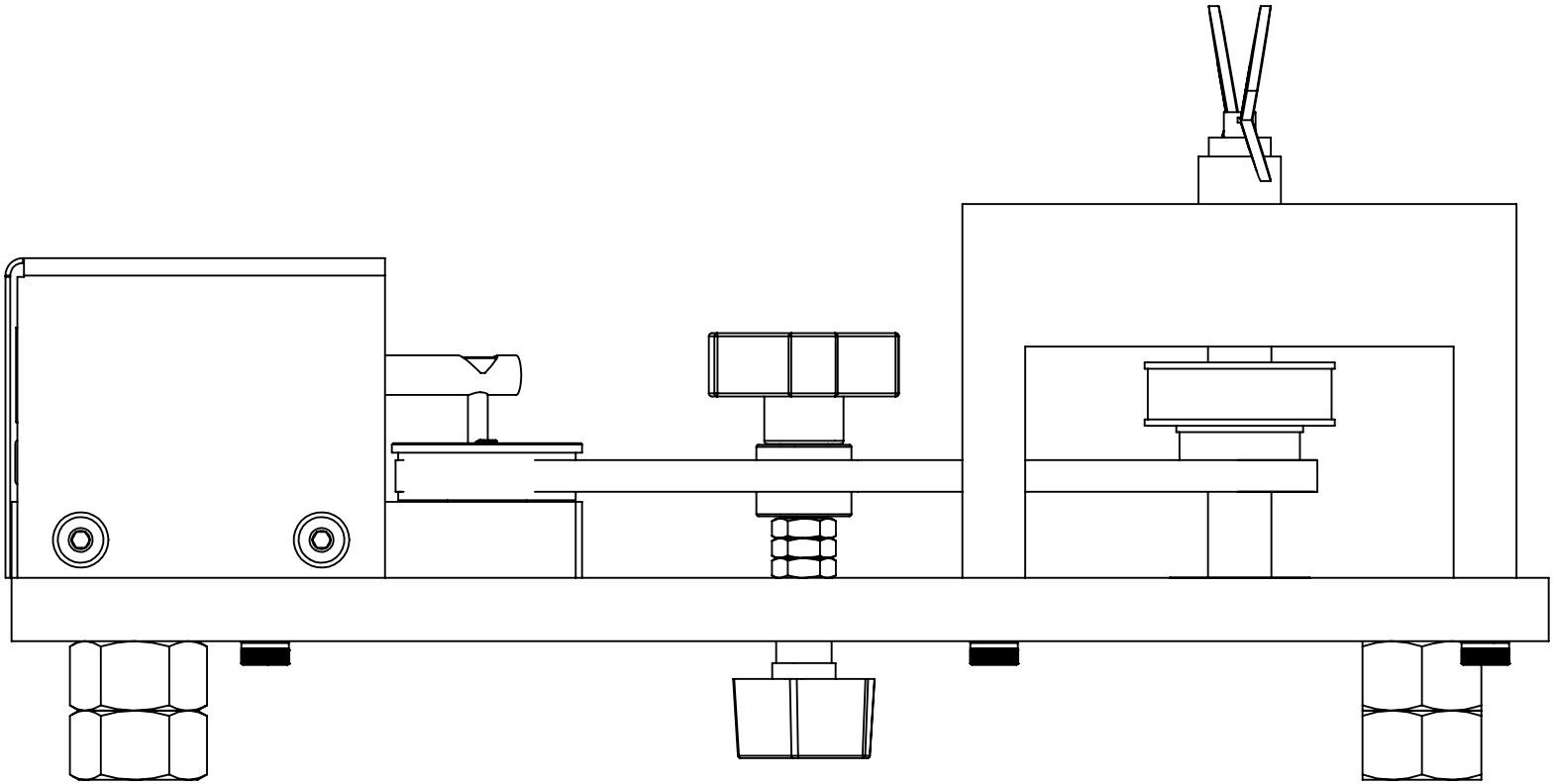
The H-Block is 3D printed from PETG with 40% infill where it supports the mason-jar interface and houses the upper shaft bearing, Oster blade housing, rubber gasket (Item 16), and Lid Block (Item 4). Concentric internal seats position the bearing and blade housing directly above the Shaft. The H-Block also contains two opposing twist-lock slots.

The Lid Block is machined from 6061 aluminum and contains two opposing L-shaped tabs that engage the corresponding twist-lock slots in the H-Block. A standard gold-coated metal wide-mouth mason-jar lid with a plastisol liner is modified (Item 6) by machining a concentric clearance hole for the Oster blade housing. This Modified Lid is permanently bonded to the Lid Block using 3M DP420 structural epoxy (Item 23), allowing the two parts to rotate and lock together as one subassembly.

To install the lid and blade subassembly, the Lid Block tabs are inserted into the H-Block slots and rotated into the locked position. This rotation draws the Lid Block downward and compresses the Modified Mason-Jar Lid, rubber gasket, and Oster blade housing against their locating surfaces. The resulting compression seats the blade housing, limits leakage, and prevents the blade assembly from lifting during operation. The mason jar threads directly into the Modified Mason-Jar Lid, securing it above the blade.

The mason jar, mixing blades, Oster blade shaft, Oster blade housing, rubber gasket, and plastisol lid liner are the intended food-contact components. The H-Block, Lid Block, Stepped Drive Shaft, mounting hardware, air-engine components, and epoxy remain outside the sealed food-contact volume. The twist-lock mechanism allows the complete lid and blade subassembly to be removed without tools for cleaning, maintenance, or installation of another compatible Oster-style attachment.

Assembly Drawings and B.O.M.



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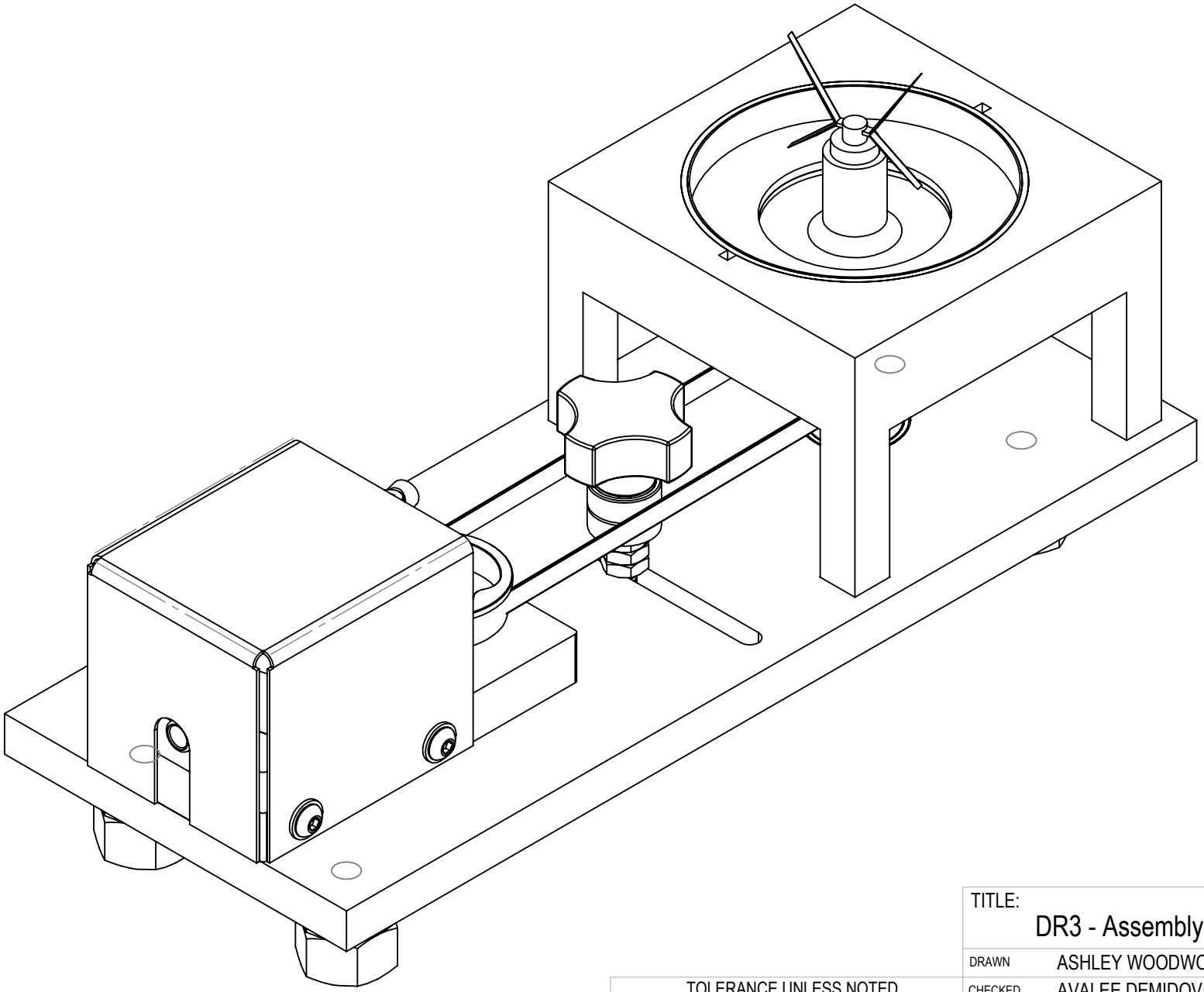
ANGULAR	±5	±2	±0.5	SCALE: 2:3	SHEET 1 OF 4

5 4 3 2 1



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CHECKED	AVALEE DEMIDOVICH				
TOLERANCE UNLESS NOTED				SIZE	DWG. NO. / REV
DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000	A	EML2322L-ASM1 / A
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ANGULAR	±5	±2	±0.5	SCALE: 2:3	SHEET 2 OF 4

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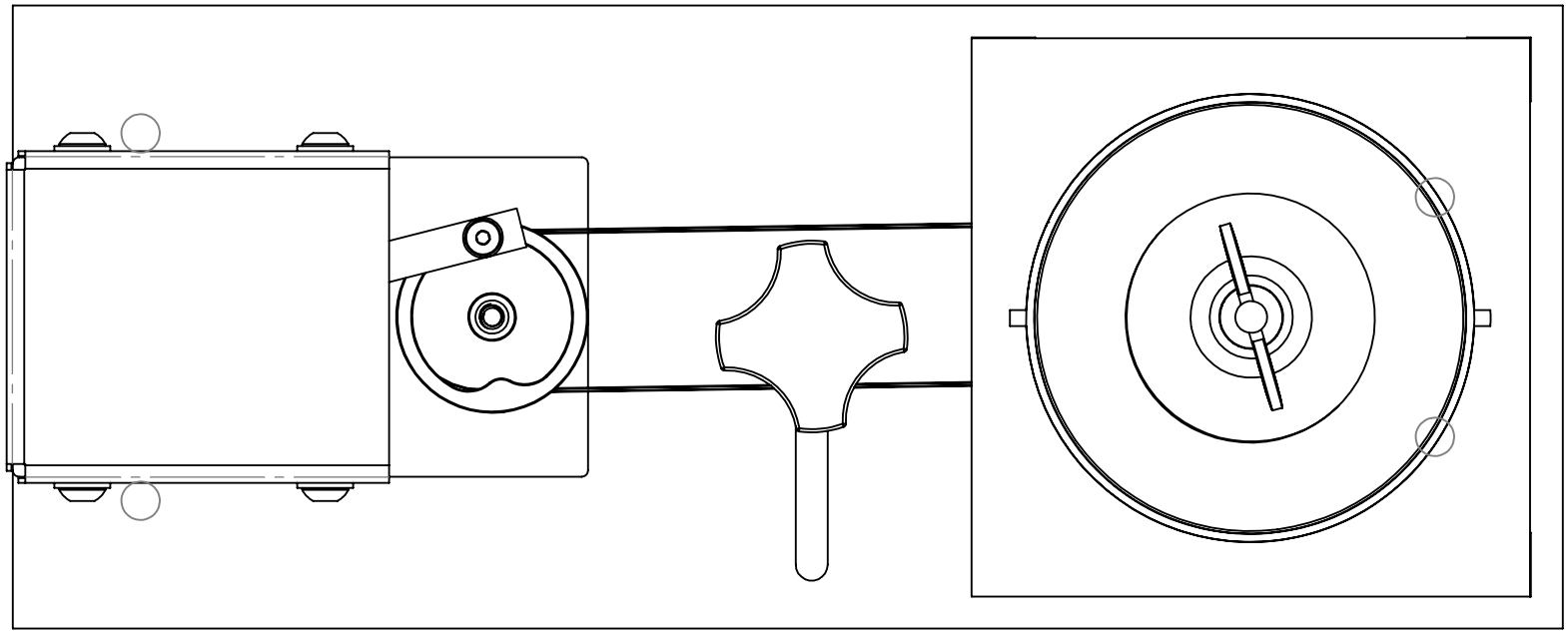
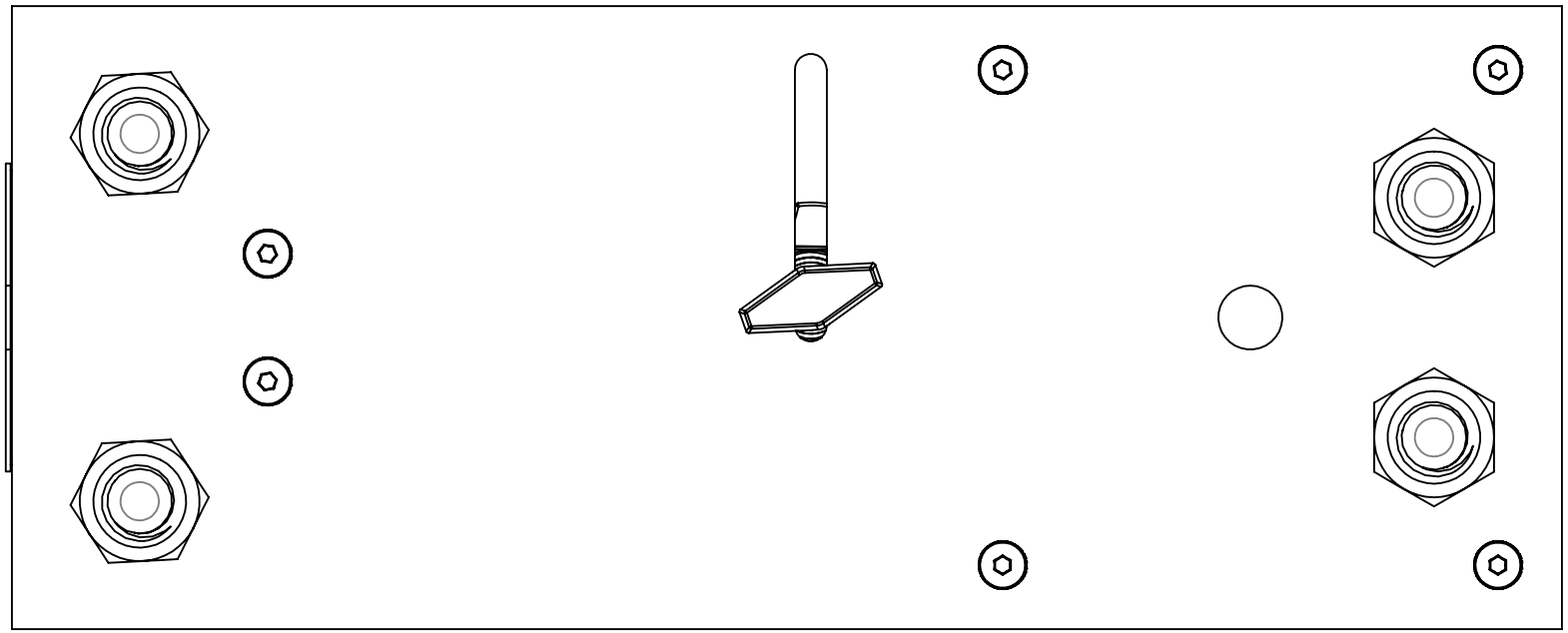


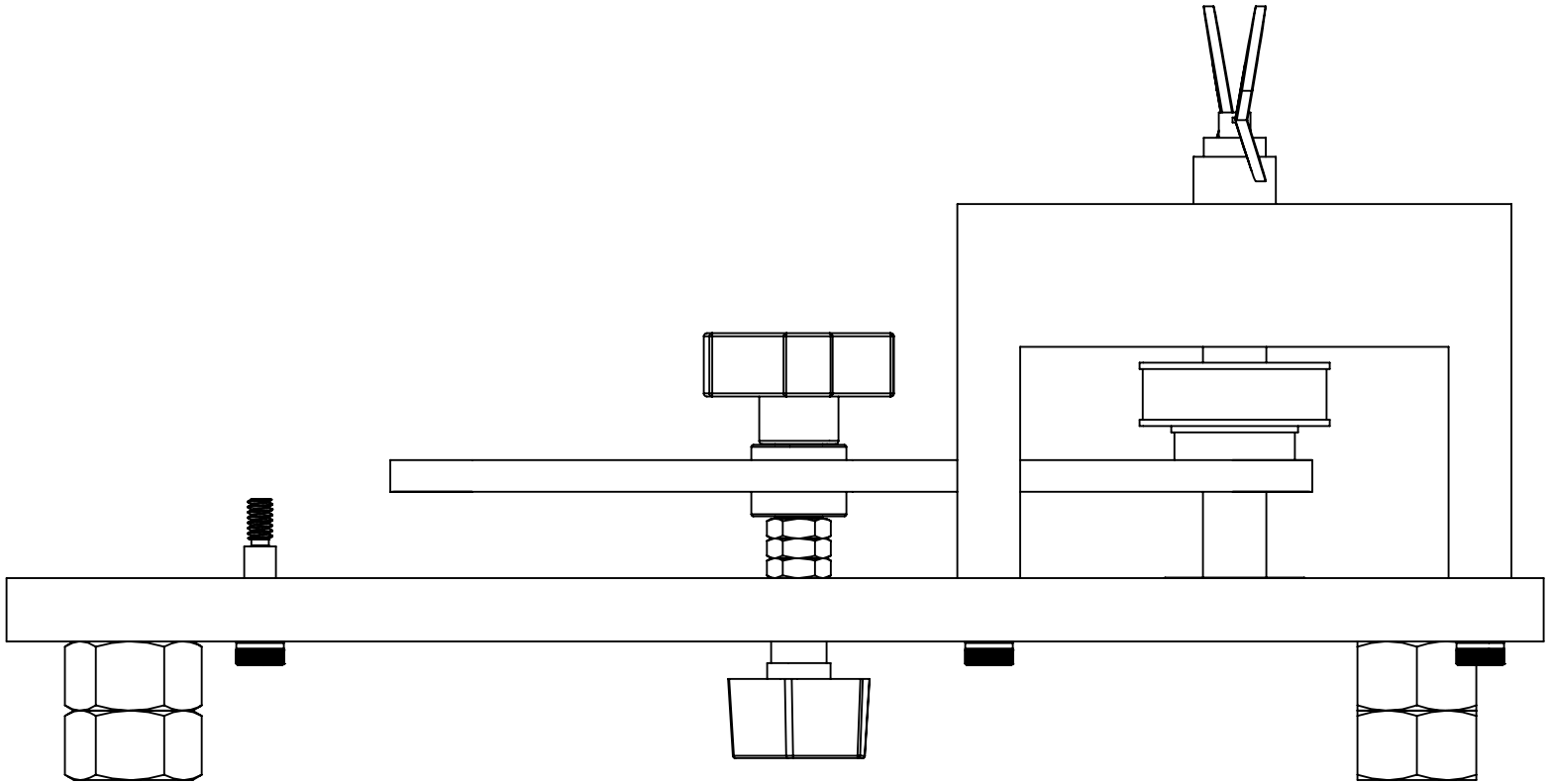
TITLE: DR3 - Assembly - Drawing						
DRAWN	ASHLEY WOODWORTH					
CHECKED	AVALEE DEMIDOVICH					
TOLERANCE UNLESS NOTED				SIZE	DWG. NO.	REV
DIMENSION TYPE	PLACES IN DIMENSION			A	EML2322L-ASM1	A
	0.0	0.00	0.000			
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 3 OF 4

5 4 3 2 1



TITLE: DR3 - Assembly - Drawing						
DRAWN	ASHLEY WOODWORTH					
CHECKED	AVALEE DEMIDOVICH					
TOLERANCE UNLESS NOTED				SIZE	DWG. NO.	REV
DIMENSION TYPE	PLACES IN DIMENSION			A	EML2322L-ASM1	A
	0.0	0.00	0.000			
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 4 OF 4

5 4 3 2 1



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DR3 - Assembly - No Air Engine - Drawing

DRAWN	ASHLEY WOODWORTH
CHECKED	SERENE YAHIA

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DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000	A	EML2322L-ASM2	A
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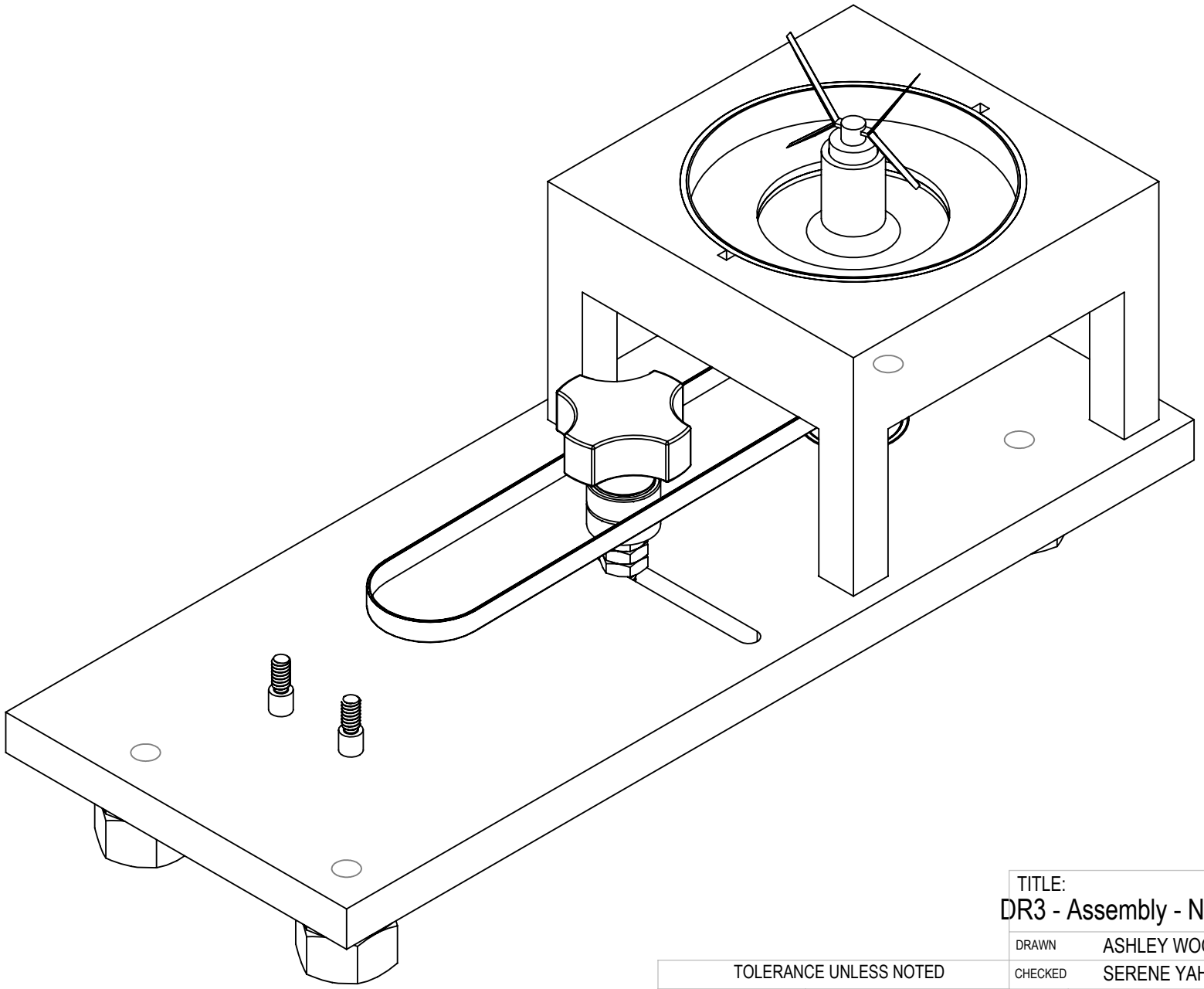
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 1 OF 3

5 4 3 2 1

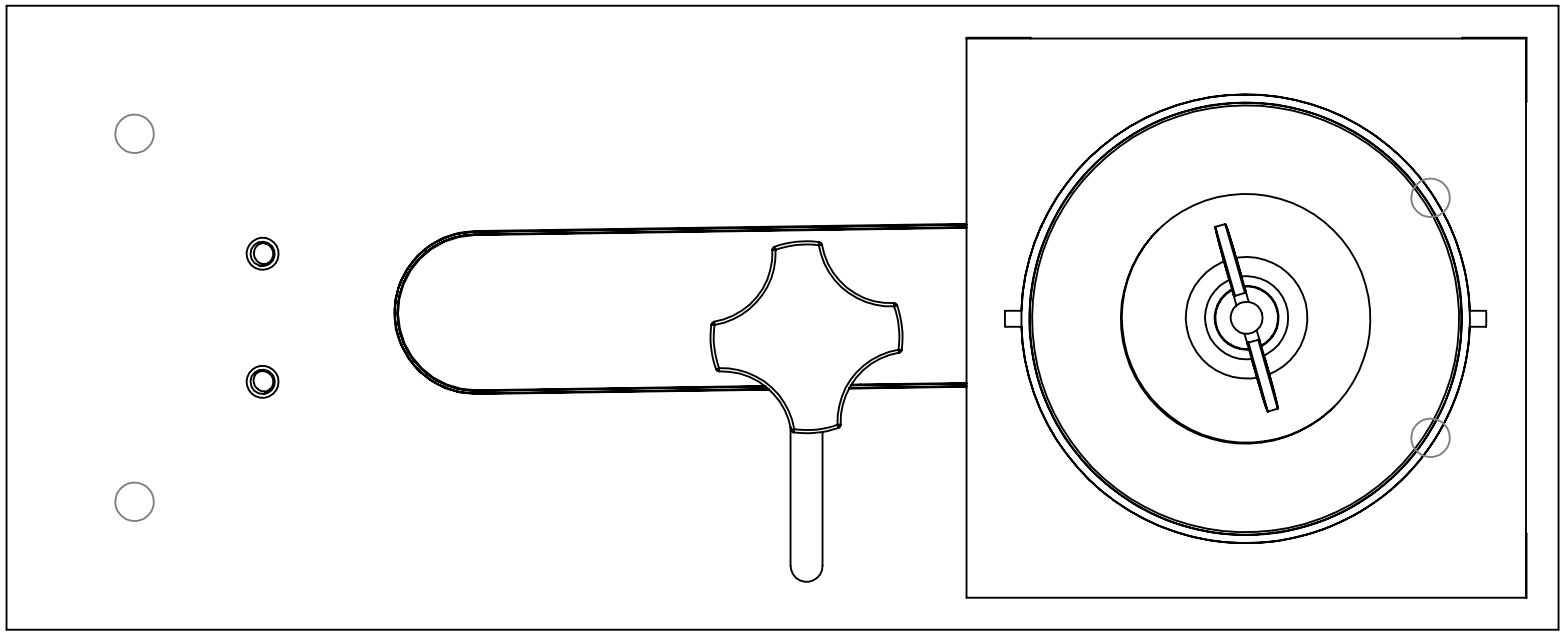


TITLE:
DR3 - Assembly - No Air Engine - Drawing

DRAWN	ASHLEY WOODWORTH
CHECKED	SERENE YAHIA

TOLERANCE UNLESS NOTED				SIZE	DWG. NO.	REV
DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000	A	EML2322L-ASM2	A
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 2 OF 3

5 4 3 2 1



TITLE: DR3 - Assembly - No Air Engine - Drawing						
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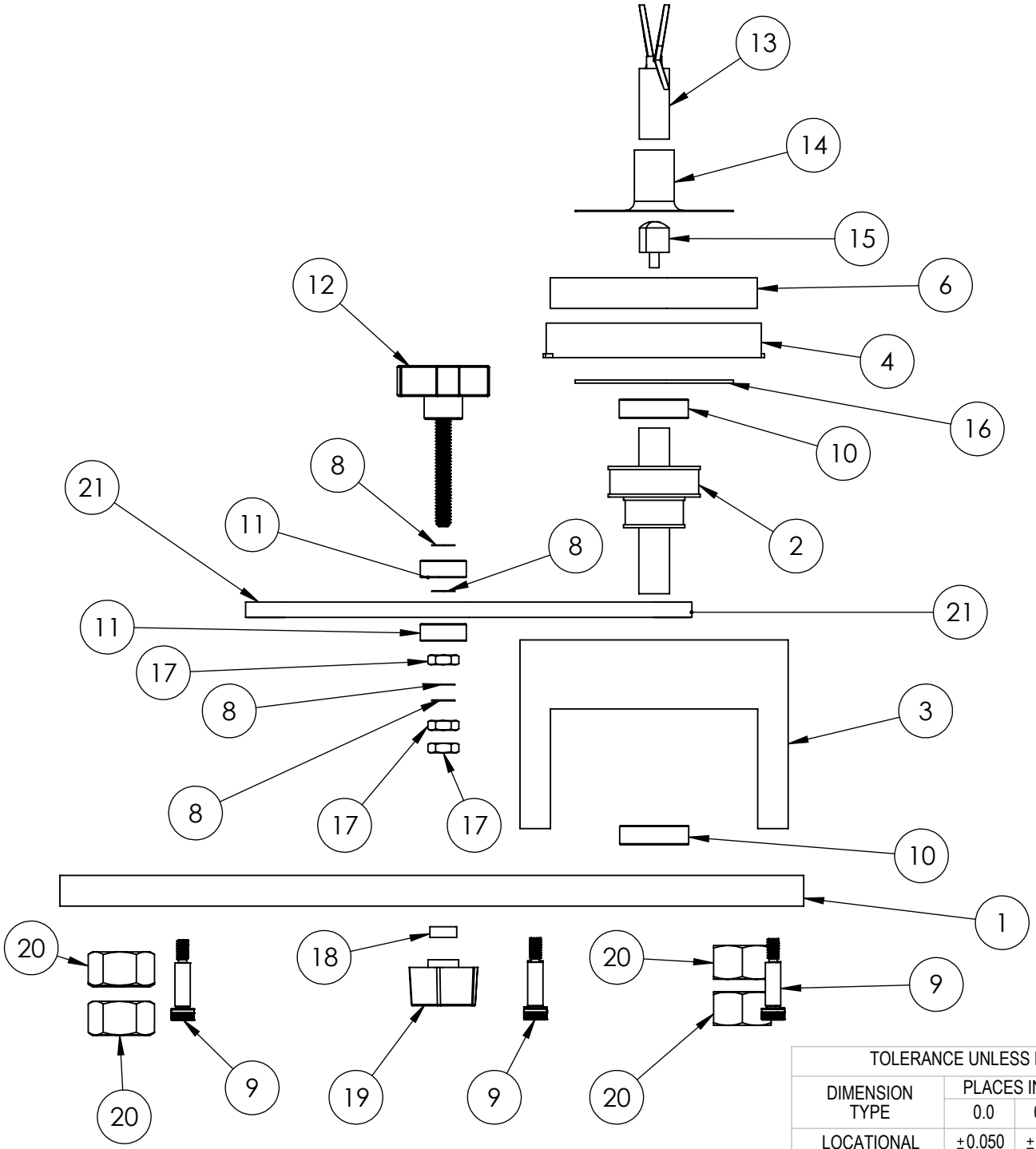
TOLERANCE UNLESS NOTED				CHECKED	SERENE YAHIA	
DIMENSION TYPE	PLACES IN DIMENSION			SIZE	DWG. NO.	REV
	0.0	0.00	0.000	A	EML2322L-ASM2	A
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 3 OF 3

5 4 3 2 1



TITLE: DR3 - Assembly - Exploded			
DRAWN: ASHLEY WOODWORTH			
CHECKED: ORI ALGAVE			
TOLERANCE UNLESS NOTED			
DIMENSION TYPE	PLACES IN DIMENSION		
	0.0	0.00	0.000
LOCATIONAL	±0.050	±0.020	±0.005
ANGULAR	±5	±2	±0.5

SIZE	DWG. NO.	REV
A	EML2322L-EXP	A

SCALE: 2:5 | SHEET 1 OF 3

5 4 3 2 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	P1 / EML2322L-001	MAIN BASE, 6061-T6 ALUMINUM	1
2	P2 / EML2322L-002	STEPPED DRIVE SHAFT, LOW CARBON STEEL	1
3	P3 / EML2322L-003	H-BLOCK, PETG, 40% INFILL	1
4	P4 / EML2322L-004	LID BLOCK, 6061 ALUMINUM	1
5	P5 / EML2322L-005	MODIFIED ENGINE FLYWHEEL, MILD STEEL	1
6	P6 / EML2322L-006	MODIFIED MASON JAR LID	1
7	P7 / EML2322L-007	MODIFIED ENGINE BASE, 6061-T6 ALUMINUM	1
8	99040A512	WASHER SHIMS	4
9	91251A540	1/4-20 SOCKET HEAD SCREWS	6
10	60355K691	1/2" SEALED BALL BEARING	2
11	60355K271	1/4" SHIELDED BALL BEARING	2
12	3992T21	FOUR-ARM GRIP KNOB	1
13	OTS-01	OSTER 4961 BLADE ASSEMBLY	1
14	OTS-02	OSTER BLADE HOUSING	1
15	OTS-03	OSTER SQUARE DRIVE PIN	1
16	OTS-04	RUBBER SEALING GASKET	1
17	94846A029	THIN HEX NUTS	3
18	OTS-05	THICK FLAT WASHER	1

TITLE: DR3 - Assembly - Exploded

DRAWN ASHLEY WOODWORTH

CHECKED ORI ALGAVE

TOLERANCE UNLESS NOTED			
DIMENSION TYPE	PLACES IN DIMENSION		
	0.0	0.00	0.000
LOCATIONAL	±0.050	±0.020	±0.005
ANGULAR	±5	±2	±0.5

SIZE A | DWG. NO. EML2322L-EXP | REV A

SCALE: 1:2 | SHEET 2 OF 3

5 4 3 2 1

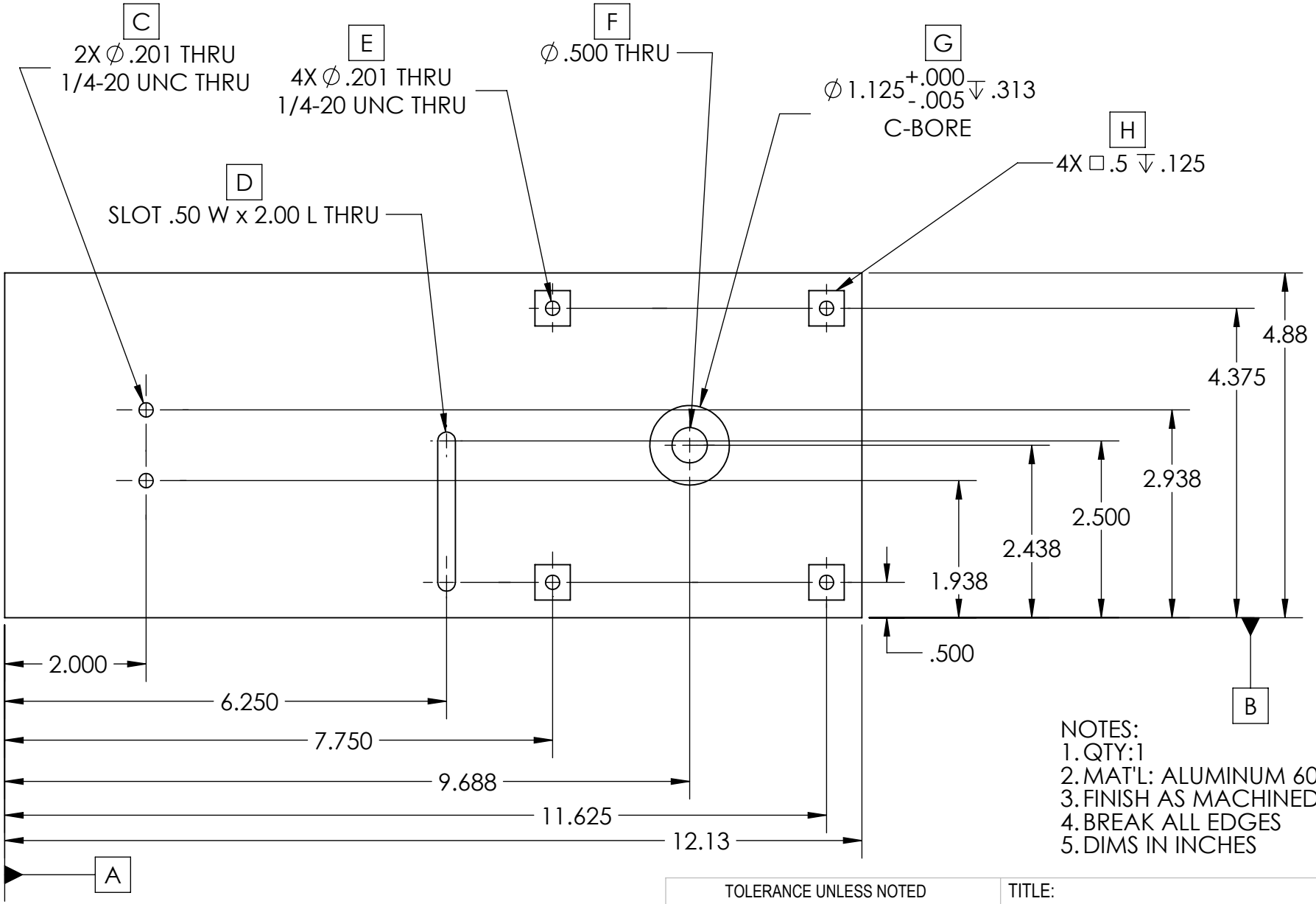
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
19	6477K57	TWO-ARM GRIP KNOB	1
20	95355A259	FEET HEX NUTS	8
21	6082K211	1/4" WIDE FLAT BELT	1
22	OTS-06	STANDARD WIDE MOUTH MASON JAR	1
23	OTS-07	3M DP420 STRUCTURAL EPOXY	1
24	EML2322L-A1	PROVIDED COMPRESSED AIR ENGINE ASSEMBLY	1

TITLE: DR3 - Assembly - Exploded			
DRAWN: ASHLEY WOODWORTH			
CHECKED: ORI ALGAVE			
TOLERANCE UNLESS NOTED			
DIMENSION TYPE	PLACES IN DIMENSION		
	0.0	0.00	0.000
LOCATIONAL	±0.050	±0.020	±0.005
ANGULAR	±5	±2	±0.5

SIZE: A	DWG. NO.: EML2322L-EXP	REV: A
SCALE: 1:2		SHEET 3 OF 3

5 4 3 2 1

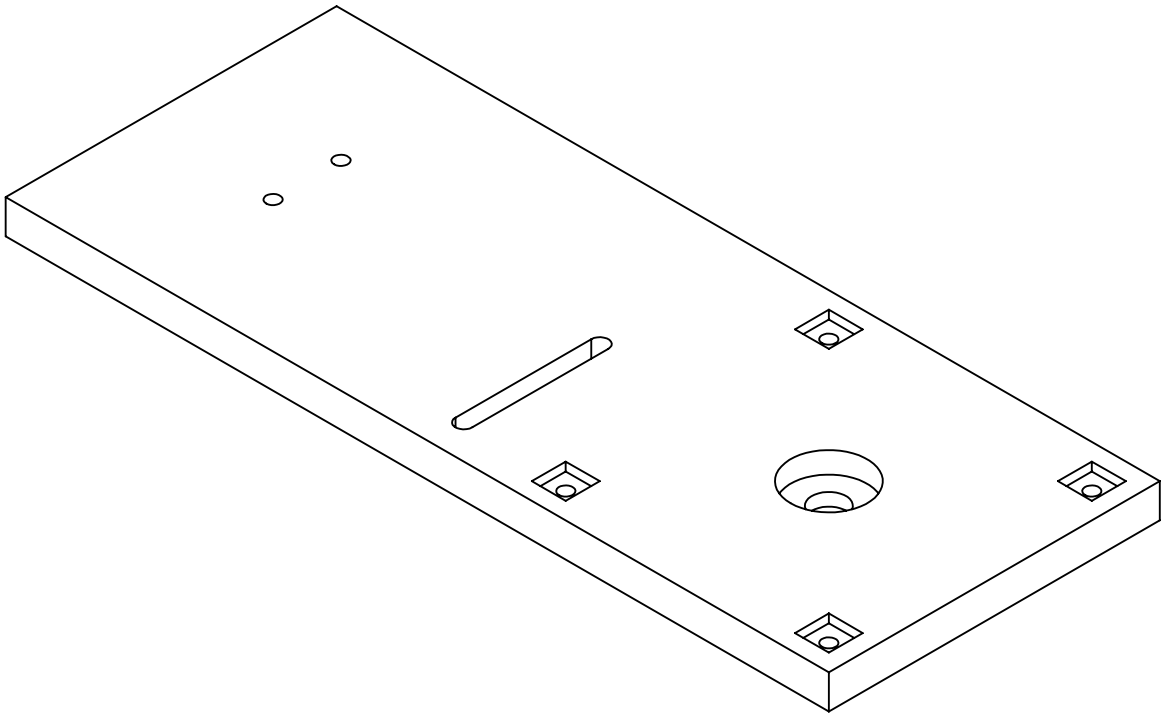
Appendix A: Detail Part Drawings

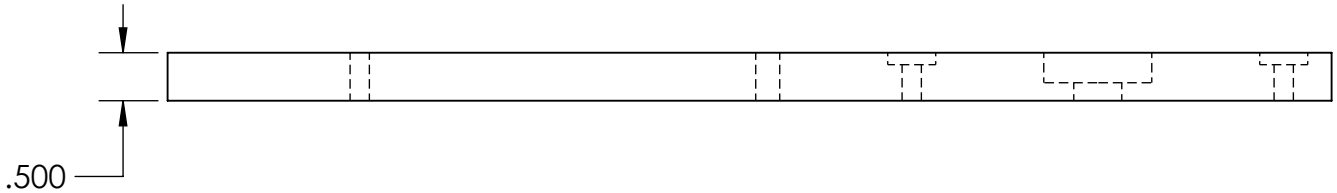


NOTES:
1. QTY:1
2. MAT'L: ALUMINUM 6061-T6
3. FINISH AS MACHINED
4. BREAK ALL EDGES
5. DIMS IN INCHES

TOLERANCE UNLESS NOTED				TITLE: Design - Base		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	AVALEE DEMIDOVICH	
MACHINING	±0.050	±0.020	±0.005	CHECKED	SERENE YAHIA	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-001	REV A
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:2		SHEET 1 OF 2

5 4 3 2 1





NOTES:
1. QTY: 1
2. MAT'L: ALUMINUM 6061-T6
3. FINISH AS MACHINED
4. BREAK ALL EDGES
5. DIMS IN INCHES

TOLERANCE UNLESS NOTED				TITLE: Design - Base		
OPERATION	PLACES IN DIMENSION					
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MACHINING	±0.050	±0.020	±0.005	CHECKED	SERENE YAHIA	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-001	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:2		SHEET 2 OF 2

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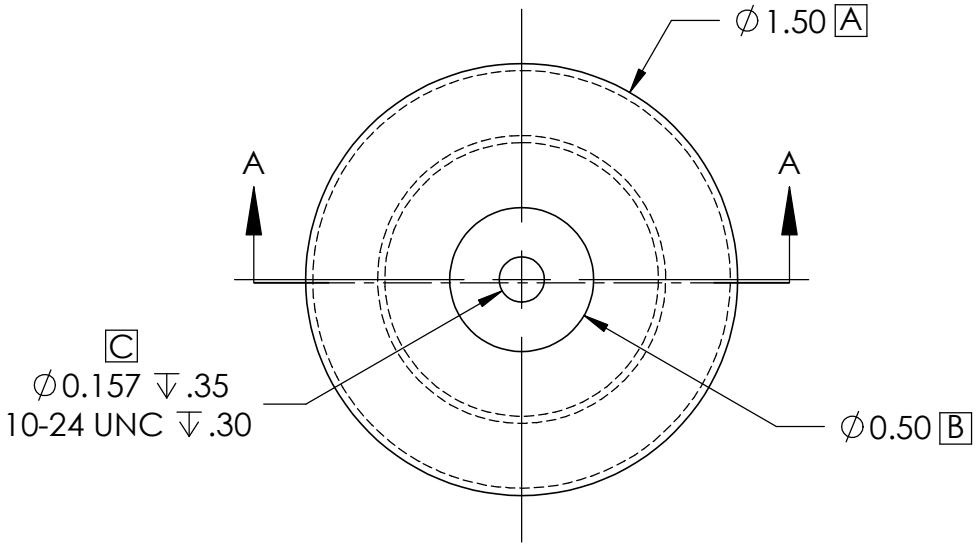
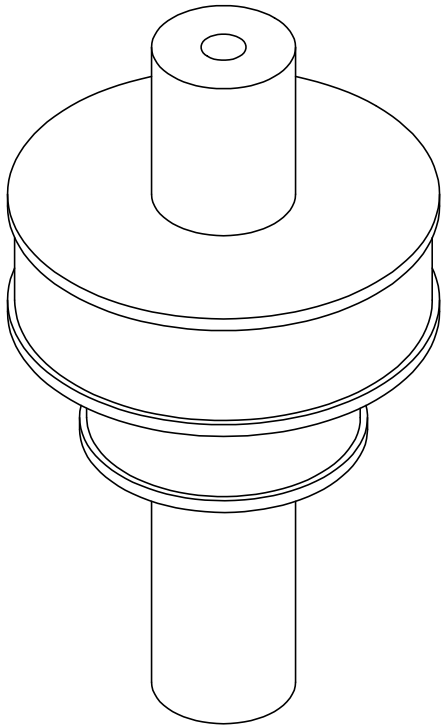
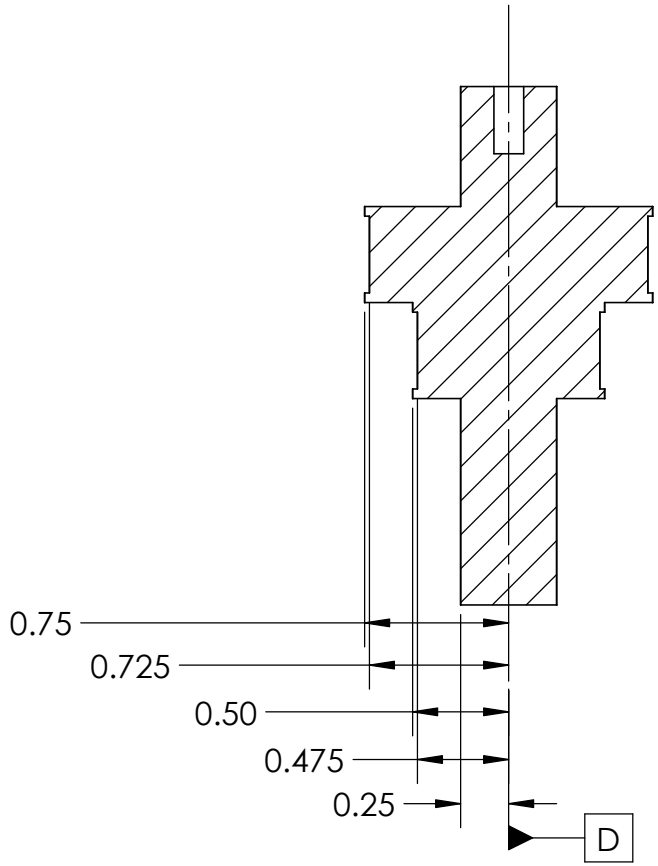




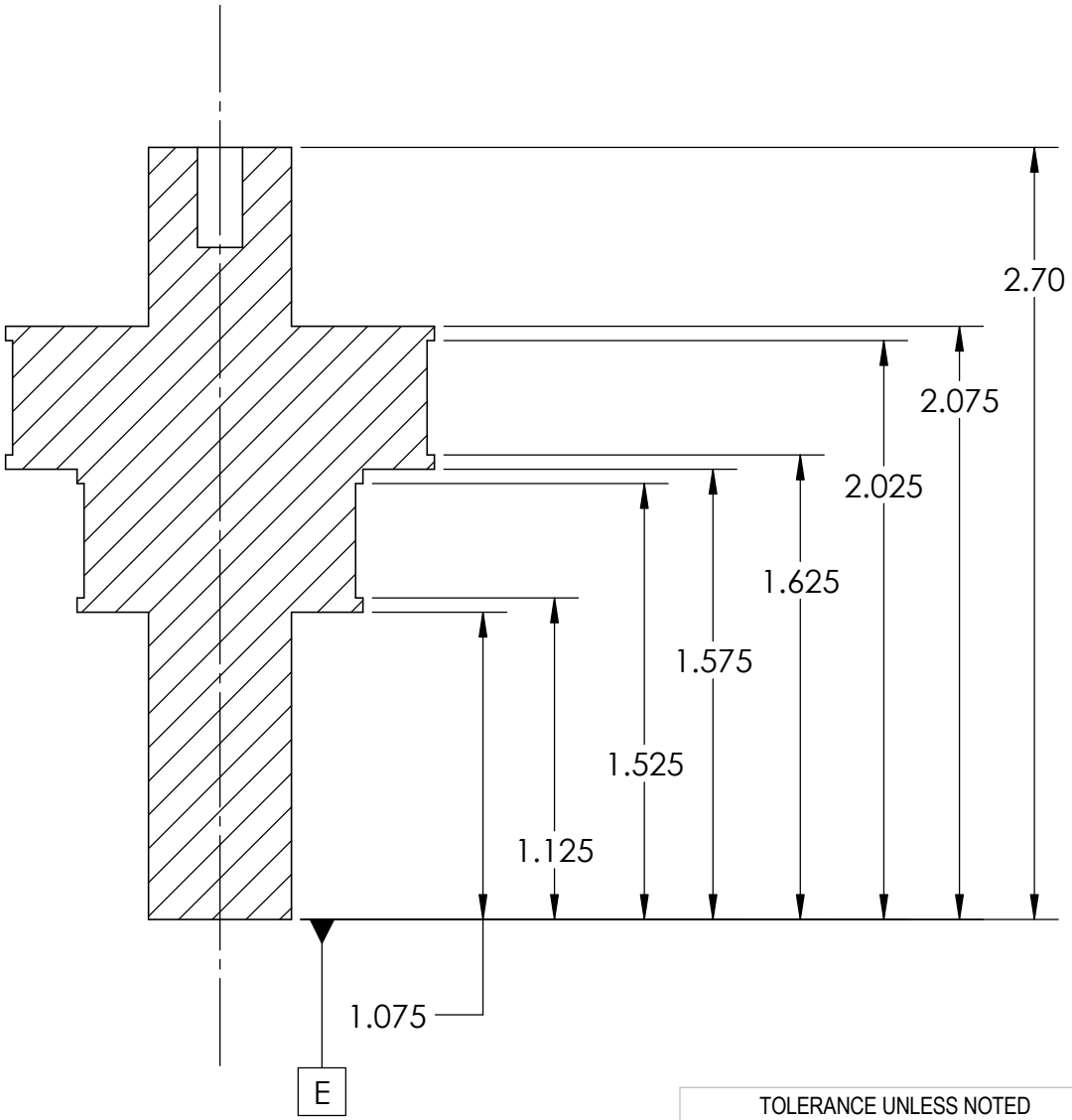


SECTION A-A
SCALE 1 : 1

NOTES:
1. QTY: 1
2. MAT'L: LOW CARBON STEEL
3. BREAK ALL EDGES
4. ALL DIMS IN INCHES
5. FINISH AS MACHINED

TOLERANCE UNLESS NOTED				TITLE: Design - Shaft		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	SERENE YAHIA	
MACHINING	±0.050	±0.020	±0.005	CHECKED	ASHLEY WOODWORTH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-002	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 3:2		SHEET 1 OF 2

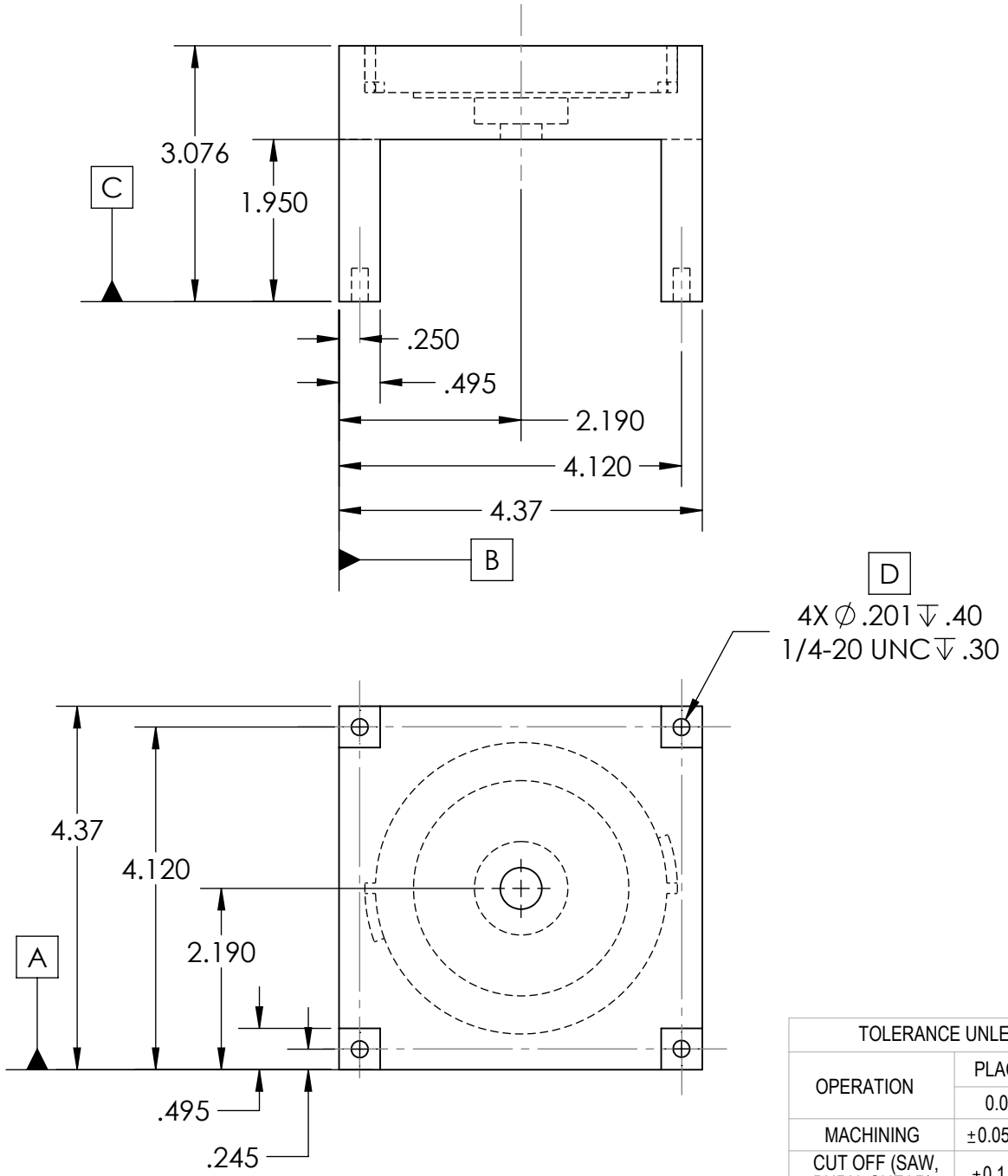
5 4 3 2 1



SECTION A-A

NOTES:
1. QTY: 1
2. MAT'L: LOW CARBON STEEL
3. BREAK ALL EDGES
4. ALL DIMS IN INCHES
5. FINISH AS MACHINED

TOLERANCE UNLESS NOTED				TITLE: Design - Shaft		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	SERENE YAHIA	
MACHINING	±0.050	±0.020	±0.005	CHECKED	ASHLEY WOODWORTH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-002	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 3:2		SHEET 2 OF 2



NOTES:
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2. MAT'L: PETG (40% INFILL)
3. BREAK ALL EDGES
4. DIMS IN INCHES

TOLERANCE UNLESS NOTED				TITLE: Design - HBlock		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	AVALEE DEMIDOVICH	
MACHINING	±0.050	±0.020	±0.005	CHECKED	ASHLEY WOODWORTH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-003	A
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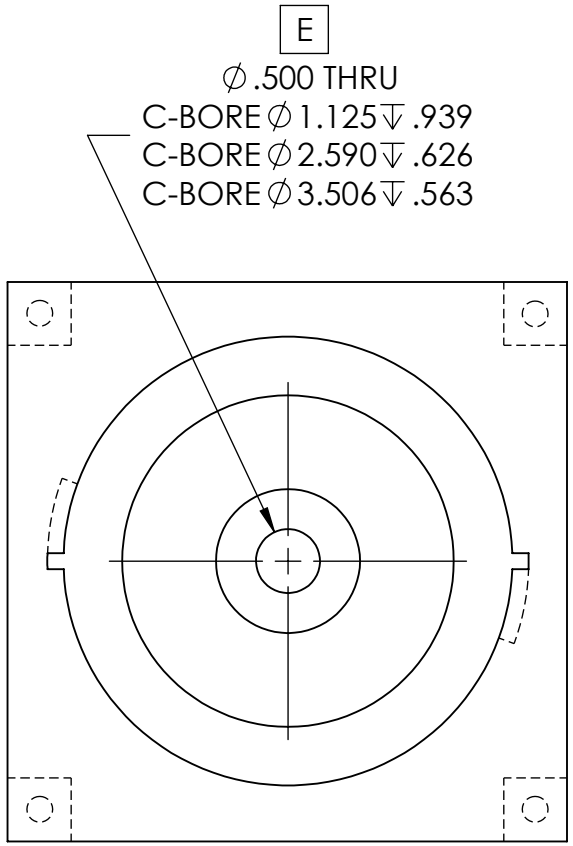
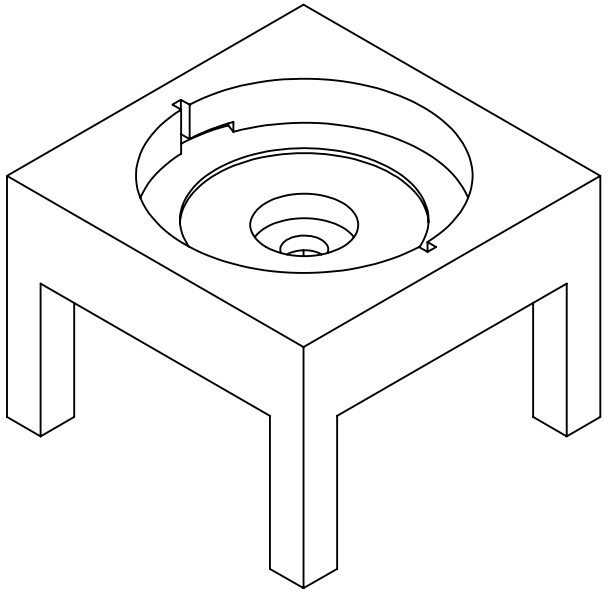
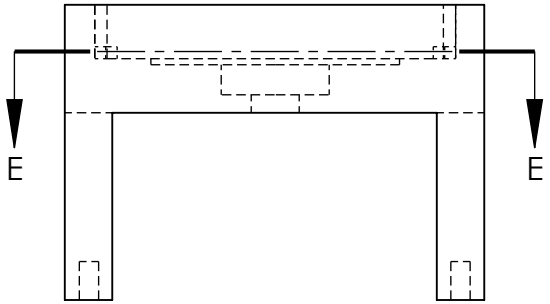


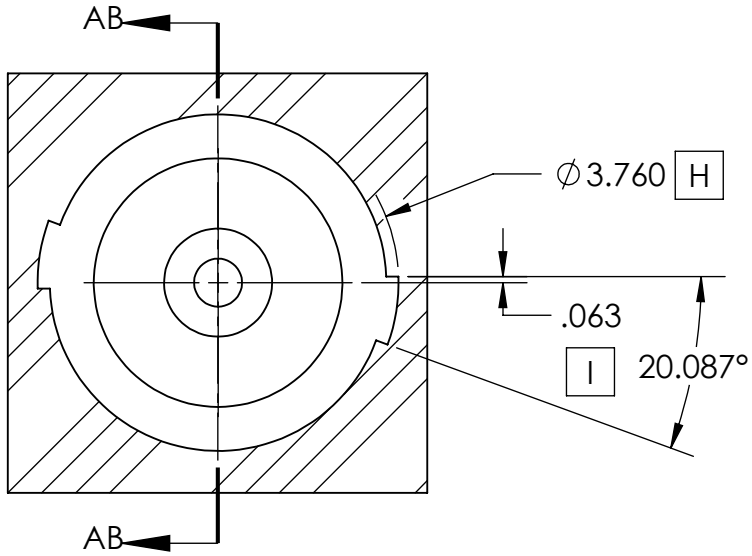


NOTES:
1. QTY: 1
2. MAT'L: PETG (40% INFILL)
3. BREAK ALL EDGES
4. DIMS IN INCHES

TOLERANCE UNLESS NOTED				TITLE: Design - HBlock		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	AVALEE DEMIDOVICH	
MACHINING	±0.050	±0.020	±0.005	CHECKED	ASHLEY WOODWORTH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-003	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 2:3		SHEET 2 OF 3

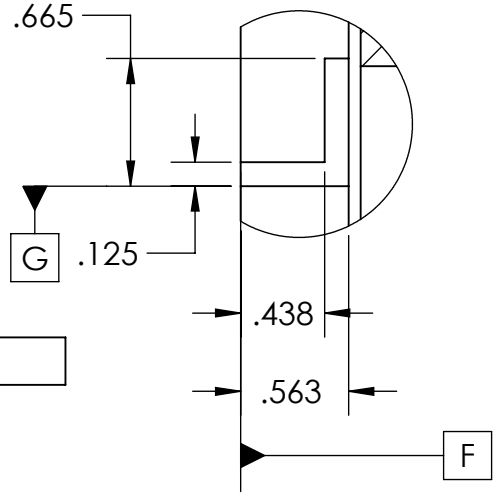
5 4 3 2 1

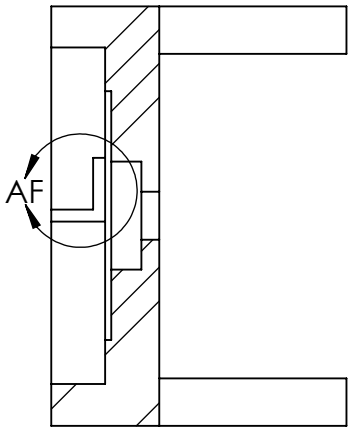




SECTION E-E

DETAIL AF
SCALE 1 : 1



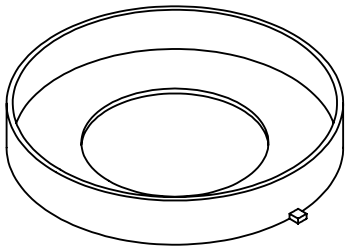


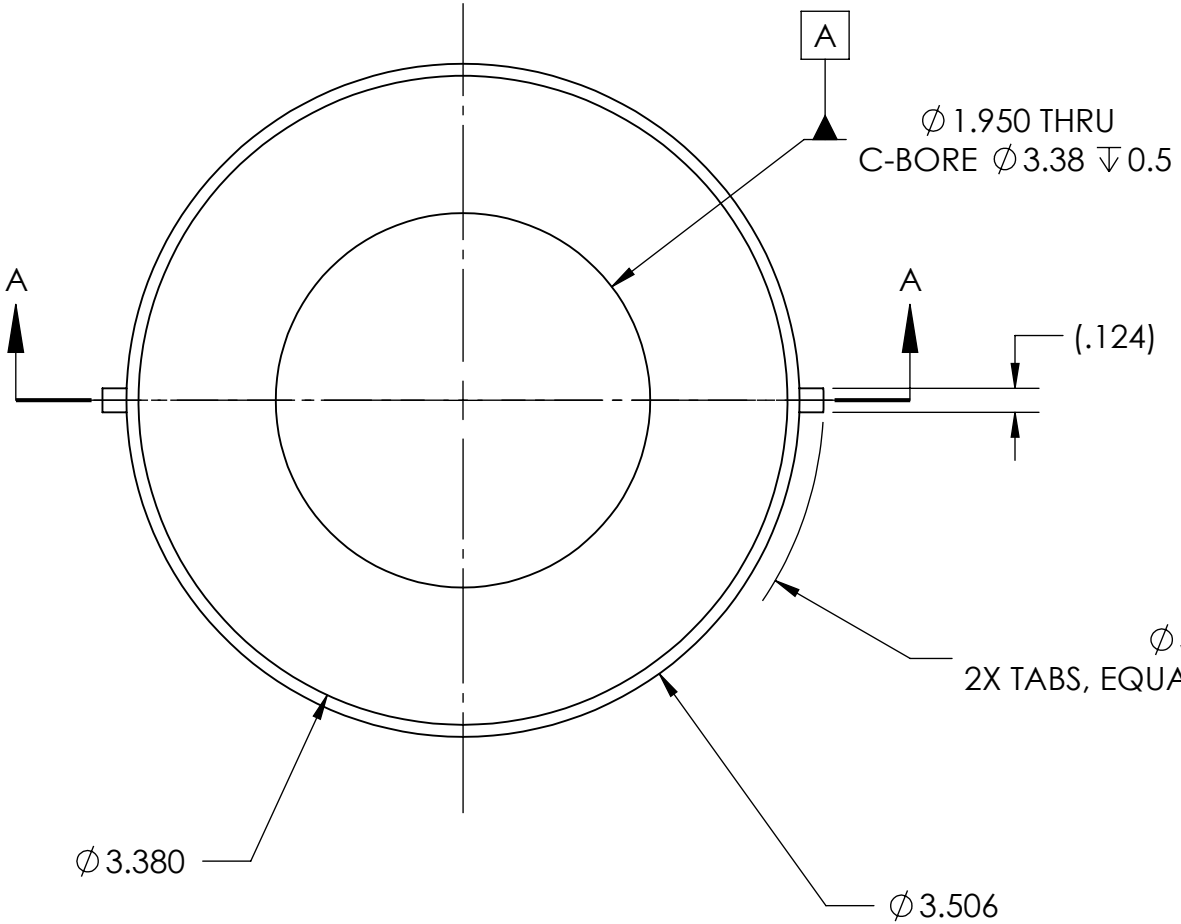
SECTION AB-AB

NOTES:
1. QTY: 1
2. MAT'L: PETG (40% INFILL)
3. BREAK ALL EDGES
4. DIMS IN INCHES

TOLERANCE UNLESS NOTED				TITLE: Design - HBlock		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	AVALEE DEMIDOVICH	
MACHINING	±0.050	±0.020	±0.005	CHECKED	ASHLEY WOODWORTH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-003	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:2		SHEET 3 OF 3

5 4 3 2 1

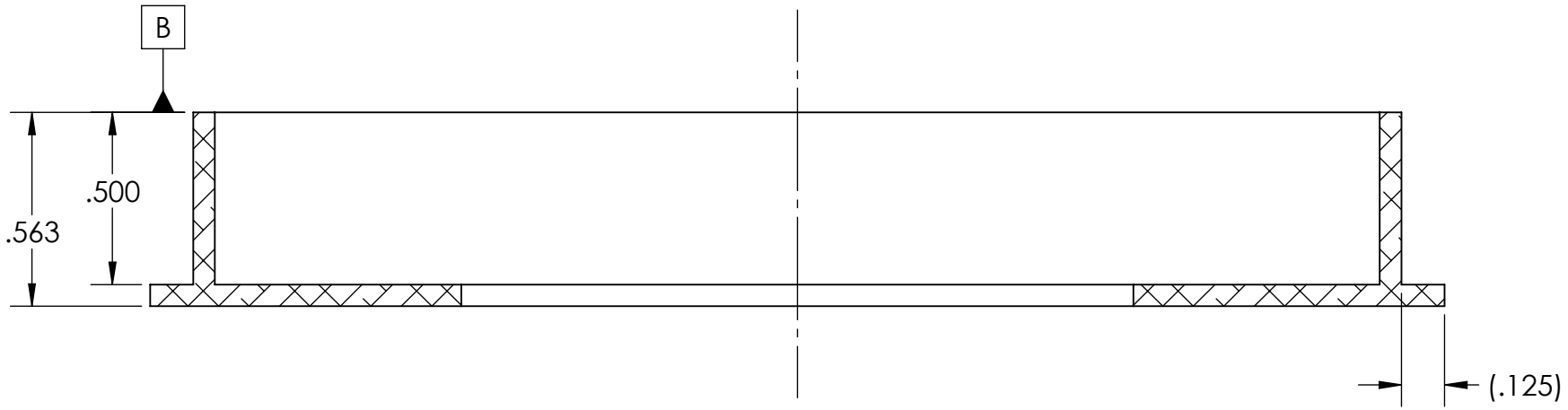




NOTES:
1. QTY: 1
2. MAT'L: 6061 ALUMINUM
3. BREAK ALL EDGES
4. ALL DIMS IN INCHES
5. FINISH AS MACHINED

TOLERANCE UNLESS NOTED				TITLE: Design - Lid Block		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	SERENE YAHIA	
MACHINING	±0.050	±0.020	±0.005	CHECKED	AVALEE DEMIDOVICH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-004	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 1 OF 2

5 4 3 2 1

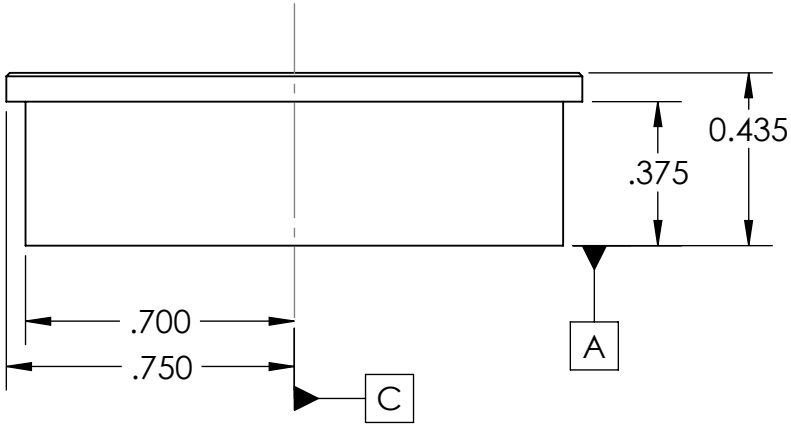


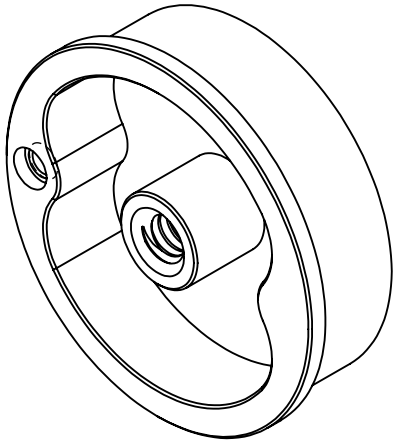
SECTION A-A
SCALE 2 : 1

NOTES:
1. QTY: 1
2. MAT'L: 6061 ALUMINUM
3. BREAK ALL EDGES
4. ALL DIMS IN INCHES
5. FINISH AS MACHINED

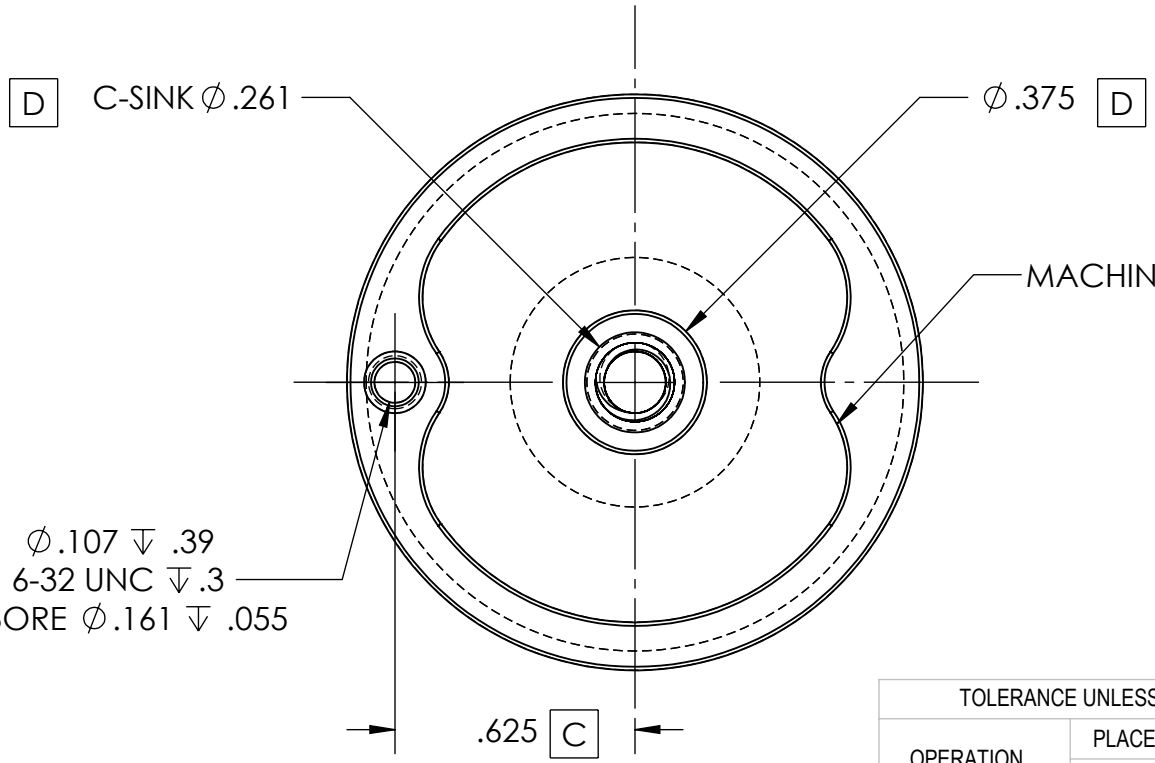
TOLERANCE UNLESS NOTED				TITLE: Design - Lid Block		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	SERENE YAHIA	
MACHINING	±0.050	±0.020	±0.005	CHECKED	AVALEE DEMIDOVICH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-004	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:2		SHEET 2 OF 2

5 4 3 2 1





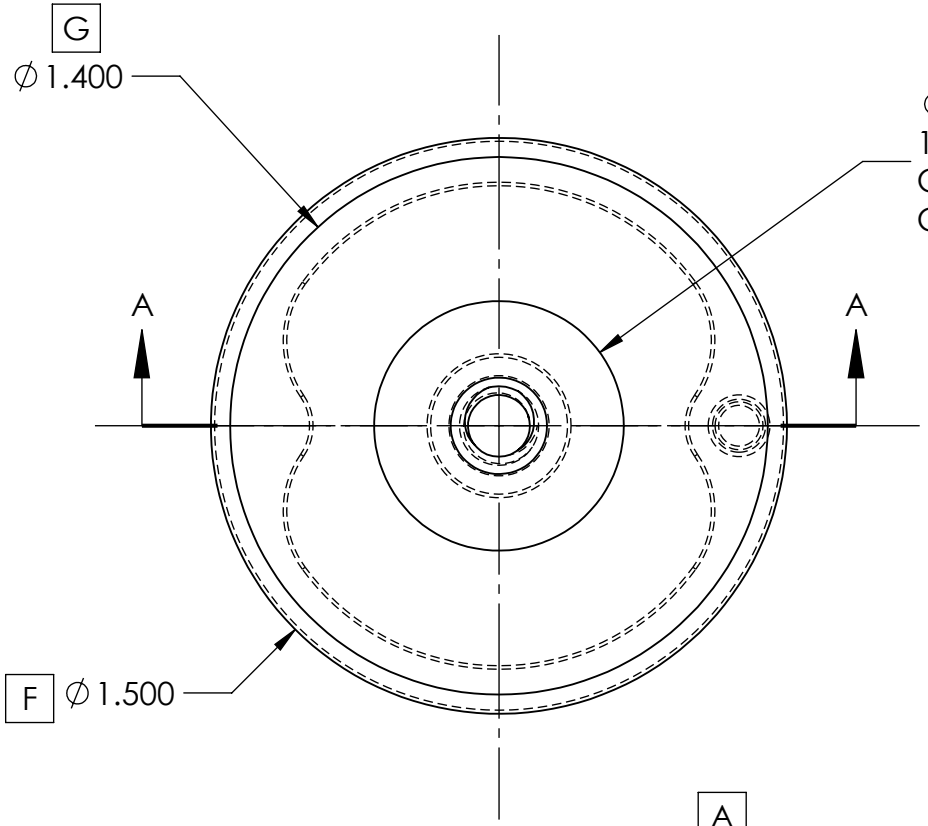
SCALE 3:2

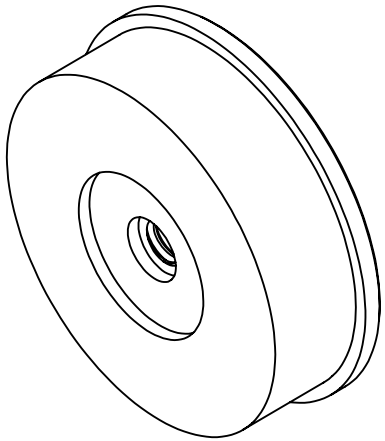


NOTES:
1. QTY: 1
2. MAT'L: MILD STEEL
3. FINISH AS MACHINED
4. BREAK ALL EDGES
5. DIMS IN INCHES

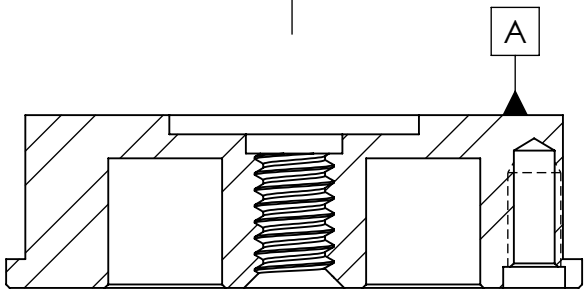
TOLERANCE UNLESS NOTED				TITLE: Design - Modified Flywheel		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	SERENE YAHIA	
MACHINING	±0.050	±0.020	±0.005	CHECKED	ORI ALGAVE	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-005	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 2:1		SHEET 1 OF 2

5 4 3 2 1





SCALE 3:2



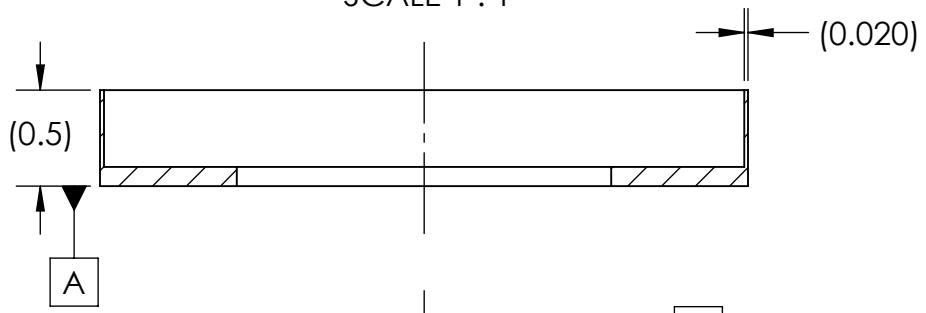
SECTION A-A

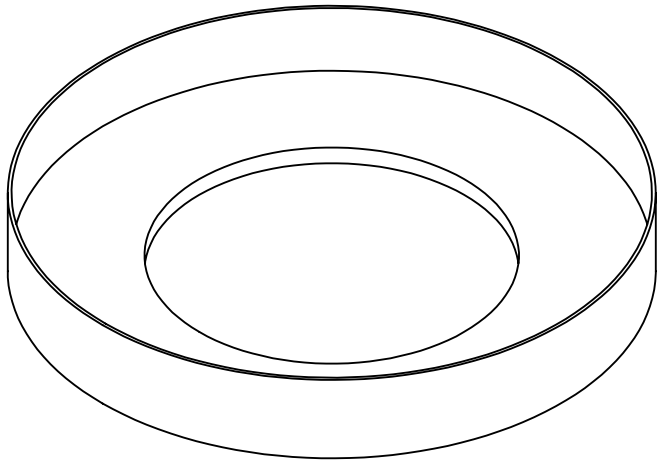
NOTES:
1. QTY: 1
2. MAT'L: MILD STEEL
3. FINISH AS MACHINED
4. BREAK ALL EDGES
5. DIMS IN INCHES

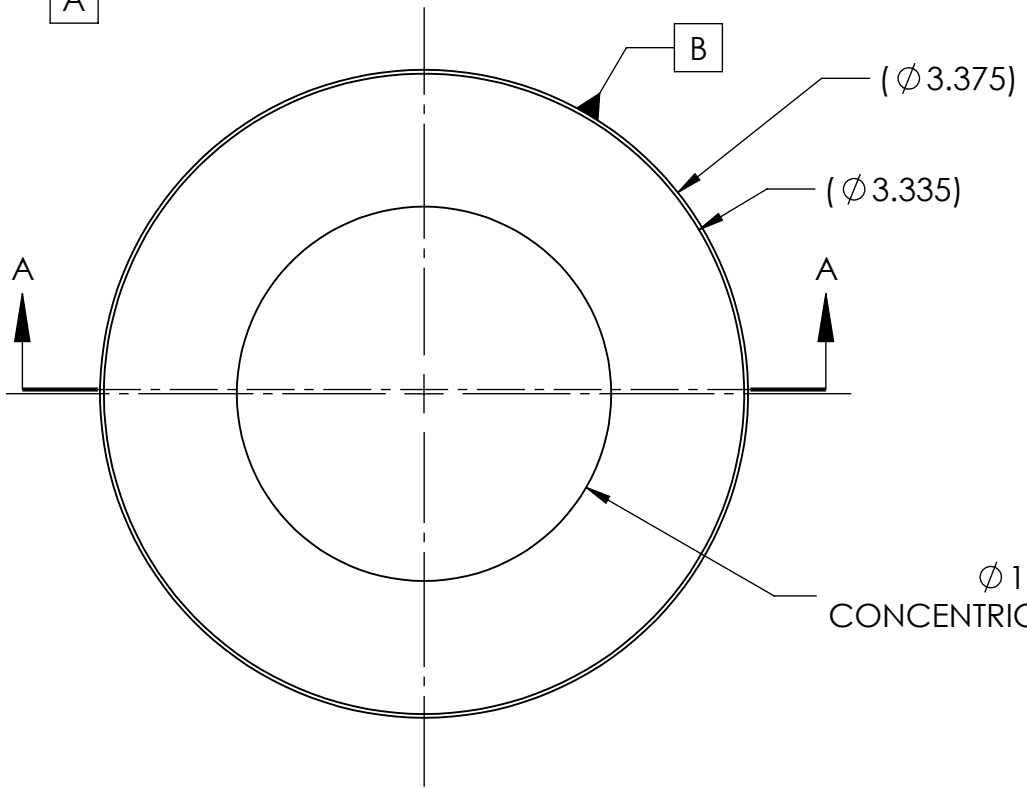
TOLERANCE UNLESS NOTED				TITLE: Design - Modified Flywheel		
OPERATION	PLACES IN DIMENSION			DRAWN	SERENE YAHIA	
	0.0	0.00	0.000			
MACHINING	±0.050	±0.020	±0.005	CHECKED	ORI ALGAVE	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-005	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 2:1		SHEET 2 OF 2

5 4 3 2 1

SECTION A-A
SCALE 1 : 1





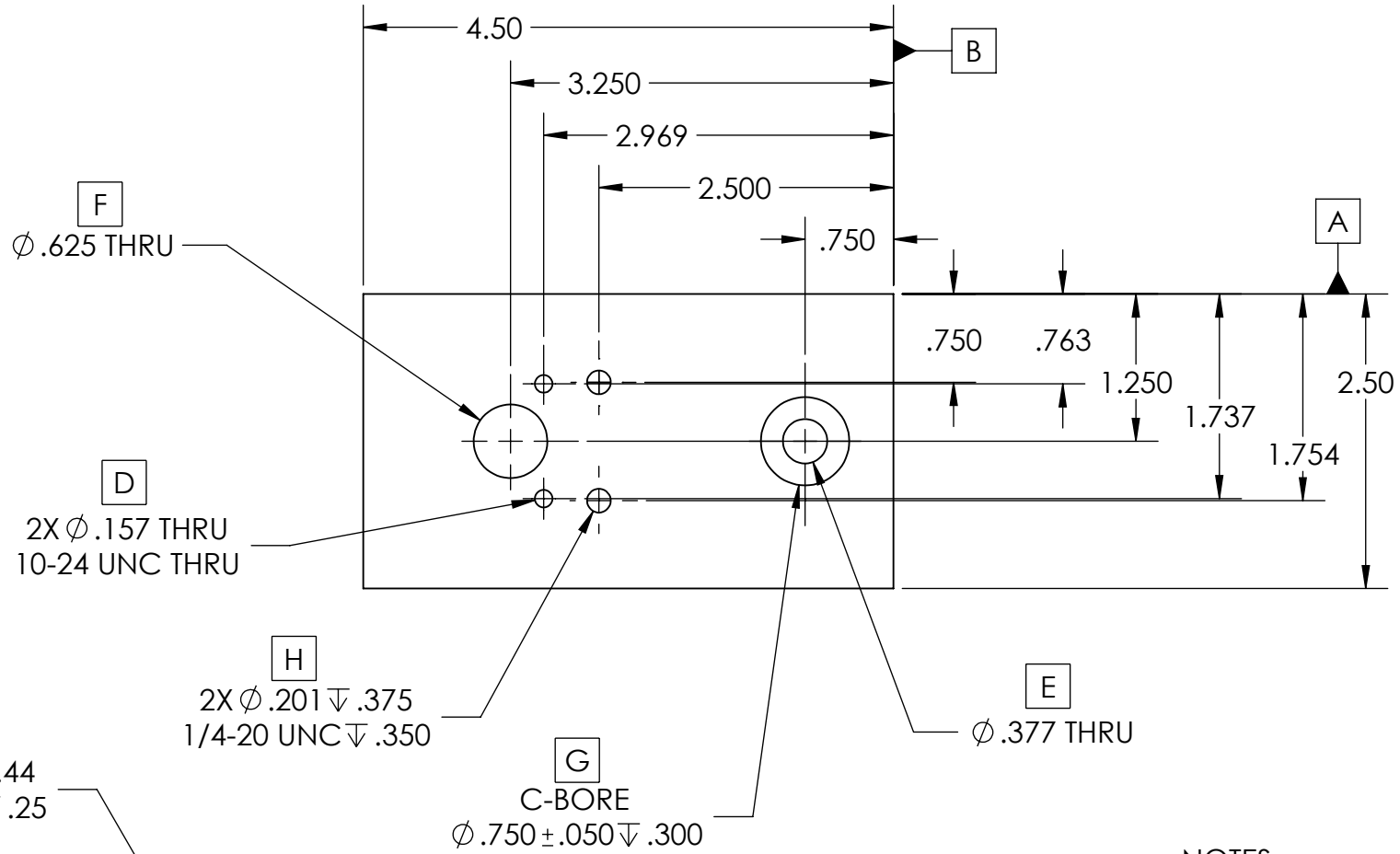


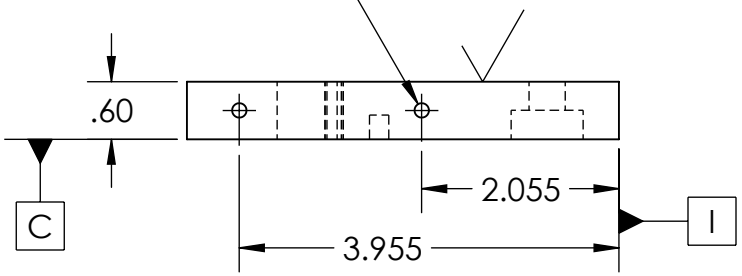
∅1.950 THRU
CONCENTRIC WITH EXISTING LID

NOTES:
1. QUANTITY: 1
2. REMOVE ALL BURRS AND SHARP EDGES 0.010 MAX
3. DIMENSIONS APPLY AFTER MODIFICAITON
4. MAT'L: OTS MASON JAR LID, GOLD-COATED METAL WITH PLASTISOL LINER
5. ALL OTS DIMS MARKED IN PARENTHESES

TOLERANCE UNLESS NOTED				TITLE: Design - Modified Jar Lid		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	SERENE YAHIA	
MACHINING	±0.050	±0.020	±0.005	CHECKED	ASHLEY WOODWORTH	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-006	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 1 OF 1

5 4 3 2 1

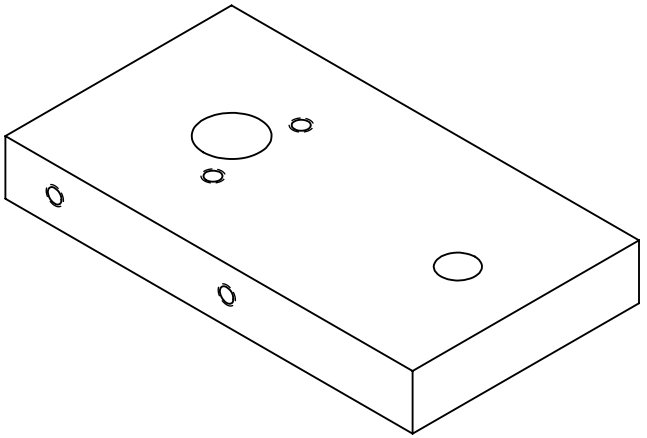


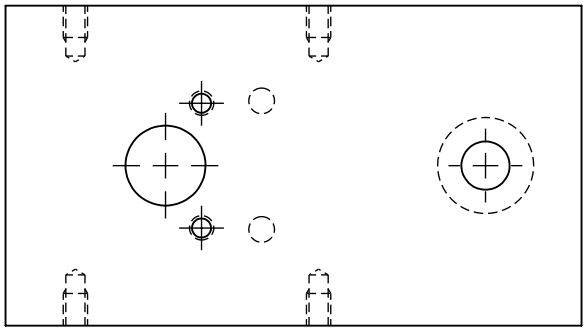


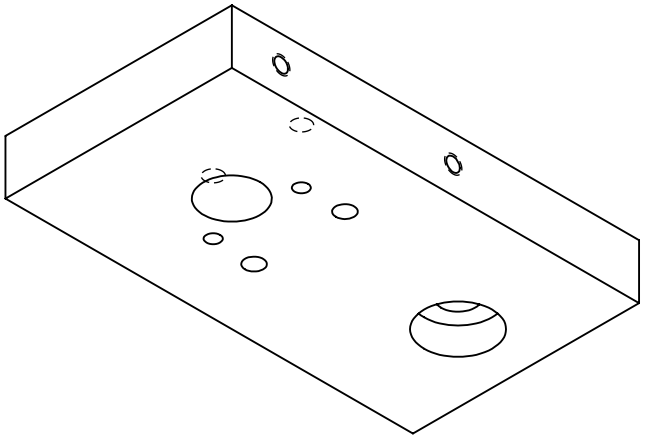
NOTES:
1. QTY:1
2. MAT'L: ALUMINUM 6061-T6
3. FINISH NOTED SURFACES
4. BREAK ALL EDGES
5. DIMS IN INCHES

TOLERANCE UNLESS NOTED				TITLE: Design - Modified Base		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	ASHLEY WOODWORTH	
MACHINING	±0.050	±0.020	±0.005	CHECKED	SERENE YAHIA	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-007	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 2:3		SHEET 1 OF 2

5 4 3 2 1







NOTES:
1. QTY: 1
2. MAT'L: ALUMINUM 6061-T6
3. FINISH NOTED SURFACES
4. BREAK ALL EDGES
5. DIMS IN INCHES

TOLERANCE UNLESS NOTED				TITLE: Design - Modified Base		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	ASHLEY WOODWORTH	
MACHINING	±0.050	±0.020	±0.005	CHECKED	SERENE YAHIA	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-007	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 2:3		SHEET 2 OF 2

5 4 3 2 1

Appendix B: Manufacturing Inspection Records

EML 2322L MANUFACTURING INSPECTION RECORD

Part Number	*Revision*	*Part Name*	*Team Number*	*Machinist:*
P1	A	BASE	1B	
				Inspector:

No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	LINEAR DIMENSION	CALIPERS	2.000	1.995	2.005	IN		
2	A	LINEAR DIMENSION	CALIPERS	6.250	6.245	6.255	IN		
3	A	LINEAR DIMENSION	CALIPERS	7.750	7.745	7.755	IN		
4	A	LINEAR DIMENSION	CALIPERS	11.625	11.62	11.63	IN		
5	A	LINEAR DIMENSION	CALIPERS	12.13	12.11	12.15	IN		
6	B	LINEAR DIMENSION	CALIPERS	0.500	0.495	0.505	IN		
7	B	LINEAR DIMENSION	CALIPERS	1.938	1.933	1.943	IN		
8	B	LINEAR DIMENSION	CALIPERS	2.438	2.433	2.443	IN		
9	B	LINEAR DIMENSION	CALIPERS	2.500	2.495	2.505	IN		
10	B	LINEAR DIMENSION	CALIPERS	2.938	2.933	2.943	IN		
11	B	LINEAR DIMENSION	CALIPERS	4.375	4.370	4.380	IN		
12	B	LINEAR DIMENSION	CALIPERS	4.88	4.86	4.90	IN		
13	C	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
14	C	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
15	D	LINEAR DIMENSION	CALIPERS	0.50	0.48	0.52	IN		SLOT WIDTH
16	D	LINEAR DIMENSION	CALIPERS	2.00	1.98	2.02	IN		SLOT LENGTH
17	E	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
18	E	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
19	E	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		

20	E	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
21	F	DIAMETER	CALIPERS	0.500	0.495	0.505	IN		
22	G	DIAMETER	CALIPERS	1.125	1.12	1.13	IN		
23	G	LINEAR DIMENSION	CALIPERS	0.313	0.308	0.318	IN		C-BORE DEPTH
24	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
25	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
26	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
27	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
28	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
29	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
30	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
31	H	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		
32	H	LINEAR DIMENSION	CALIPERS	0.125	0.120	0.130	IN		
33	H	LINEAR DIMENSION	CALIPERS	0.125	0.120	0.130	IN		
34	H	LINEAR DIMENSION	CALIPERS	0.125	0.120	0.130	IN		
35	H	LINEAR DIMENSION	CALIPERS	0.125	0.120	0.130	IN		
36	NOTES	NOTE	VISUAL	FINISH MACHIENED SURFACES	-	-	-		
37	NOTES	NOTE	VISUAL	BREAK ALL EDGES	-	-	-		

		RESULT:	PASS
Inspector Signature:		FAIL	☐ Remanufacture
Group Member 1:	ORI ALGAVE		☐ Rework
Group Member 2:	AVALEE DEMIDOVICH		☐ Engineering Change
Group Member 3	ASHLEY WOODWORTH	TA Signature	
Group Member 4	SERENE YAHIA		

EML 2322L MANUFACTURING INSPECTION RECORD

Part Number	*Revision*	*Part Name*	*Team Number*	*Machinist:*
P2	A	SHAFT	1B	
				Inspector:

No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	DIAMETER	CALIPERS	1.50	1.48	1.52	IN		
2	B	DIAMETER	CALIPERS	0.50	0.48	0.52	IN		
3	C	DIAMETER	CALIPERS	0.157	0.152	0.162	IN		
4	C	LINEAR DIMENSION	CALIPERS	0.35	0.33	0.37	IN		HOLE DEPTH
5	C	LINEAR DIMENSION	CALIPERS	0.30	0.28	0.32	IN		TAP DEPTH
6	D	LINEAR DIMENSION	CALIPERS	0.25	0.23	0.27	IN		
7	D	LINEAR DIMENSION	CALIPERS	0.475	0.470	0.480	IN		
8	D	LINEAR DIMENSION	CALIPERS	0.50	0.48	0.52	IN		
9	D	LINEAR DIMENSION	CALIPERS	0.725	0.720	0.730	IN		
10	D	LINEAR DIMENSION	CALIPERS	0.75	0.73	0.77	IN		
11	E	LINEAR DIMENSION	CALIPERS	1.075	1.070	1.080	IN		
12	E	LINEAR DIMENSION	CALIPERS	1.125	1.120	1.130	IN		
13	E	LINEAR DIMENSION	CALIPERS	1.525	1.520	1.530	IN		
14	E	LINEAR DIMENSION	CALIPERS	1.575	1.570	1.580	IN		
15	E	LINEAR DIMENSION	CALIPERS	1.625	1.620	1.630	IN		
16	E	LINEAR DIMENSION	CALIPERS	2.025	2.020	2.030	IN		
17	E	LINEAR DIMENSION	CALIPERS	2.075	2.070	2.080	IN		
18	E	LINEAR DIMENSION	CALIPERS	2.70	2.68	2.72	IN		
19	NOTES	NOTE	VISUAL	FINISH MACHIENED SURFACES	-	-	-		

20	NOTES	NOTE	VISUAL	BREAK ALL EDGES	-	-	-		
							RESULT:	PASS	
Inspector Signature:								FAIL	□ Remanufacture
Group Member 1:	ORI ALGAVE								□ Rework
Group Member 2:	AVALEE DEMIDOVICH								□ Engineering Change
Group Member 3	ASHLEY WOODWORTH			TA Signature					
Group Member 4	SERENE YAHIA								

Part Number	*Revision*	*Part Name*	*Team Number*	*Machinist:*
P3	A	H-BLOCK	1B	
				Inspector:

No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	LINEAR DIMENSION	CALIPERS	0.245	0.240	0.250	IN		
2	A	LINEAR DIMENSION	CALIPERS	0.495	0.490	0.500	IN		
3	A	LINEAR DIMENSION	CALIPERS	4.120	4.115	4.125	IN		
4	A	LINEAR DIMENSION	CALIPERS	2.190	2.185	2.195	IN		
5	A	LINEAR DIMENSION	CALIPERS	4.37	4.35	4.39	IN		
6	B	LINEAR DIMENSION	CALIPERS	0.250	0.245	0.255	IN		
7	B	LINEAR DIMENSION	CALIPERS	0.495	0.490	0.500	IN		
8	B	LINEAR DIMENSION	CALIPERS	2.190	2.185	2.195	IN		
9	B	LINEAR DIMENSION	CALIPERS	4.120	4.115	4.125	IN		
10	B	LINEAR DIMENSION	CALIPERS	4.37	4.35	4.39	IN		
11	C	LINEAR DIMENSION	CALIPERS	1.950	1.945	1.955	IN		
12	C	LINEAR DIMENSION	CALIPERS	3.076	3.071	3.081	IN		
13	D	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
14	D	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
15	D	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
16	D	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
17	D	LINEAR DIMENSION	CALIPERS	0.40	0.38	0.42	IN		HOLE DEPTH
18	D	LINEAR DIMENSION	CALIPERS	0.40	0.38	0.42	IN		HOLE DEPTH

19	D	LINEAR DIMENSION	CALIPERS	0.40	0.38	0.42	IN		HOLE DEPTH
20	D	LINEAR DIMENSION	CALIPERS	0.40	0.38	0.42	IN		HOLE DEPTH
21	D	LINEAR DIMENSION	CALIPERS	0.30	0.28	0.32	IN		TAP DEPTH
22	D	LINEAR DIMENSION	CALIPERS	0.30	0.28	0.32	IN		TAP DEPTH
23	D	LINEAR DIMENSION	CALIPERS	0.30	0.28	0.32	IN		TAP DEPTH
24	D	LINEAR DIMENSION	CALIPERS	0.30	0.28	0.32	IN		TAP DEPTH
25	E	DIAMETER	CALIPERS	0.500	0.495	0.505	IN		
26	E	DIAMETER	CALIPERS	1.125	1.120	1.130	IN		C-BORE DIAMETER
27	E	LINEAR DIMENSION	CALIPERS	0.939	0.934	0.944	IN		C-BORE DEPTH
28	E	DIAMETER	CALIPERS	2.590	2.585	2.595	IN		C-BORE DIAMETER
29	E	LINEAR DIMENSION	CALIPERS	0.626	0.621	0.631	IN		C-BORE DEPTH
30	E	DIAMETER	CALIPERS	3.506	3.501	3.511	IN		C-BORE DIAMETER
31	E	LINEAR DIMENSION	CALIPERS	0.563	0.558	0.568	IN		C-BORE DEPTH
32	F	LINEAR DIMENSION	CALIPERS	0.438	0.433	0.443	IN		
33	F	LINEAR DIMENSION	CALIPERS	0.563	0.558	0.568	IN		
34	G	LINEAR DIMENSION	CALIPERS	0.125	0.120	0.130	IN		
35	G	LINEAR DIMENSION	CALIPERS	0.665	0.660	0.670	IN		
36	H	DIAMETER	CALIPERS	3.760	3.755	3.765	IN		
37	I	LINEAR DIMENSION	CALIPERS	0.063	0.058	0.068	IN		
38	I	ANGLE	PROTRACTOR	20.087	19.587	20.587	DEGRESS		
39	NOTES	NOTE	VISUAL	FINISH PRINTED SURFACES	-	-	-		
40	NOTES	NOTE	VISUAL	BREAK ALL EDGES	-	-	-		

		RESULT:	PASS	
Inspector Signature:			FAIL	☐ Remanufacture
Group Member 1:	ORI ALGAVE			☐ Rework
Group Member 2:	AVALEE DEMIDOVICH			☐ Engineering Change
Group Member 3	ASHLEY WOODWORTH	TA Signature		
Group Member 4	SERENE YAHIA			

EML 2322L MANUFACTURING INSPECTION RECORD

Part Number	*Revision*	*Part Name*	*Team Number*	*Machinist:*
P4	A	LID BLOCK	1B	
				Inspector:

No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	DIAMETER	CALIPERS	3.756	3.751	3.761	IN		
2	A	DIAMETER	CALIPERS	3.506	3.501	3.511	IN		
3	A	DIAMETER	CALIPERS	3.380	3.375	3.385	IN		COUNTERBORE
4	A	LINEAR DIMENSION	CALIPERS	0.5	0.45	0.55	IN		COUNTERBORE DEPTH
5	A	DIAMETER	CALIPERS	1.950	1.945	1.955	IN		
6	B	LINEAR DIMENSION	CALIPERS	0.500	0.495	0.505	IN		
7	B	LINEAR DIMENSION	CALIPERS	0.563	0.558	0.568	IN		
8	NOTES	NOTE	VISUAL	FINISH MACHIENED SURFACES	-	-	-		
9	NOTES	NOTE	VISUAL	BREAK ALL EDGES	-	-	-		

		RESULT:	PASS
Inspector Signature:		FAIL	☐ Remanufacture
Group Member 1:	ORI ALGAVE		☐ Rework
Group Member 2:	AVALEE DEMIDOVICH		☐ Engineering Change
Group Member 3	ASHLEY WOODWORTH	TA Signature	
Group Member 4	SERENE YAHIA		

EML 2322L MANUFACTURING INSPECTION RECORD

Part Number	*Revision*	*Part Name*	*Team Number*	*Machinist:*
P5	A	MODIFIED FLYWHEEL	1B	
				Inspector:

No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	LINEAR DIMENSION	CALIPERS	0.435	0.430	0.440	IN		
2	A	LINEAR DIMENSION	CALIPERS	0.375	0.370	0.380	IN		
3	C	LINEAR DIMENSION	CALIPERS	0.700	0.695	0.705	IN		
4	C	LINEAR DIMENSION	CALIPERS	0.750	0.745	0.755	IN		
5	G	DIAMETER	CALIPERS	1.400	1.395	1.405	IN		
6	NOTES	NOTE	VISUAL	FINISH MACHIENED SURFACES	-	-	-		
7	NOTES	NOTE	VISUAL	BREAK ALL EDGES	-	-	-		

			RESULT:	PASS
Inspector Signature:			FAIL	☐ Remanufacture
Group Member 1:	ORI ALGAVE			☐ Rework
Group Member 2:	AVALEE DEMIDOVICH			☐ Engineering Change
Group Member 3	ASHLEY WOODWORTH	TA Signature		
Group Member 4	SERENE YAHIA			

EML 2322L MANUFACTURING INSPECTION RECORD

Part Number	*Revision*	*Part Name*	*Team Number*	*Machinist:*
P6	A	MODIFIED MASON JAR LID	1B	
				Inspector:

No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	B	DIAMETER	CALIPERS	1.950	1.945	1.955	IN		
2	NOTES	NOTE	VISUAL	FINISH MACHIENED SURFACES	-	-	-		
3	NOTES	NOTE	VISUAL	BREAK ALL EDGES	-	-	-		

RESULT:	PASS

INspector Signature:		FAIL	□ Remanufacture
Group Member 1:	ORI ALGAVE		□ Rework
Group Member 2:	AVALEE DEMIDOVICH		□ Engineering Change
Group Member 3	ASHLEY WOODWORTH	TA Signature	
Group Member 4	SERENE YAHIA		

EML 2322L MANUFACTURING INSPECTION RECORD

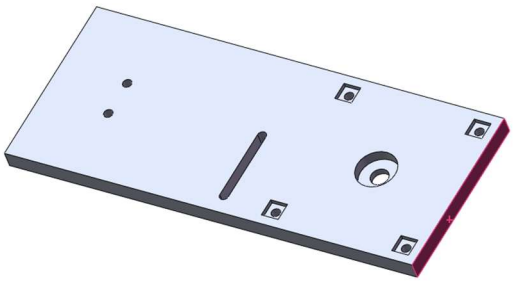
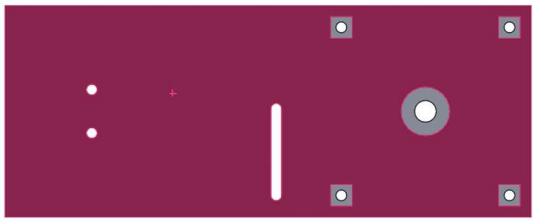
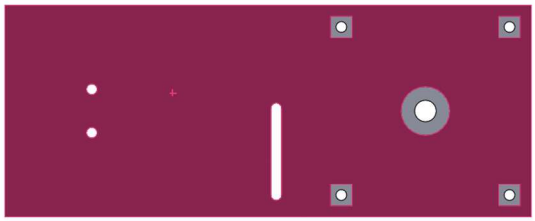
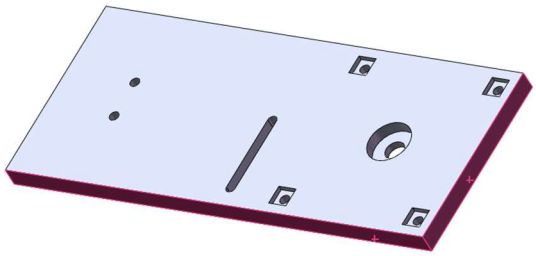
Part Number	*Revision*	*Part Name*	*Team Number*	*Machinist:*
P7	A	MODIFIED ENGINE BASE	1B	
				Inspector:

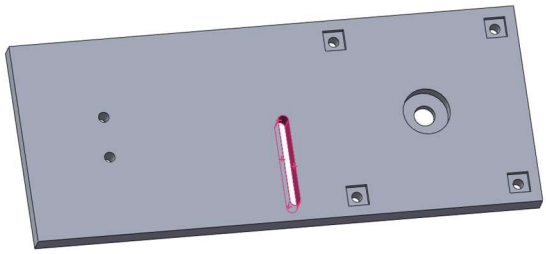
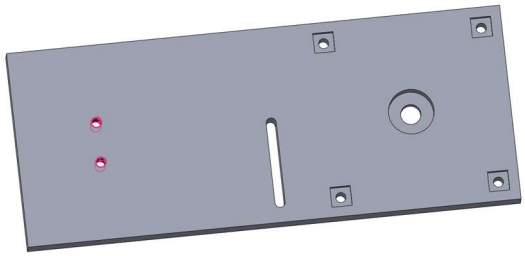
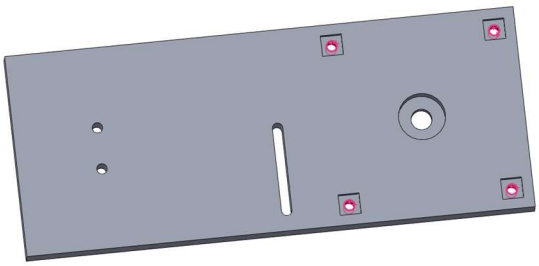
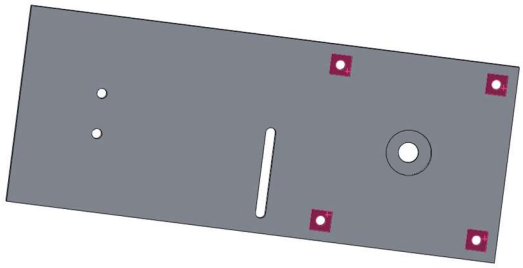
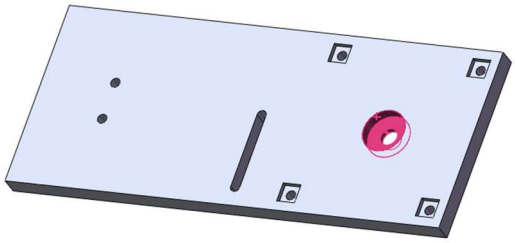
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	LINEAR DIMEMSION	CALIPERS	0.750	0.745	0.755	IN		
2	A	LINEAR DIMEMSION	CALIPERS	1.754	1.749	1.759	IN		
3	B	LINEAR DIMEMSION	CALIPERS	2.500	2.495	2.505	IN		
4	H	DIAMETER	CALIPERS	0.250	0.245	0.255	IN		
5	H	LINEAR DIMEMSION	CALIPERS	0.375	0.370	0.380	IN		
6	H	LINEAR DIMEMSION	CALIPERS	0.375	0.370	0.380	IN		TAP DEPTH
7	H	DIAMETER	CALIPERS	0.201	0.196	0.206	IN		
8	H	LINEAR DIMEMSION	CALIPERS	0.375	0.370	0.380	IN		
9	H	LINEAR DIMEMSION	CALIPERS	0.350	0.345	0.355	IN		TAP DEPTH
10	NOTES	NOTE	VISUAL	FINISH MACHIENED SURFACES	-	-	-		
11	NOTES	NOTE	VISUAL	BREAK ALL EDGES	-	-	-		
							RESULT:		PASS

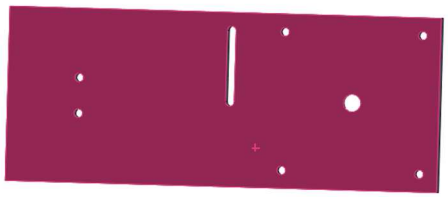
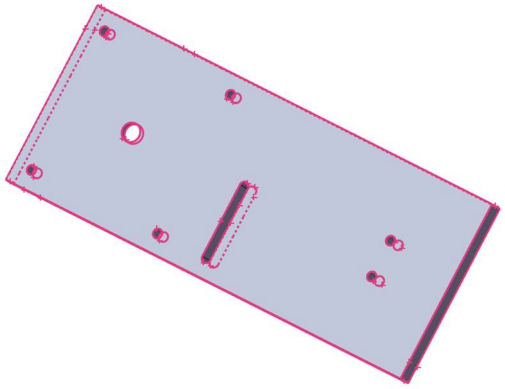
INspector Signature:			FAIL	☐ Remanufacture
Group Member 1:	ORI ALGAVE			☐ Rework
Group Member 2:	AVALEE DEMIDOVICH			☐ Engineering Change
Group Member 3	ASHLEY WOODWORTH	TA Signature		
Group Member 4	SERENE YAHIA			

Appendix C: Manufacturing Process Outlines

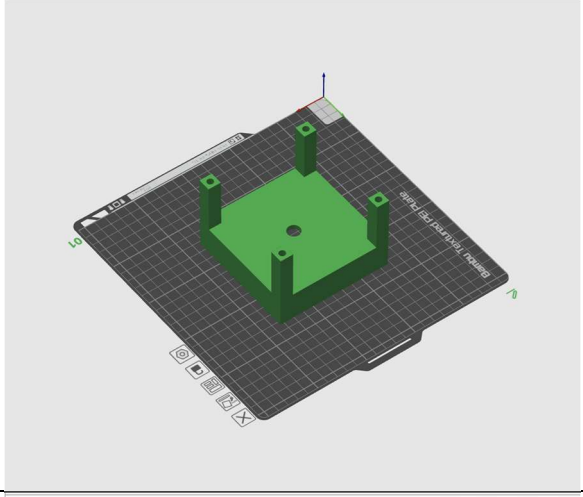
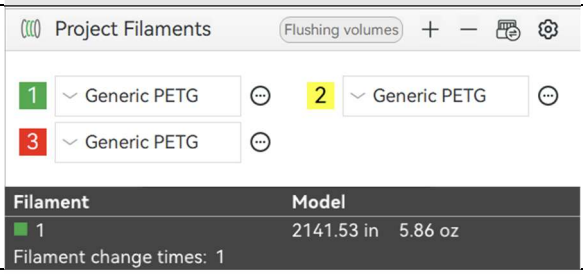
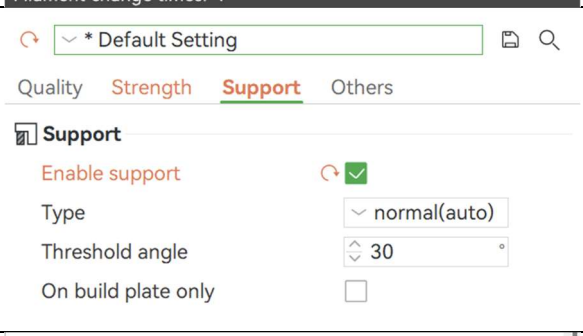
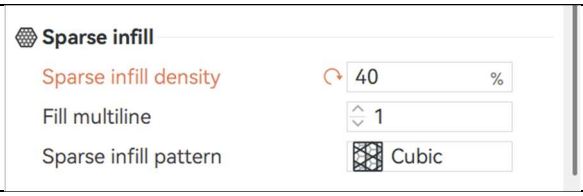
PART 1: BASE

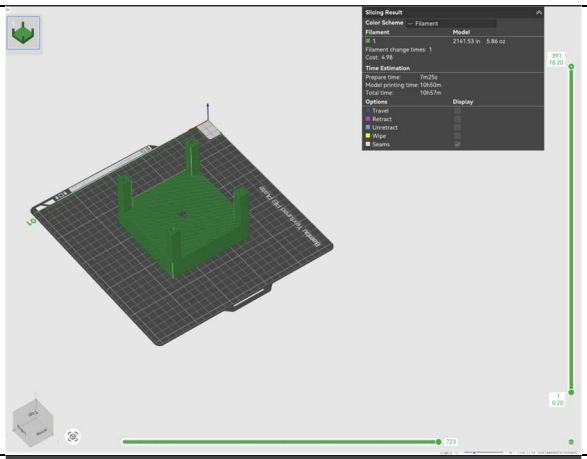
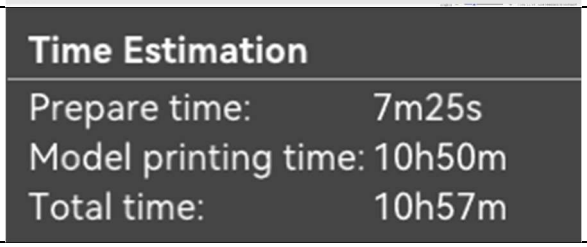
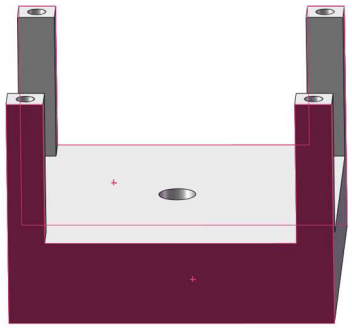
MANUFACTURING PROCESS	PROCESS SETUP
1. CUT 6061 ALUMINUM PLATE FROM OVERSIZED STOCK TO A ROUGH RECTANGULAR SHAPE ON THE VERTICAL BANDSAW, LEAVING APPROX 0.10 IN EXCESS MAT'L ON EACH SIDE FOR FINISH MACHINING.	
2. CLAMP THE 6061-T6 ALUMINUM PLATE FLAT IN THE CNC MILL VISE ON PARALLELS WITH THE TOP FACING UPWARDS. FACE MILL THE TOP SURFACE TO ESTABLISH PRIMARY DATUM SURFACE USING A 2" FACE MILL.	
3. FIND YOUR ZEROS IN THE X, Y, Z AXES USING A CYLINDRICAL AND CONICAL EDGE FINDER ON THE LEFT AND BOTTOM EDGES OF THE FACED TOP SURFACE.	
4. CNC PROFILE MILL THE OUTSIDE PERIMETER TO THE FINAL OVERALL DIMENSIONS OF 12.13" X 4.88" USING A 1/2" 2-FLUTE CARBIDE FLAT END MILL.	

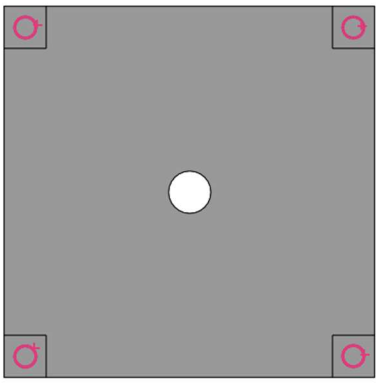
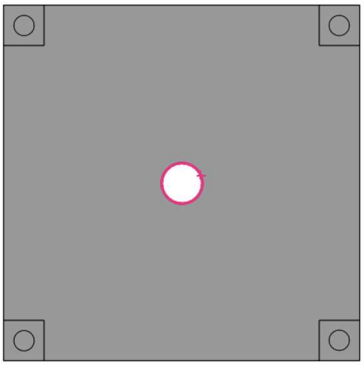
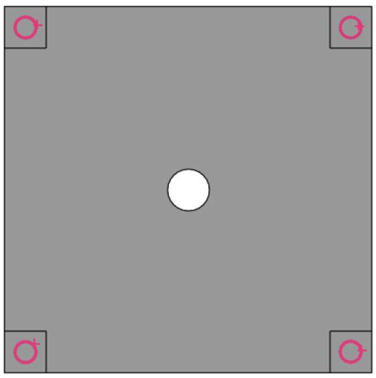
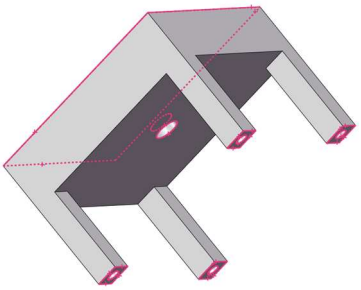
5. CNC MILL THE 0.50” X 2.00” THROUGH SLOT USING A 1/2" FLAT END MILL WITH MULTIPLE DEPTH PASSES.	
6. SPOT DRILL THEN PECK DRILL THE TWO Ø0.201” THROUGH HOLES LOCATED ON THE LEFT SIDE OF THE PLATE MAKING YOUR WAY UP TO A #7 DRILL BIT USING 1/4" STEP SIZES.	
7. SPOT DRILL THEN PECK DRILL THE FOUR Ø0.201” THROUGH MOUNTING HOLES FOR THE C-BORE FASTENERS MAKING YOUR WAY UP TO A #7 DRILL BIT USING 1/4" STEP SIZES.	
8. MACHINE THE FOUR 0.500” SQUARE MOUNTING HOLES TO A DEPTH OF 0.125” USING A 1/4" FLAT END MILL.	
9. SPOT DRILL THEN PECK DRILL THE Ø0.500” CENTER THROUGH HOLE USING A 1/2" DRILL BIT, THEN MACHINE THE Ø1.125” X 0.313” DEEP C-BORE USING A 1/2" FLAT END MILL TO FORM THE CIRCULAR POCKET.	

10. REMOVE WORKPIECE FROM VISE, FLIP IT OVER, RECLAMP WITH BOTTOM FACING UPWARDS ON PARALLELS, ADN REFIND Z-ZEROS. FACE MILL THE BOTTOM SURFAFCE TO ACHIEVE FINAL THICKNESS OF 0.500” USING A 2” FACE MILL.	
11. DEBURR ALL MACHINES EDGES, SLOT EDGES, AND HOLES. BREAK ALL SHARP EDGES. VERIFY ALL CRITICAL DIMENSIONS.	

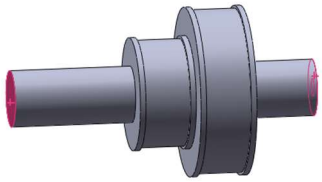
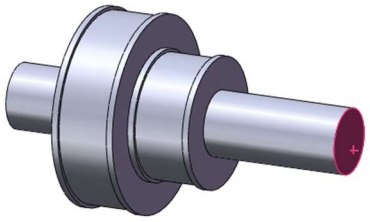
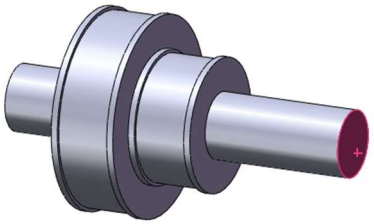
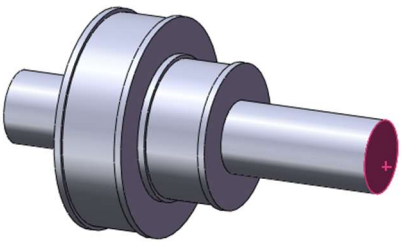
PART 2: H-BLOCK

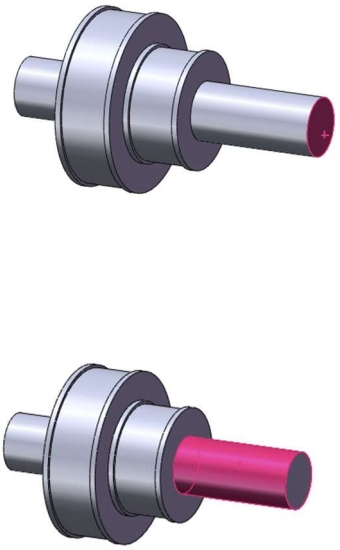
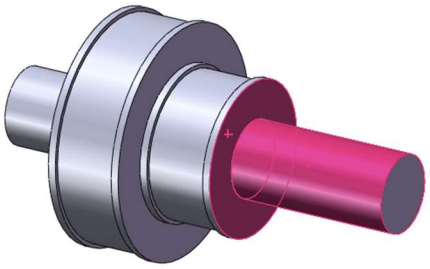
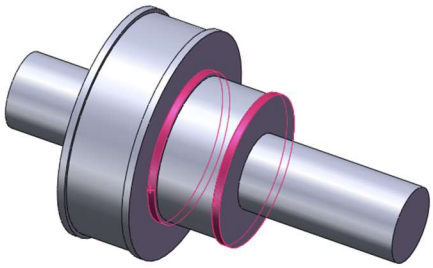
MANUFACTURING PROCESS	PROCESS SETUP
1. EXPORT H-BLOCK SLDPRT AS AN STL FILE, IMPORT INTO 3D SLICER WITH DIMS IN INCHES. ALL IMAGES DEMONSTRATE SLICING/PRINTING IN BAMBU STUDIO.	
2. SELECT PETG FILLAMENT AND VERIFY SPOOL WEIGHT IS SUFFICIENT FOR PRINTING.	
3. ADD BED ADHESION AND SUPPORT FEATURES WITH THE BUILT IN “BRIM” FEATURE, OR EQUIVALENT FEATURE IN OTHER SLICER.	
4. SET 40% INFILL PARAMETERS.	

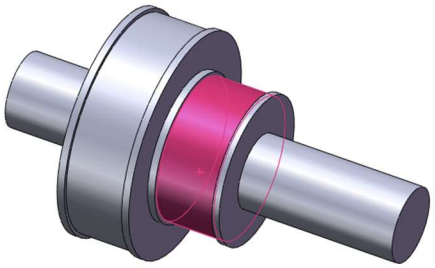
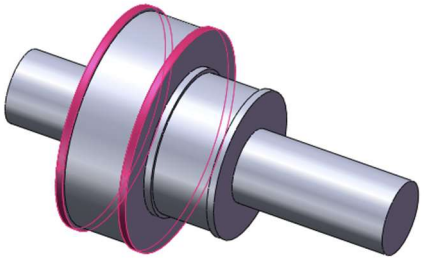
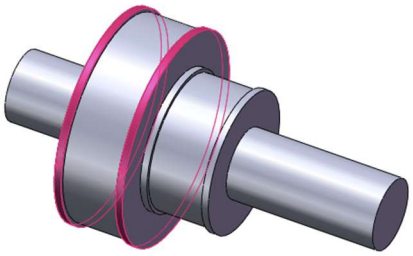
5. SLICE THE PART AND INSPECT ALL LAYERS ENSURING THERE ARE NO BLOCKED HOLES, UNSUPPORTED ISLANDS, OR MISSING WALLS.	
6. RECORD FILLAMENT MASS AND SLICER TIME ESTIMATE.	
7. CLEAN BUILD PLATE, LOAD PETG, VERIFY NOZZLE, AND LEVEL PRINT BED.	
8. START PRINT AND INSPECT FIRST FEW LAYERS.	
9. COMPLETE PRINT AND COOL BEFORE RELEASING.	
10. REMOVE PART AND SUPPORTS WHILE PREVENTING CRACKING IN THE LEGS AND PRESERVING COUNTERBORE AND HOLE DIAMETERS.	
11. CLAMP H-BLOCK UPSIDE DOWN WITH LEGS FACING UP ON ENDMILL PARALELLS.	

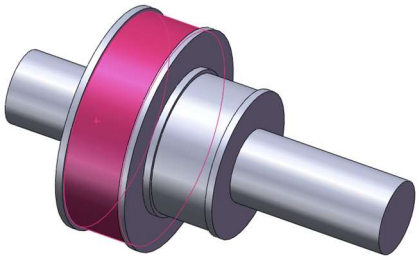
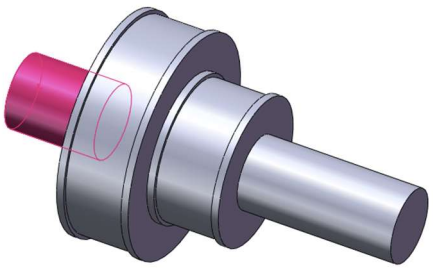
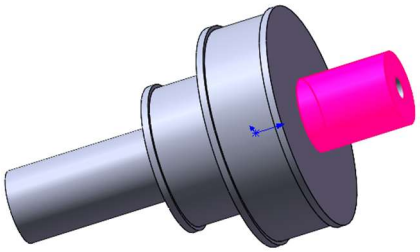
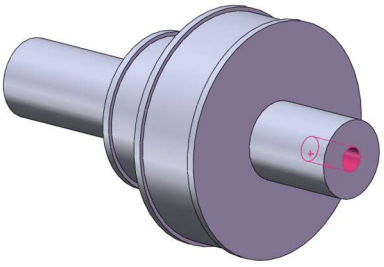
12. PECK DRILL THEN DRILL THE FOUR Ø0.201” X 0.400” DEEP LEG HOLES MAKING YOUR WAY UP TO A #7 DRILL BIT WITH 1/4" STEP SIZES.	
13. REAM THE CENTER HOLE THROUGH USING 1/2” REAMER.	
14. HAND TAP THE FOUR LEG HOLES USING ¼-20 UNC TAP TO 0.300” DEPTH.	
15. BREAK ALL SHARP PRINTED EDGES AND CLEAN ALL HOLE RECESSES. VERIFY ALL MAJOR DIMENSIONS.	

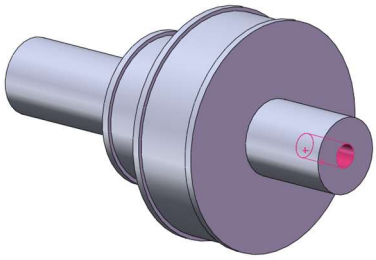
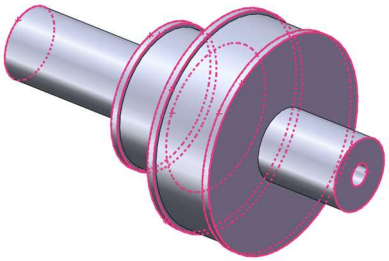
PART 3: SHAFT

MANUFACTURING PROCESS	PROCESS SETUP
1. CUT LOW CARBON STEEL ROUND STOCK TO ROUGH LENGTH USING VERTICAL BANDSAW, LEAVING AT LEAST 0.010” OF EXTRA MATERIAL FOR FACING.	
2. CLAMP THE STOCK IN A 3-JAW LATHE CHUCK USING THE CHUCK KEY. FACE THE EXPOSED END TO CREATE REFERENCE DATUM E.	
3. INSTALL A CENTER DRILL INTO THE TAILSTOCK DRILL CHUCK THEN CENTER DRILL THE FACED END TO CREATE A HOLE FOR LIVE CENTER SUPPORT.	
4. REMOVE CENTER DRILL FROM THE TAILSTOCK AND INSTALL LIVE CENTER. ADVANCE THE TAILSTOCK QUILL SO THE LIVE CENTER END SITS INSIDE THE CENTER-DRILLED HOLE. TURN ON LATHE TO ENSURE LIVE CENTER TURNS WITH THE WORKPIECE.	

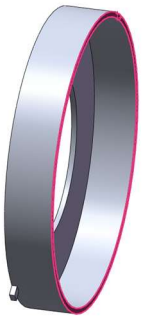
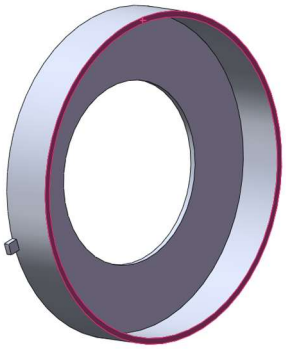
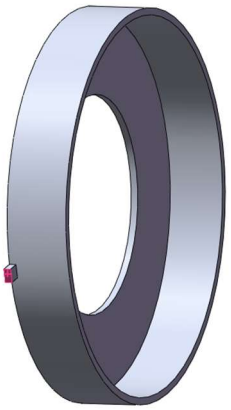
5. INSTALL AN 80° CARBIDE TURNING TOOL TO TOUCH OFF DATUM E AND SET THE CARRIAGE Z-ZERO ON THE DRO. USE THE SAME TOOL TO TOUCH OFF THE OUTSIDE DIAMETER AND SET THE DRO X-ZERO WHEN A RING, CHIPS, OR A LOUD SOUND ARE IDENTIFIED.	
6. TURN THE SHAFT SECTION TO A 0.25” RADIUS, UNTIL Z = 1.075” FROM DATUM E. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
7. TURN THE SHAFT SECTION FROM Z = 1.075” TO Z = 1.575” TO A RADIAL DIMENSION OF 0.50”. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	

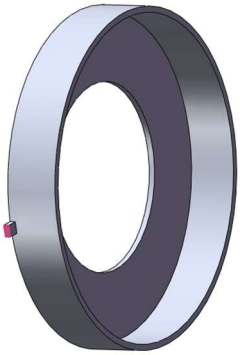
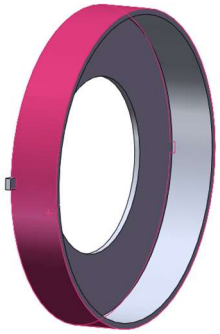
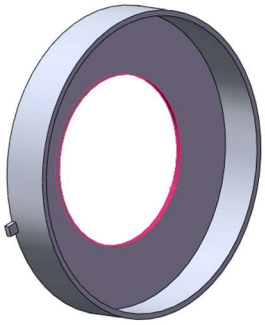
8. TURN THE SHAFT SECTION FROM Z = 1.125” TO Z = 1.525” TO A RADIAL DIMENSION OF 0.475”. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
9. TURN THE SHAFT SECTION FROM Z = 1.525” TO Z = 1.575” TO A RADIAL DIMENSION OF 0.50”. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
10. TURN THE SHAFT SECTION FROM Z = 1.575” TO Z = 2.075” TO A RADIAL DIMENSION OF 0.75”. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	

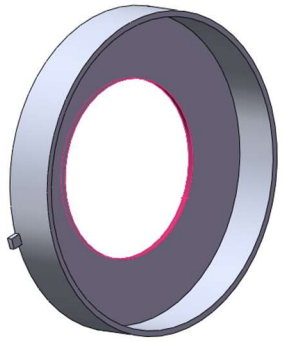
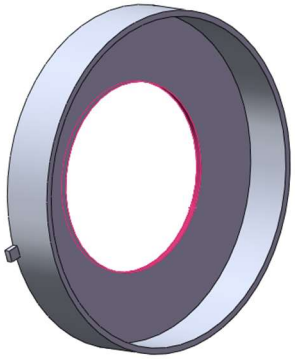
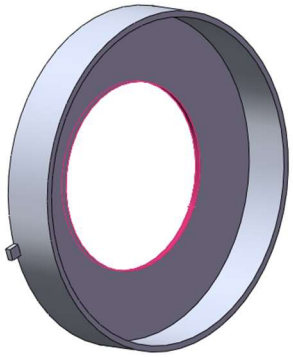
11. TURN THE SHAFT SECTION FROM Z = 1.625” TO Z = 2.025” TO A RADIAL DIMENSION OF 0.725”. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
12. TURN THE SHAFT SECTION FROM Z = 2.075” TO Z = 2.70” TO A RADIAL DIMENSION OF 0.25”. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
13. USE THE CHUCK KEY TO REMOVE THE WORKPIECE FROM THE LATHE AND FLIP AROUND HORIZONTALLY. USE SAME TOOL TO RESET X AND Z-ZEROS ON DRO.	
14. REMOVE LIVE CENTER AND INSERT A #22 DRILL BIT INTO THE TAILSTOCK. USE CUTTING OIL AND PECK DRILL UNTIL DESIRED HOLE DEPTH OF 0.35” IS REACHED.	

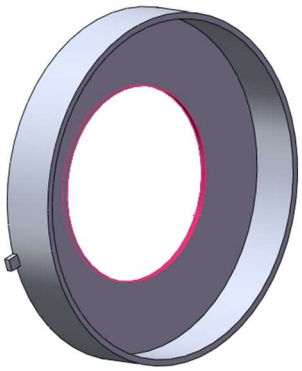
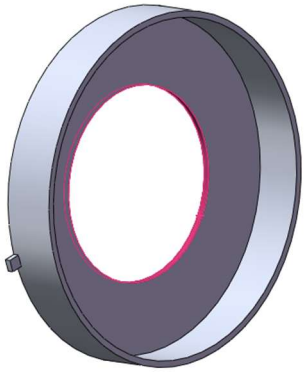
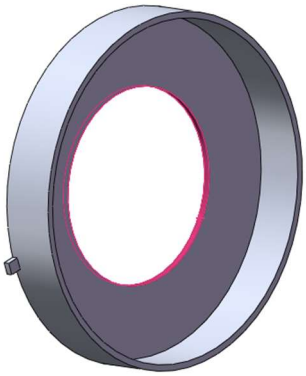
15. HAND TAP 10-24 UNC TO DEPTH OF 0.30” FROM TOP FACE.	
16. BREAK AND BURR ALL SHARP HOLES AND EDGES	

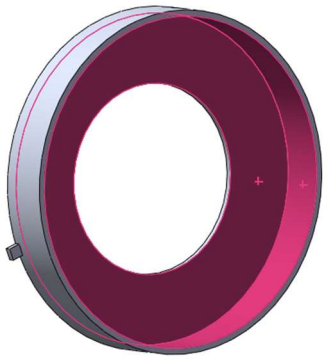
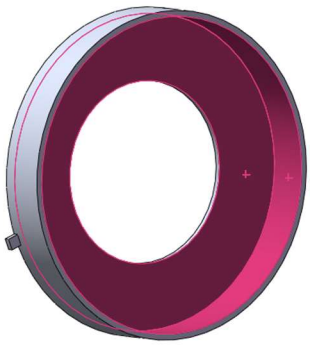
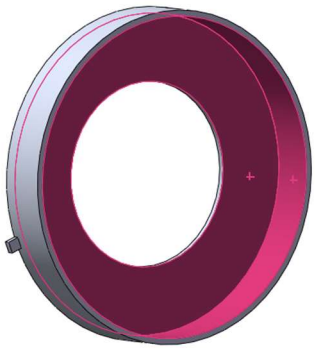
PART 4: LID BLOCK

MANUFACTURING PROCESS	PROCESS SETUP
1. USE CHUCK KEY TO CLAMP Ø4.0” ROUND 6061 ALUMINUM STOCK WORKPIECE INTO 3-JAW LATHE CHUCK. FACE THE EXPOSED END ON THE Z-AXIS TO CREATE DATUM B USING AN 80° HSS TURNING TOOL.	
2. TOUCH THE TURNING TOOL TO DATUM B AND SET THE Z-ZERO ON THE DRO. TOUCH THE TURNING TOOL ON THE OUTSIDE DIAMETER AND SET THE DRO X-ZERO WHEN A RING, CHIPS, OR A LOUD SOUND ARE IDENTIFIED.	 

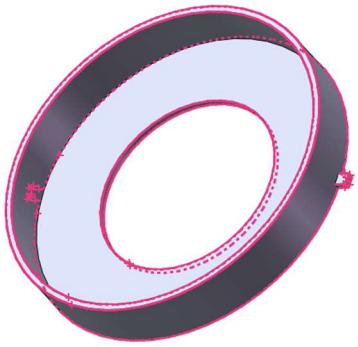
3. TURN THE SHAFT TO Ø3.756” UNTIL Z = 0.563” FROM DATUM A. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
4. TURN THE SHAFT TO Ø3.506” UNTIL Z = 0.500” FROM DATUM B. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
5. USE A CENTER DRILL TO ESTABLISH THE CENTER HOLE.	

6. USE A 1/2" DRILL BIT TO PECK DRILL A PILOT HOLE COMPLETELY THROUGH THE WORKPIECE, Z = 0.563” AT ESTABLISHED CENTER.	
7. USE A 1" DRILL BIT TO PECK DRILL COMPLETELY THROUGH THE WORKPIECE AT ESTABLISHED CENTER.	
8. USE A 1-1/2" DRILL BIT TO PECK DRILL COMPLETELY THROUGH THE WORKPIECE AT ESTABLISHED CENTER.	

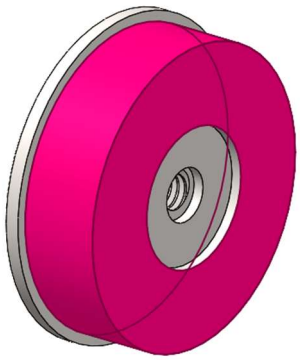
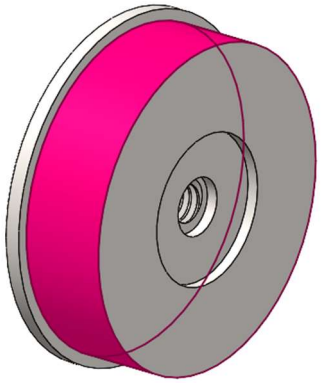
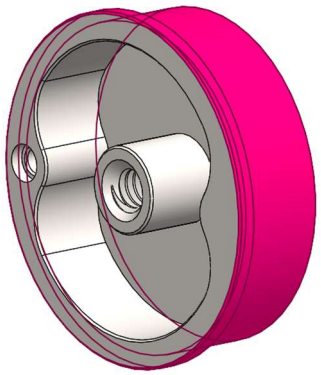
9. USE A 1-7/8" DRILL BIT TO PECK DRILL COMPLETELY THROUGH THE WORKPIECE AT ESTABLISHED CENTER.	
10. USE A 1/2" SHANK BORING BAR AND GRADUALLY INCREASE THE DIAMETER UNTIL Ø1.925" IS REACHED.	
11. TAKE LIGHT FINISH BORING PASSES UNTIL THE THROUGH HOLE REACHES Ø1.950".	

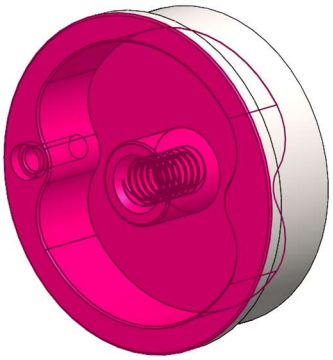
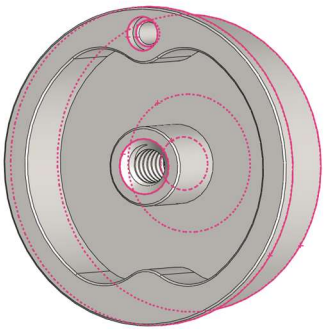
12. USE A 3" DRILL BIT TO PECK DRILL THE COUNTERBORE TO A DEPTH OF 0.5" AT ESTABLISHED CENTER.	
13. USE A BORING BAR AND GRADUALLY INCREASE THE COUNTERBORE DIAMETER UNTIL Ø3.350" IS REACHED.	
14. TAKE LIGHT FINISH BORING PASSES UNTIL THE COUNTERBORE REACHES Ø3.380" × 0.500" DEEP. VERIFY THE DIAMETER AND DEPTH WITH MEASURING TOOLS.	

15. CUT WORKPIECE TO ROUGH THICKNESS USING THE HORIZONTAL BANDSAW, LEAVING ABOUT 0.010” OF EXTRA MATERIAL FOR FACING.	
16. TRANSFER THE PART TO THE VERTICAL MILL. MOUNT THE PART ON A ROTARY TABLE USING A MANDREL THROUGH THE CENTER HOLE. INDICATE THE WORKPIECE TO ALIGN ITS CENTER WITH THE ROTARY TABLE AXIS. LOCATE THE ROTARY TABLE CENTER USING A CONICAL EDGE FINDER AND SET X = 0 AND Y = 0.	
17. INSTALL A 1/4" END MILL. ROTATE THE ROTARY TABLE TO THE FIRST INDEXED POSITION (0°) AND LOCK THE TABLE. MILL THE FIRST SIDE OF THE PART TO THE SPECIFIED DIMENSIONS, TO CREATE THE FIRST TAB.	

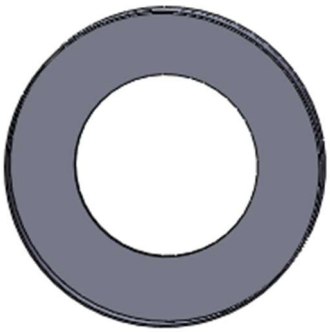
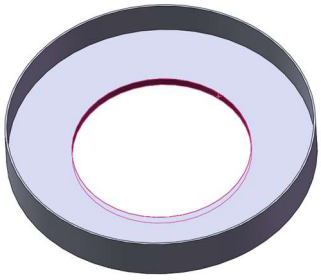
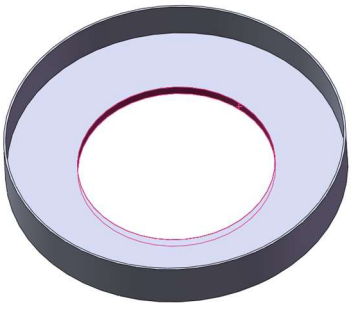
18. ROTATE THE ROTARY TABLE 180° AND LOCK THE TABLE. REPEAT THE MILLING OPERATION TO FORM THE SECOND TAB. VERIFY TAB WIDTHS AND LOCATIONS USING CALIPERS.	
19. BREAK ALL SHARP EDGES, DEBURR THE PART, AND PERFORM A FINAL DIMENSIONAL INSPECTION.	

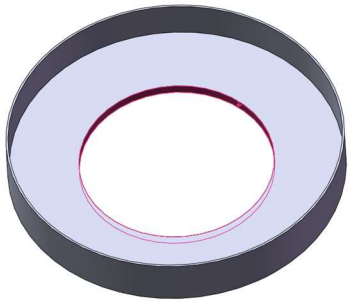
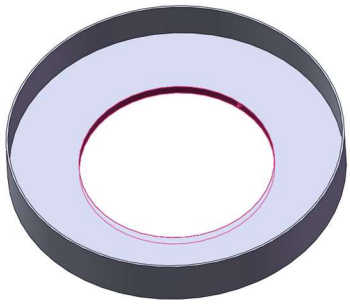
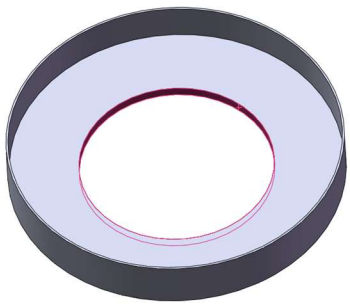
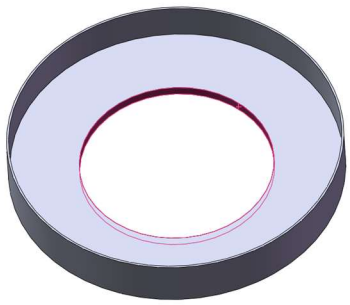
PART 5: MODIFIED FLYWHEEL

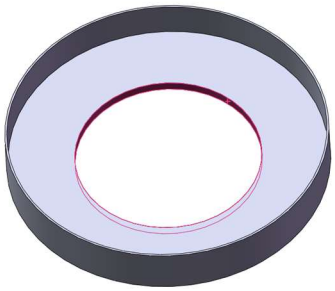
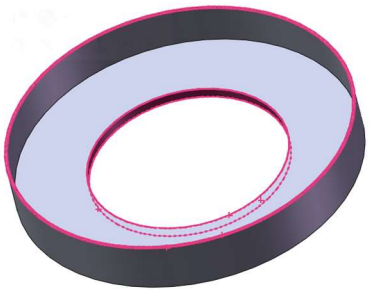
MANUFACTURING PROCESS	PROCESS SETUP
1. LEAVE FLYWHEEL WORKPIECE AS CLAMPED IN THE LATHE. USE PRE-ESTABLISHED DATUMS ON THE Z-AXIS AND X-AXIS AS REFERENCE FOR OUTER DIAMETER MODIFICATIONS.	
2. USE THE EXISTING TOOL TO TURN THE FLYWHEEL DOWN TO Ø1.400”, 0.375” FROM DATUM A. USE CUTTING OIL FOR ROUGH PASSES AND VERIFY MEASUREMENTS WITH CALIPERS AFTER EACH PASS.	
3. USE CHUCK KEY UNCLAMP THE WORKPIECE AND CONTINUE FLYWHEEL MANUFACTURING AS NORMAL: VERTICAL BANDSAW WITH MARVEL TO ACHIEVE DESIRED THICKNESS AND MACHINE PROFILE ON THE CNC.	

	
4. FINISH AS MACHINED, BREAK AND BURR ALL HOLES AND EDGES.	

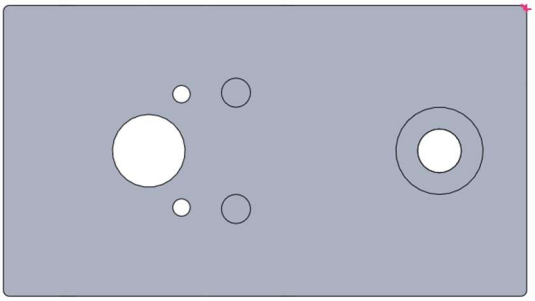
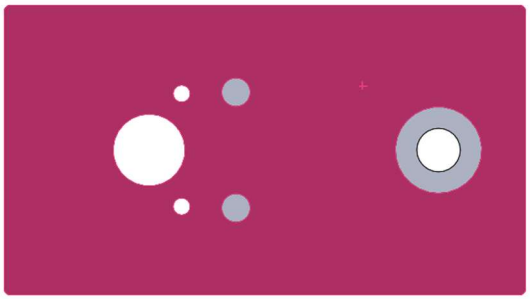
PART 6: MODIFIED MASON JAR LID

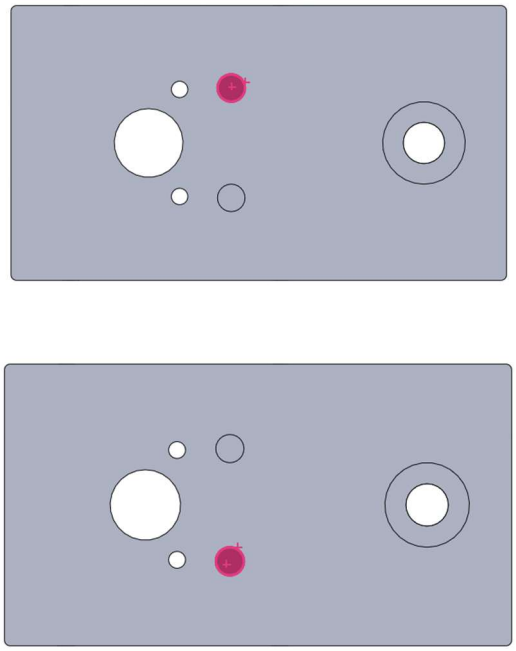
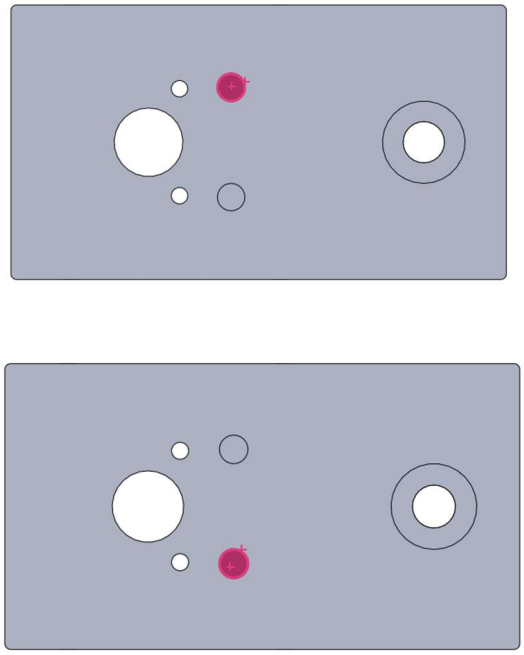
MANUFACTURING PROCESS	PROCESS SETUP
1. SECURE LID TO A FLAT ALUMINUM BACKING PLATE WITH DOUBLE-SIDED TAPE OR A RETAINING FIXTURE. CLAMP THE BACKING PLATE IN BETWEEN THE MILL VISE ON TOP OF PARALLELS. IMAGE REPRESENTS TOP VIEW OF CLAMPED PIECE.	
2. USE EDGE FINDER TO LOCATE THE OUTSIDE DIAMETER IN THE X-AXIS. ZERO X ON DRO AT EDGE, THEN MOVE HALF OF THE OUTSIDE DIAMETER TO ESTABLISH CENTERLINE. REPEAT FOR Y-AXIS.	
3. USE A 1/8” DRILL BIT TO PECK DRILL PILOT HOLE AT ESTABLISHED CENTER.	
4. USE A 1/4" DRILL BIT TO PECK DRILL A THROUGH HOLE AT ESTABLISHED CENTER.	

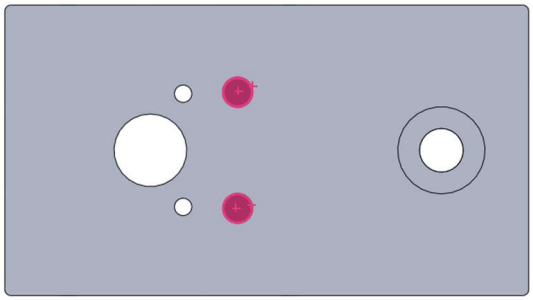
5. USE A 1/2” DRILL BIT TO PECK DRILL A THROUGH HOLE AT ESTABLISHED CENTER.	
6. USE A 3/4" DRILL BIT TO PECK DRILL A THROUGH HOLE AT ESTABLISHED CENTER.	
7. USE A 1" DRILL BIT TO PECK DRILL A THROUGH HOLE AT ESTABLISHED CENTER.	
8. USE A 1/2” SHANK BORING BAR AND GRADUALLY INCREASE DIAMETER USING ¼" STEP SIZES UNTIL Ø1.925” IS REACHED.	

9. TAKE LIGHT FINISH BORING PASSES UNTIL Ø1.950” IS ACHIEVED.	
10. BREAK AND BURR ALL HOLES AND EDGES.	

PART 7: MODIFIED AIR ENGINE BASE

MANUFACTURING PROCESS	PROCESS SETUP
1. LEAVE AIR ENGINE BASE CLAMPED IN MILL VISE, USING X-AXIS AND Y-AXIS ZEROS FROM PREVIOUS MACHINING.	
2. INSTALL A CYLINDRICAL EDGE FINDER INTO THE DRILL CHUCK. TAKE A NONDESTRUCTIVE ZERO ON THE Z AXIS BY PLACING A PIECE OF PAPER WORKPIECE TOP FACE. SET THE SPINDLE TO AN ARBITRARY DEPTH AND LOWER THE CENTER FINDER UNTIL THE PAPER CANNOT BE WIGGLED OUT. SET THE Z-AXIS ZERO. MAKE SURE THE SPINDLE IS LOWERED AND REACHING THE ARBITRARY DEPTH'S MAX. REMOVED THE PAPER AND LOWER THE Z AXIS BY 0.003". RE-ZERO THE Z-AXIS TO ACCOUNT FOR THE PAPER THICKNESS.	

3. MOVE THE TABLE UNTIL THE DRO READS –2.500” IN THE X-AXIS AND –0.750” IN THE Y-AXIS. SET THE Z-AXIS TO 0.375”. USING A CENTER DRILL, PECK DRILL TO PREP PILOT HOLES. REPEAT AT X = -2.500” AND Y = 1.754”.	
4. PECK DRILL AT X = -2.500” AND Y = -0.750” WITH A #7 DRILL BIT UNTIL A DEPTH OF 0.375” IS REACHED USING STEP SIZES OF ¼". REPEAT AT X = -2.500” AND Y = 1.754”.	

5. HAND TAP BOTH HOLES USING ¼-20 UNC TAP TO A DEPTH OF 0.350”.	
6. FINISH AS MACHINED, BREAK AND BURR ALL HOLES AND EDGES.