

Design Report 3

Group 10C

EML 2322L - Fall 2025

11/23/2025

Evan Farnan

Marshall Leone

Garrett Wallace

Ryan Lowe

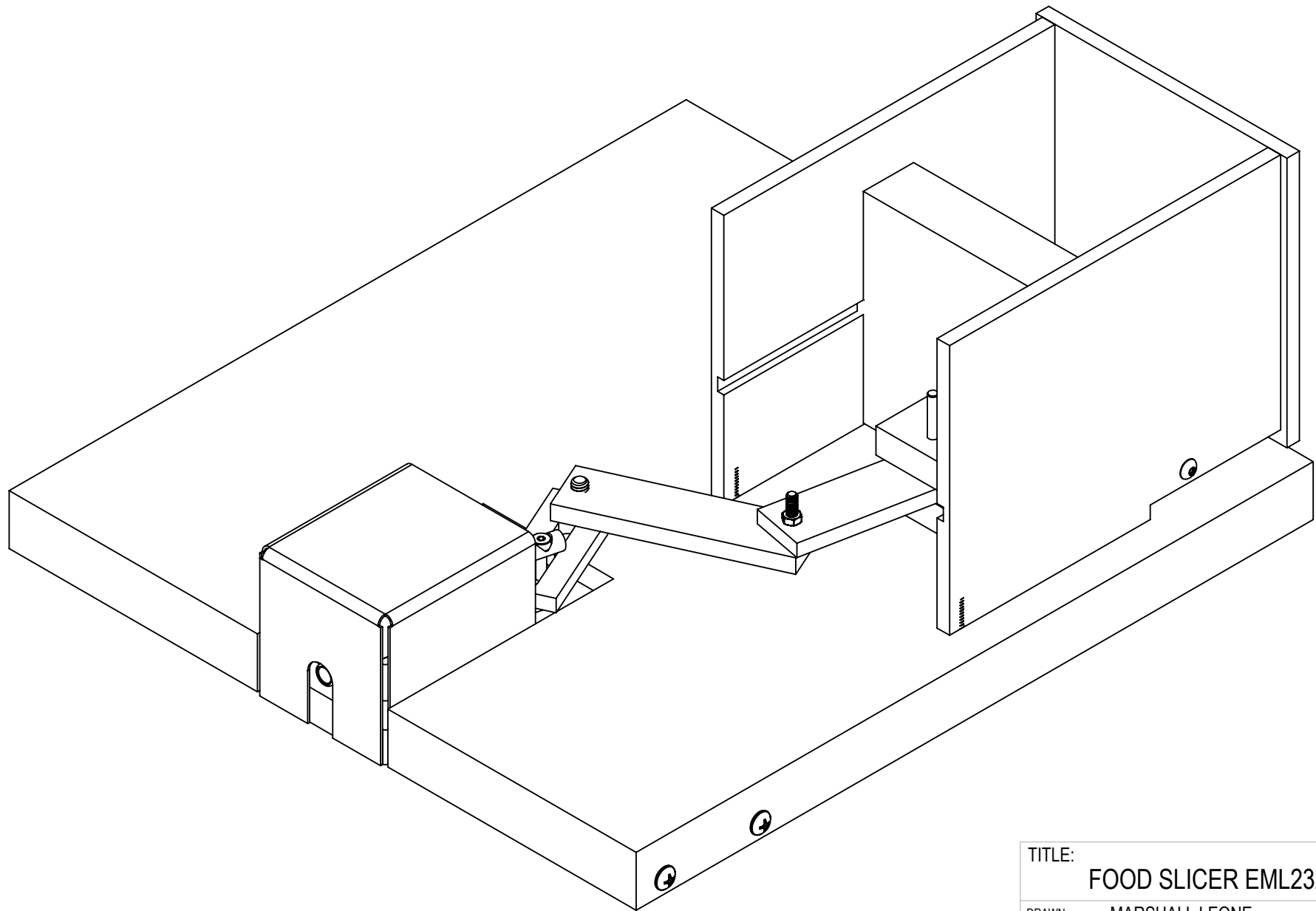
Concept Description

The selected design uses a bell crank mechanism attached to the shoulder screw of the air engine's flywheel to create its motion and function. The bell crank is made up of a slotted input arm (6061 Aluminum) that has an input length of 1", and an output arm (6061 Aluminum) that has a length of 3.2". Multiplying the 3.2"/1" x the radius of the flywheel (0.625"), we achieve the desired stroke length of 4". The conversion of the rotational flywheel motion to linear motion creates a 4-inch slicing motion that can be used to cut food with a blade that allows for adjustable thickness settings.

The input arm and output arm are pinned together at a pivot in the base (HDPE) with a 1/4 - 20 threaded rod. The motion that they create together is translated using a piston arm (6061 Aluminum) which connects to a piston plate (HDPE), via a clevis bearing (6061 Aluminum). The piston plate is pushed forward and backward using the converted rotational motion of the flywheel with its motion constrained to a straight, linear path using slots in the HDPE blade carriage walls. The piston plate pushes food into a 304 Stainless Steel blade which is mounted to a blade plate (HDPE) secured between the two walls of the blade carriage, and the backing plate (HDPE) using #8-32 screws. There are two #10-24 knurled-head thumb screws that drive the blade into the blade plate and then into the base of the food slicer assembly. These screws can be adjusted for variable thickness in cuts.

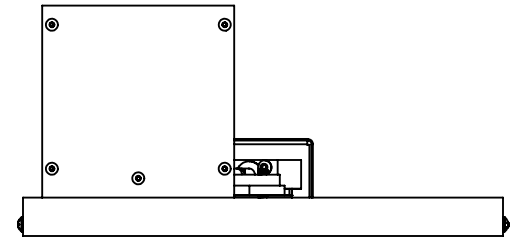
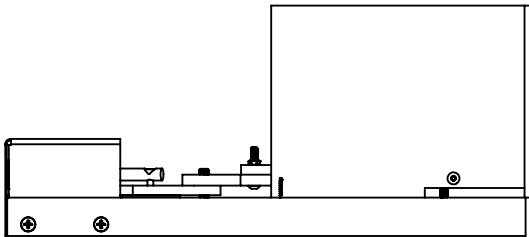
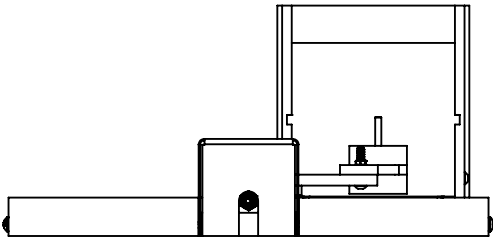
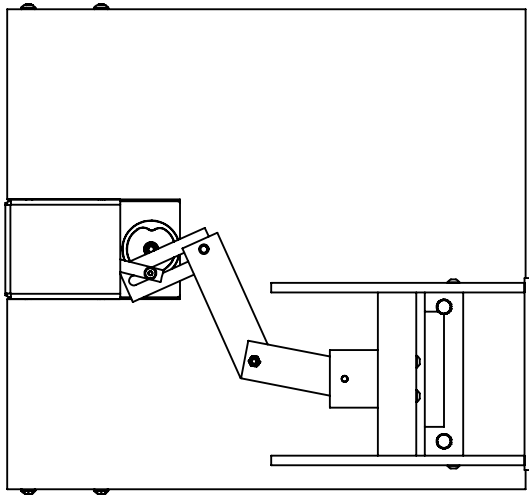
The air engine fits into a pocket of the food slicer base, and is held into place using #10-24 screws that screw into the holes that hold the case of the air engine together instead of using the given screws.

Assembly Drawings & B.O.M.



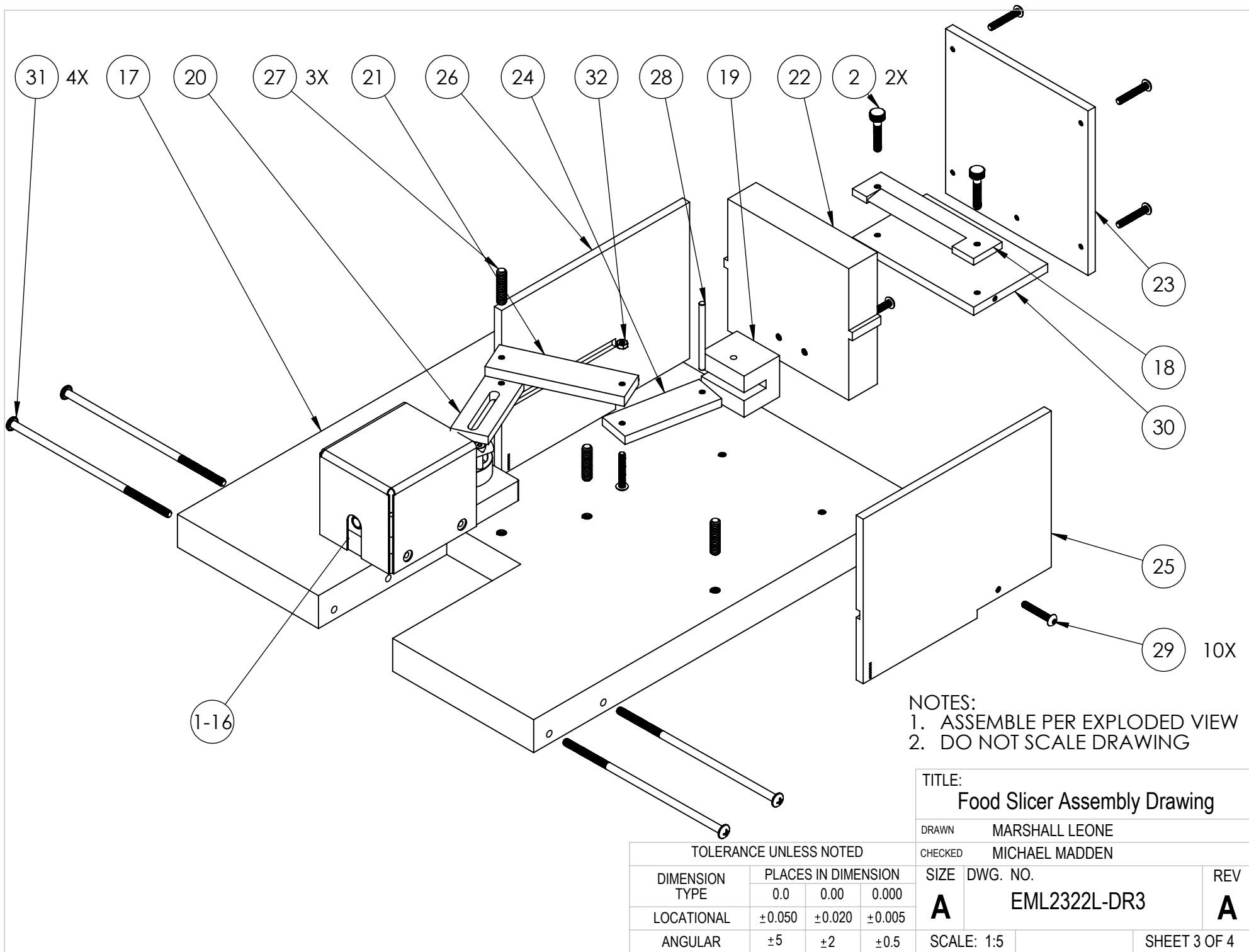
TITLE:				FOOD SLICER EML2322L			
DRAWN				MARSHALL LEONE			
CHECKED				MICHAEL MADDEN			
SIZE		DWG. NO.			REV		
A		EML2322L-DR3			A		
SCALE: 1:2					SHEET 1 OF 4		

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



TITLE:				FOOD SLICER EML2322L			
DRAWN		MARSHALL LEONE					
CHECKED		MICHAEL MADDEN					
SIZE		DWG. NO.				REV	
A		EML2322L-DR3				A	
SCALE: 1:5					SHEET 2 OF 4		

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



NOTES:
 1. ASSEMBLE PER EXPLODED VIEW
 2. DO NOT SCALE DRAWING

TITLE:			
Food Slicer Assembly Drawing			
DRAWN		MARSHALL LEONE	
CHECKED		MICHAEL MADDEN	
SIZE	DWG. NO.		REV
A	EML2322L-DR3		A
SCALE: 1:5		SHEET 3 OF 4	

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

BILL OF MATERIALS

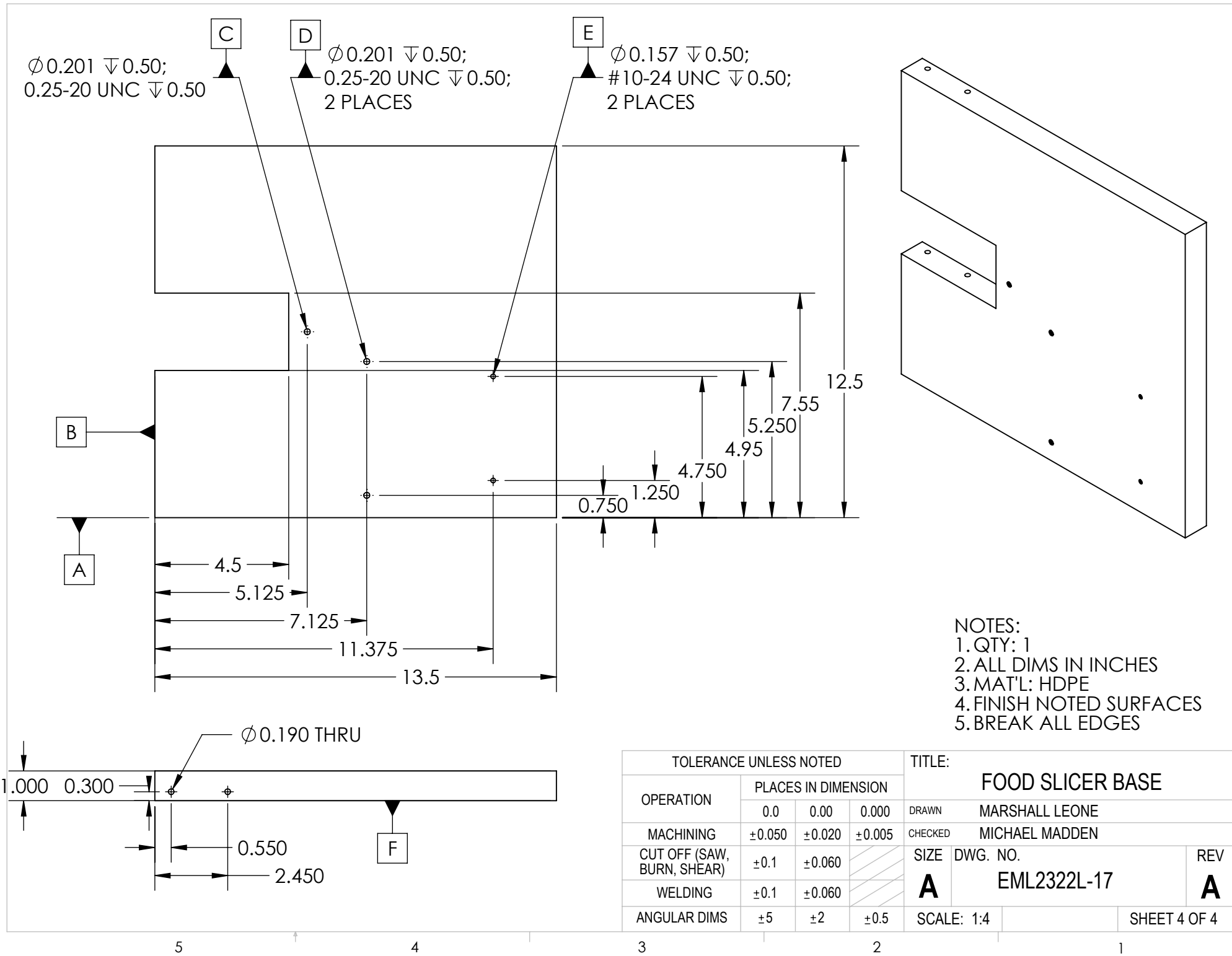
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1-16	Air Engine	Multiple Parts	1
17	Food Slicer Base	HDPE	1
18	Blade	304 Stainless	1
19	Clevis Bearing	6061 Aluminum	1
20	InputArm	6061 Aluminum	1
21	OutputArm	6061 Aluminum	1
22	Piston Plate	HDPE	1
23	Backing Plate	HDPE	1
24	PistonArm	6061 Aluminum	1
25	Flipped Wall	HDPE	1
26	Wall	HDPE	1
27	98758A305	Medium-Strength Threaded Rod	3
28	98381A493	Dowel Pin	1
29	92949A199	18-8 Stainless Steel Button Head Hex Drive Screw	10
30	Blade plate	HDPE	1
31	91772A932	Passivated 18-8 Stainless Steel Pan Head Phillips Screw	4
32	94600A100	18-8 Stainless Steel Hex Nut	1
33	91746A512	Knurled-Head Thumb Screw	2

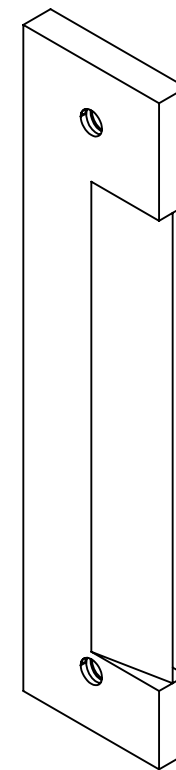
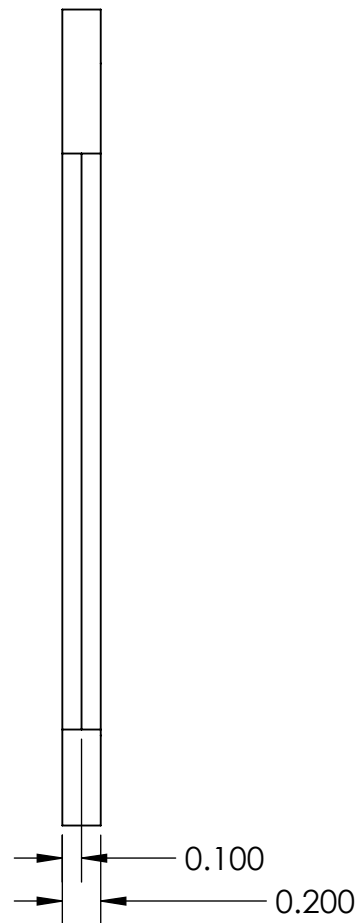
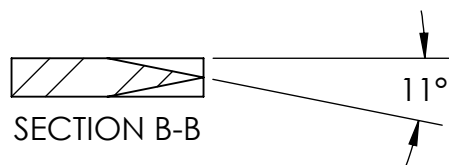
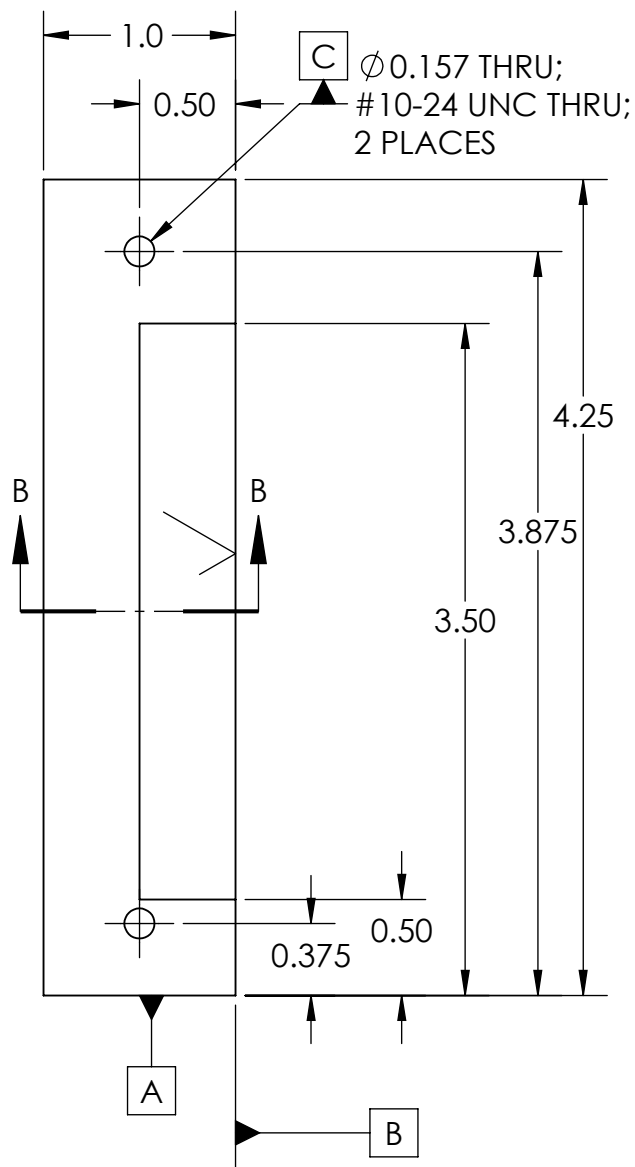
TITLE: Food Slicer Assembly Drawing			
DRAWN MARSHALL LEONE		CHECKED MICHAEL MADDEN	
SIZE A	DWG. NO. EML2322L-DR3		REV A
SCALE: 1:8		SHEET 4 OF 4	

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

Appendix A:

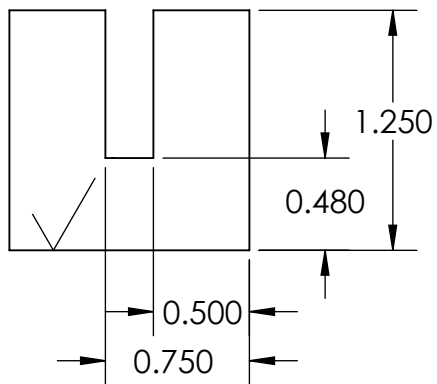
Detailed Part Drawings



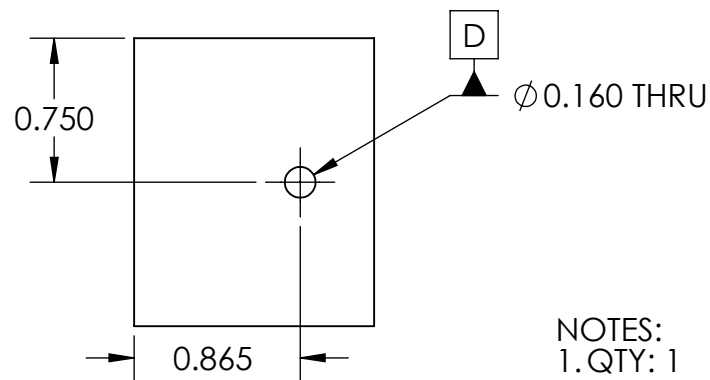
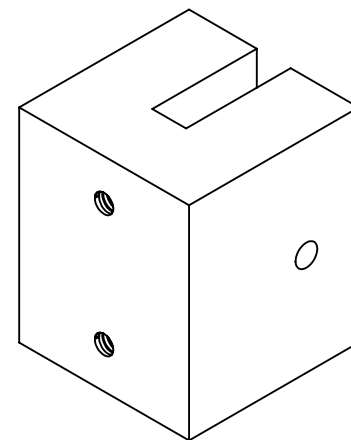
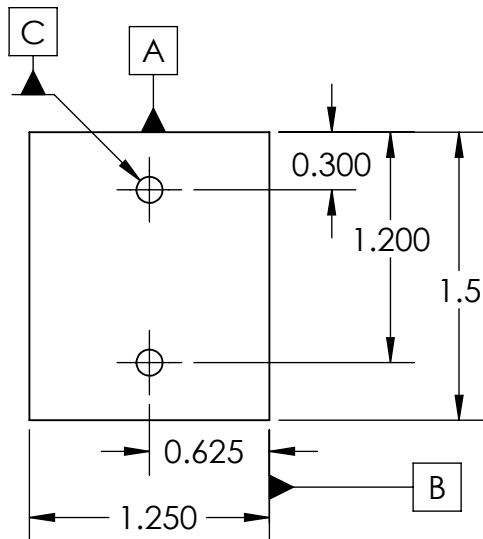


- NOTES:
1. QTY: 1
 2. ALL DIMS IN INCHES
 3. MAT'L: 304 STAINLESS STEEL
 4. FINISH NOTED SURFACES
 5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE:		
OPERATION	PLACES IN DIMENSION			BLADE		
	0.0	0.00	0.000	DRAWN	MARSHALL LEONE	
MACHINING	±0.050	±0.020	±0.005	CHECKED	MICHAEL MADDEN	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-18	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1	SHEET 4 OF 4	

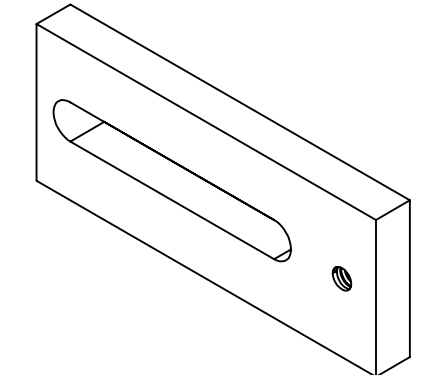
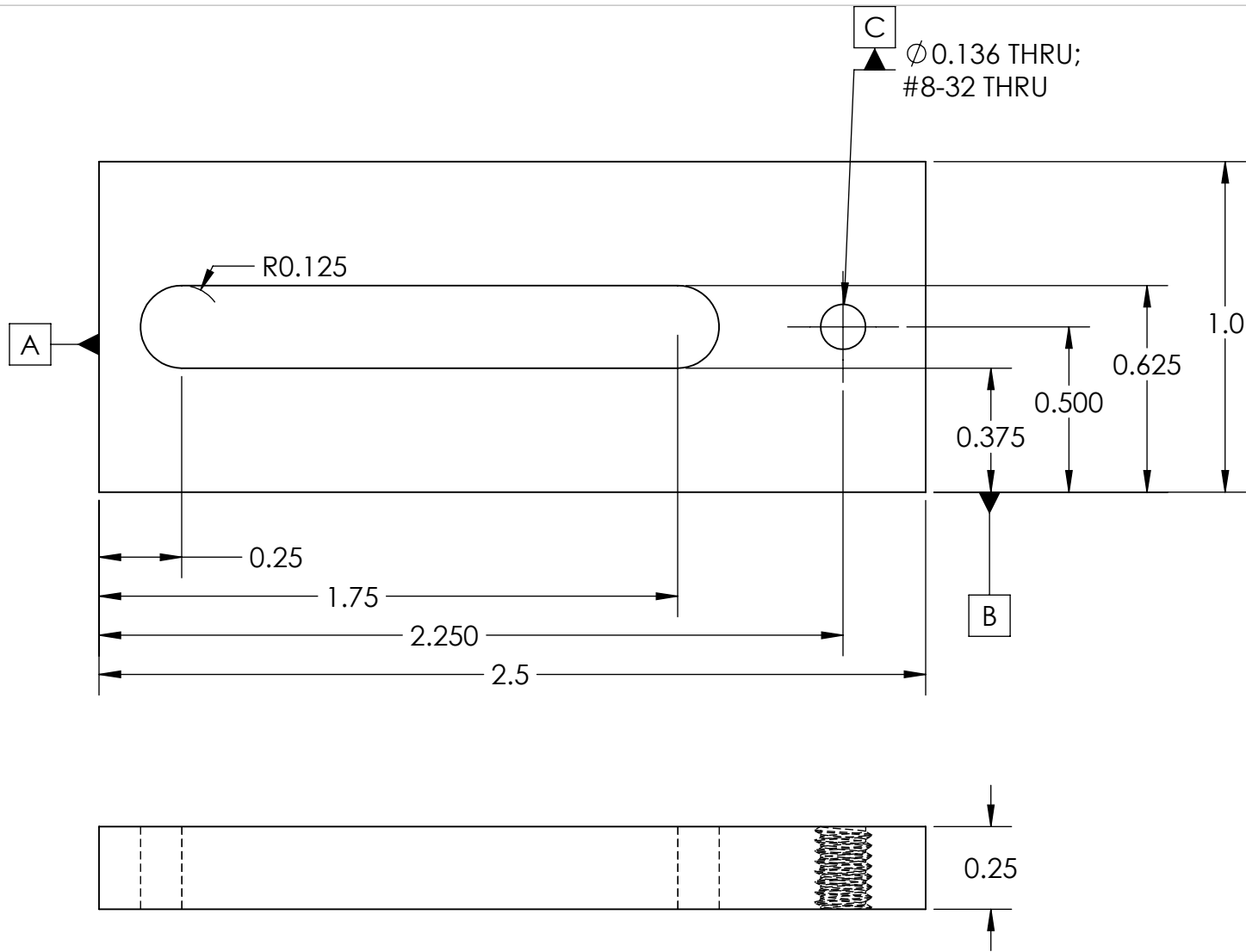


Ø0.136 THRU;
#8-32 UNC THRU;
2 PLACES



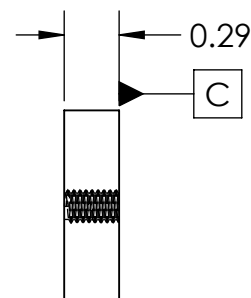
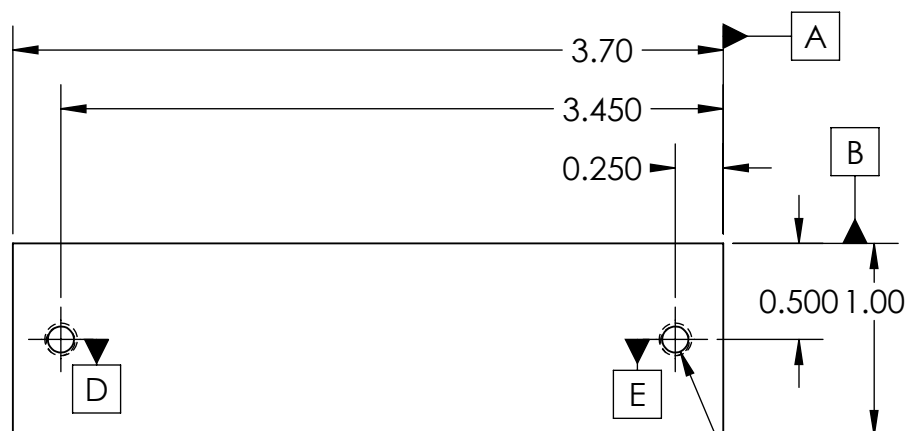
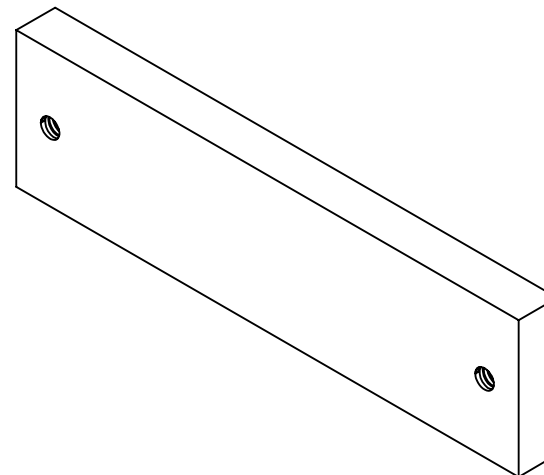
- NOTES:
1. QTY: 1
2. ALL DIMS IN INCHES
3. MAT'L: 6061 ALUMINUM
4. FINISH NOTED SURFACES
5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE: CLEVIS BEARING			
OPERATION	PLACES IN DIMENSION						
	0.0	0.00	0.000	DRAWN	MARSHALL LEONE		
MACHINING	±0.050	±0.020	±0.005	CHECKED	MICHAEL MADDEN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.		REV
WELDING	±0.1	±0.060		A	EML2322L-19		A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 4 OF 4	



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

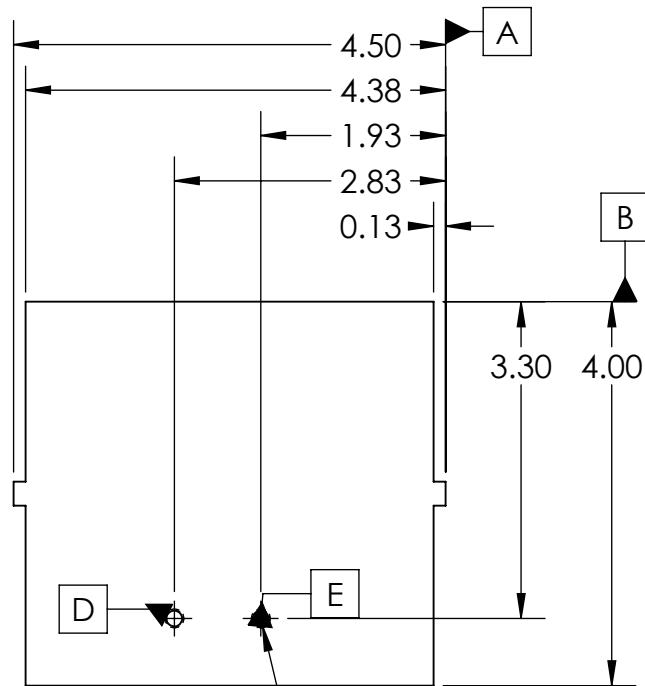
TOLERANCE UNLESS NOTED				TITLE: INPUT ARM			
OPERATION	PLACES IN DIMENSION						
	0.0	0.00	0.000	DRAWN	MARSHALL LEONE		
MACHINING	±0.050	±0.020	±0.005	CHECKED	MICHAEL MADDEN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.		REV
WELDING	±0.1	±0.060		A	EML2322L-20		A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 2:1		SHEET 4 OF 4	



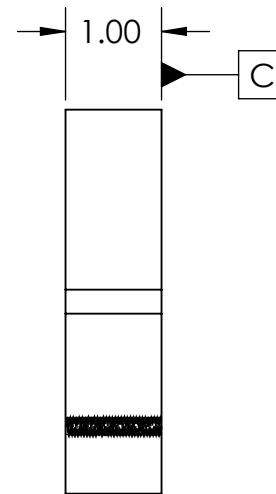
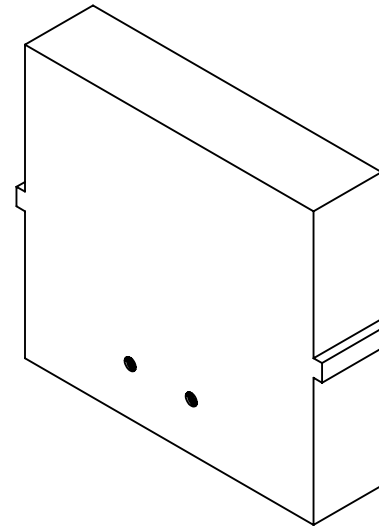
Ø0.136 THRU;
#8-32 THRU;
2 PLACES

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

TOLERANCE UNLESS NOTED				TITLE:		
OPERATION	PLACES IN DIMENSION			Output Arm		
	0.0	0.00	0.000	DRAWN	GARRETT WALLACE	
MACHINING	±0.050	±0.020	±0.005	CHECKED	MICHAEL MADDEL	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-022	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1	SHEET 4 OF 4	

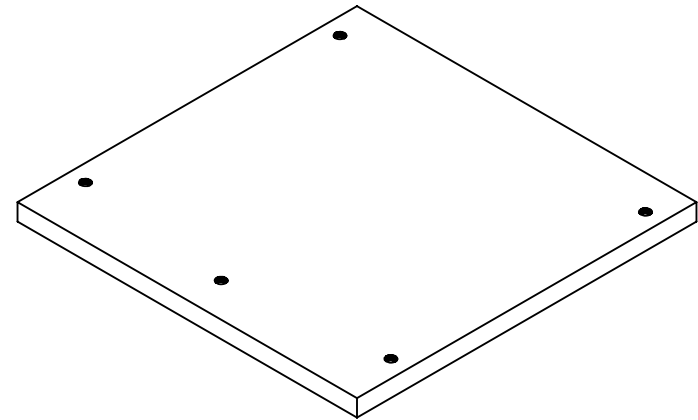
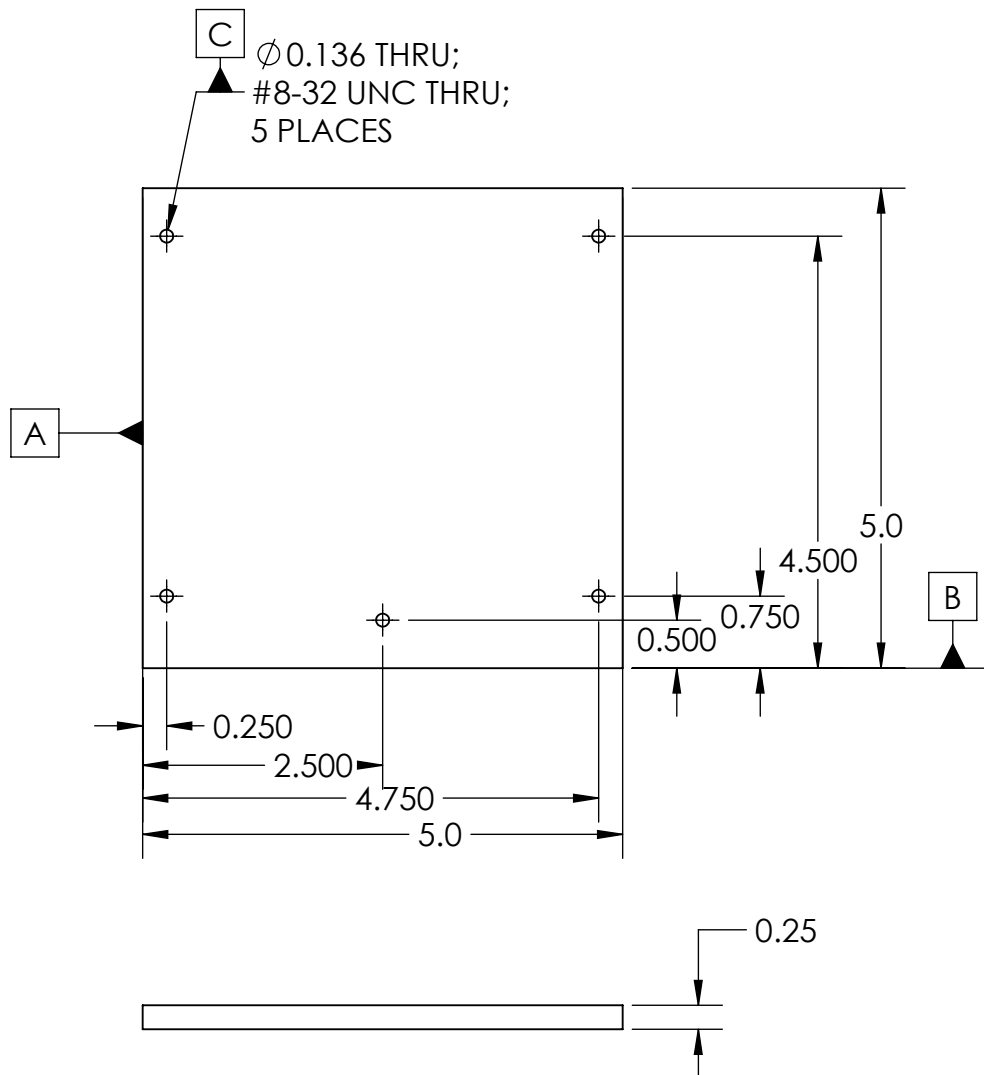


Ø 0.164 THRU;
#8-32 THRU;
2 PLACES



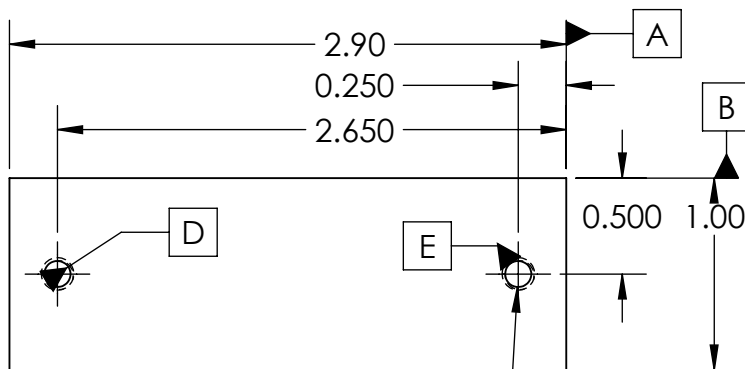
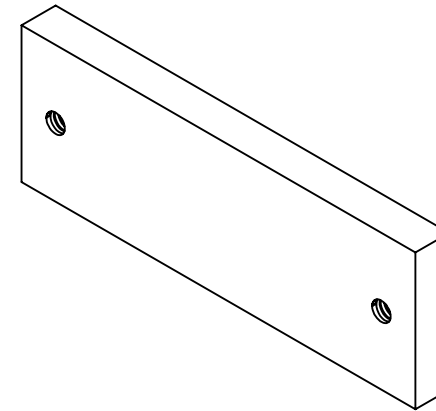
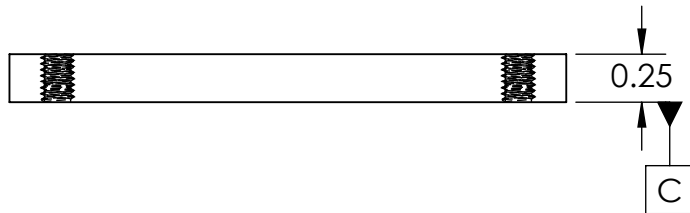
- NOTES:
1. QTY: 1
 2. ALL DIMS IN INCHES
 3. MAT'L: ALUMINUM 6061
 4. FINISH NOTED SURFACES
 5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE:		
OPERATION	PLACES IN DIMENSION			Piston Plate		
	0.0	0.00	0.000	DRAWN	GARRETT WALLACE	
MACHINING	±0.050	±0.020	±0.005	CHECKED	MICHAEL MADDEN	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-023	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:2	SHEET 4 OF 4	



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

TOLERANCE UNLESS NOTED				TITLE: BACKING PLATE		
OPERATION	PLACES IN DIMENSION			DRAWN	MARSHALL LEONE	
	0.0	0.00	0.000	CHECKED	MICHAEL MADDEN	
MACHINING	± 0.050	± 0.020	± 0.005	SIZE	DWG. NO.	REV
CUT OFF (SAW, BURN, SHEAR)	± 0.1	± 0.060		A	EML2322L-23	A
WELDING	± 0.1	± 0.060		SCALE: 1:2		
ANGULAR DIMS	± 5	± 2	± 0.5			SHEET 4 OF 4

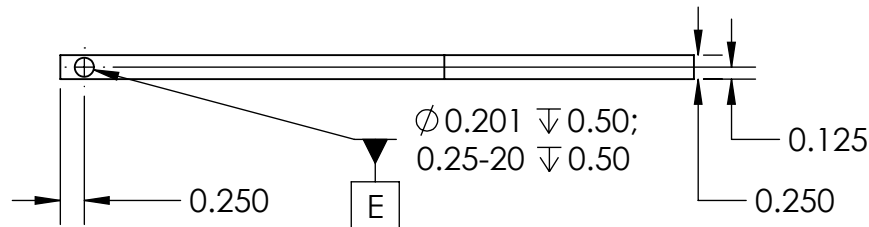
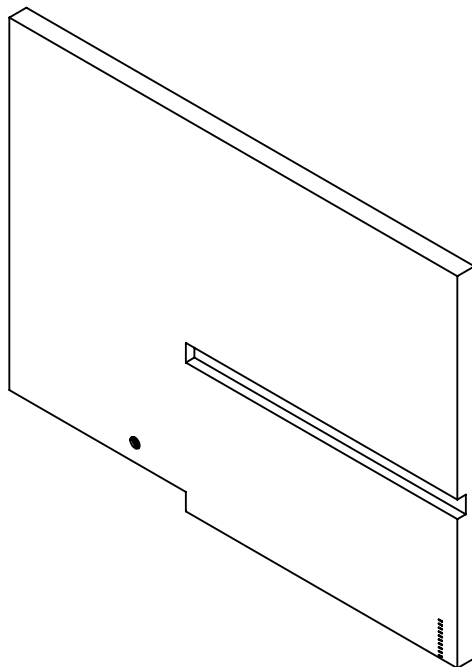
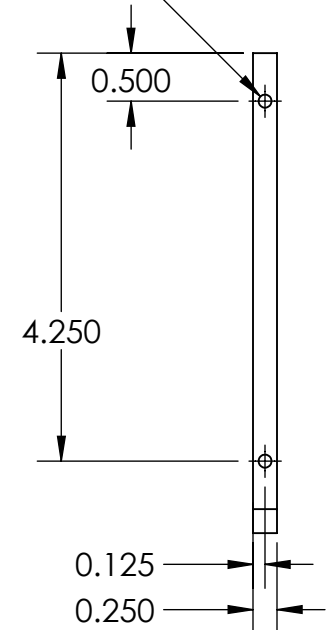
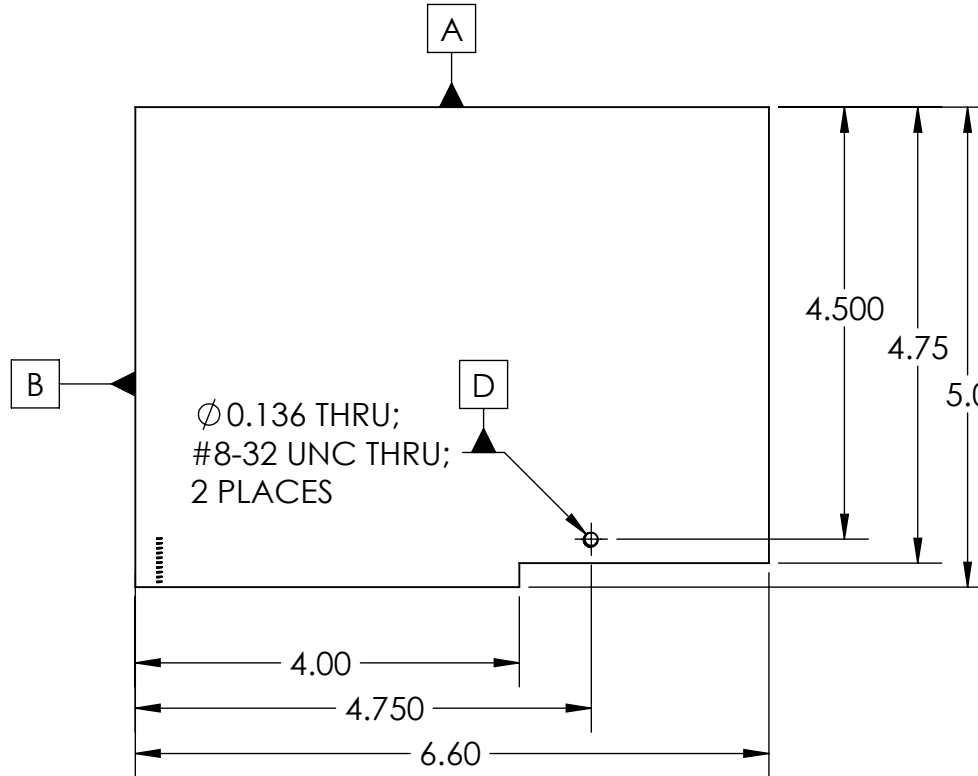
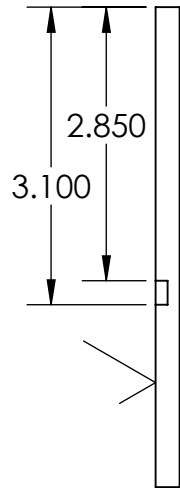


$\varnothing 0.14$ THRU;
 #8-32 THRU;
 2 PLACES



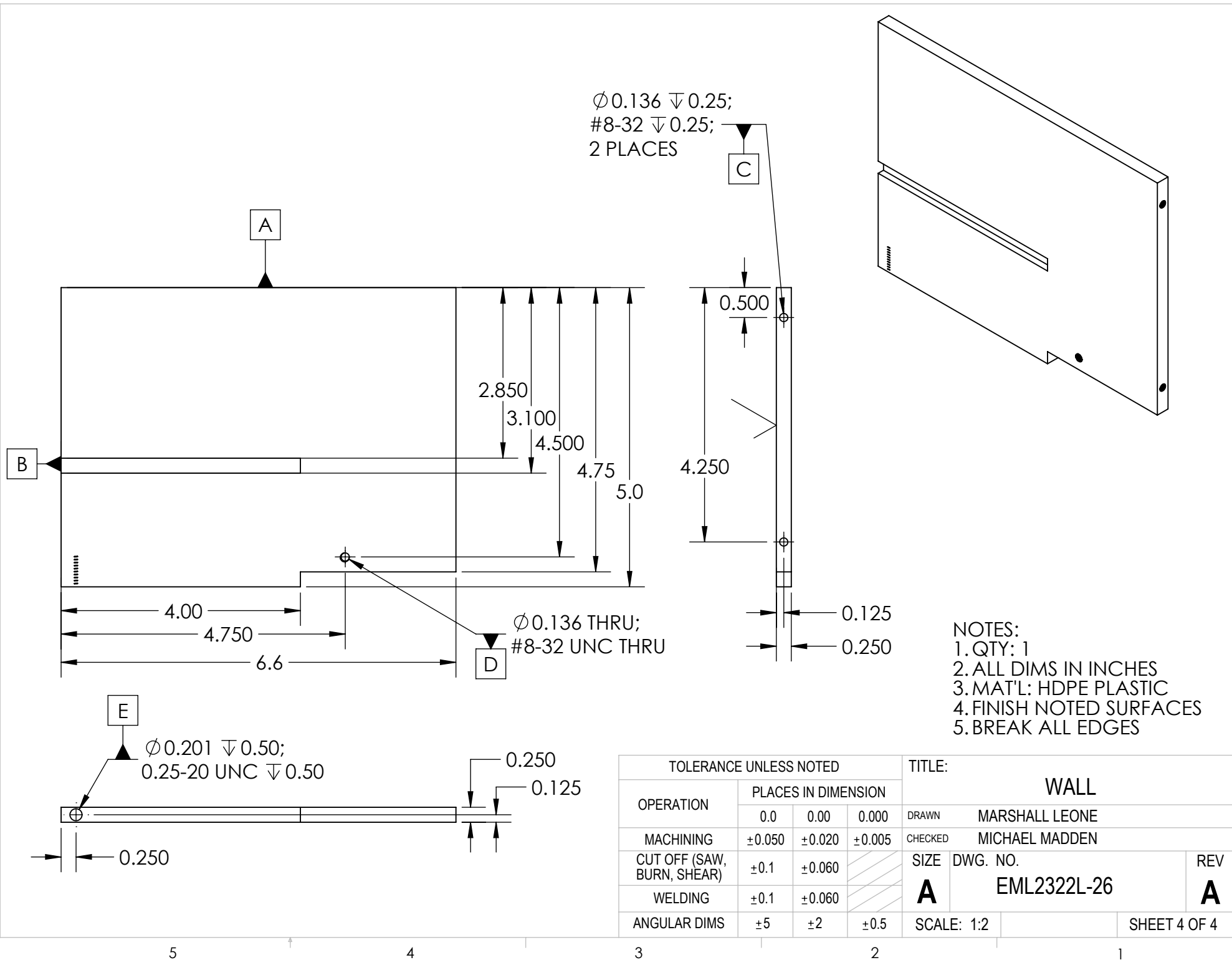
- NOTES:
1. QTY: 1
 2. ALL DIMS IN INCHES
 3. MAT'L: ALUMINUM 6061
 4. FINISH NOTED SURFACES
 5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE: Piston Arm			
OPERATION	PLACES IN DIMENSION						
	0.0	0.00	0.000	DRAWN	GARRETT WALLACE		
MACHINING	±0.050	±0.020	±0.005	CHECKED	MICHAEL MADDEN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.		REV
WELDING	±0.1	±0.060		A	EML2322L-027		A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 1 OF 1	



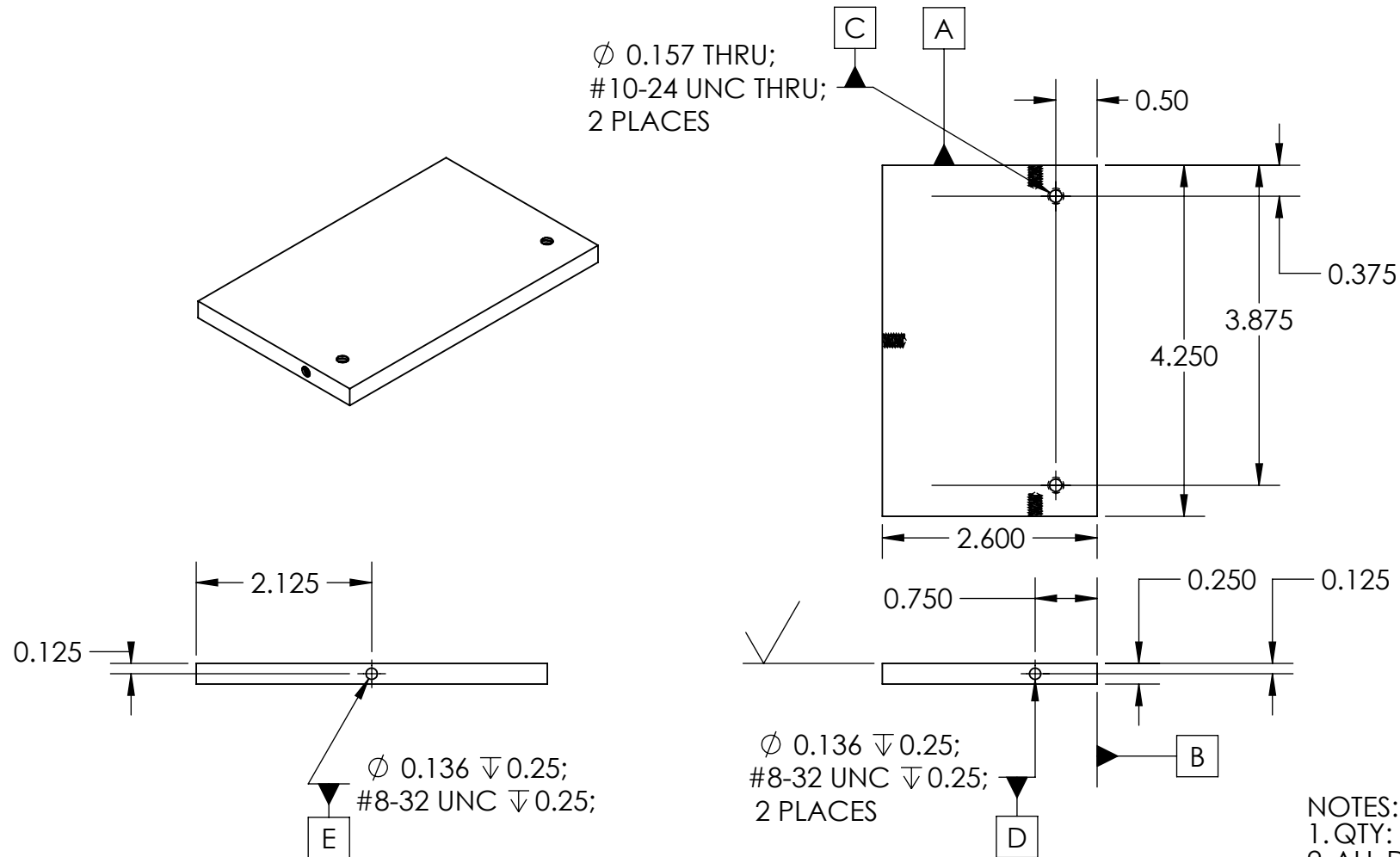
- NOTES:
1. QTY: 1
 2. ALL DIMS IN INCHES
 3. MAT'L: HDPE PLASTIC
 4. FINISH NOTED SURFACES
 5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE:		
OPERATION	PLACES IN DIMENSION			WALL (FLIPPED)		
	0.0	0.00	0.000	DRAWN	MARSHALL LEONE	
MACHINING	± 0.050	± 0.020	± 0.005	CHECKED	MICHAEL MADDEN	
CUT OFF (SAW, BURN, SHEAR)	± 0.1	± 0.060		SIZE	DWG. NO.	REV
WELDING	± 0.1	± 0.060		A	EML2322L-25	A
ANGULAR DIMS	± 5	± 2	± 0.5	SCALE: 1:2	SHEET 4 OF 4	



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

TOLERANCE UNLESS NOTED				TITLE:		
OPERATION	PLACES IN DIMENSION			WALL		
	0.0	0.00	0.000	DRAWN	MARSHALL LEONE	
MACHINING	± 0.050	± 0.020	± 0.005	CHECKED	MICHAEL MADDEN	
CUT OFF (SAW, BURN, SHEAR)	± 0.1	± 0.060		SIZE	DWG. NO.	REV
WELDING	± 0.1	± 0.060		A	EML2322L-26	A
ANGULAR DIMS	± 5	± 2	± 0.5	SCALE: 1:2	SHEET 4 OF 4	



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

TOLERANCE UNLESS NOTED				TITLE:		
OPERATION	PLACES IN DIMENSION			BLADE PLATE DRAWING		
	0.0	0.00	0.000	DRAWN	MARSHALL LEONE	
MACHINING	± 0.050	± 0.020	± 0.005	CHECKED	MICHAEL MADDEN	
CUT OFF (SAW, BURN, SHEAR)	± 0.1	± 0.060		SIZE	DWG. NO.	REV
WELDING	± 0.1	± 0.060		A	EML2322L-30	A
ANGULAR DIMS	± 5	± 2	± 0.5	SCALE: 1:2	SHEET 1 OF 4	

Appendix B:

Manufacturing Inspection Records

EML 2322L MANUFACTURING INSPECTION RECORD

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
17		A	Base		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Extruded Cut Length	Caliper	4.5	4.45	4.55	In		
2	A	Hole Location	Caliper	5.125	5.120	5.130	In		
3	A	Hole Location	Caliper	6.175	6.170	6.180	In		
4	A	Hole Location	Caliper	6.175	6.170	6.180	In		
5	A	Hole Location	Caliper	10.125	10.120	10.130	In		
6	A	Hole Location	Caliper	10.125	10.120	10.130	In		
7	A	Part Width	Caliper	13.5	13.45	13.55	In		
8	B	Feature Length	Caliper	5.0	4.95	5.05	In		
9	B	Hole Location	Caliper	0.75	0.73	0.77	In		
10	B	Hole Location	Caliper	1.25	1.23	1.27	In		
11	B	Hole Location	Caliper	4.75	4.73	4.77	In		
12	B	Hole Location	Caliper	5.25	5.23	5.27	In		
13	B	Hole Location	Caliper	6.25	6.23	6.27	In		
14	B	Part Length	Caliper	12.5	12.45	12.55	In		
15	C	Hole Diameter	Fastener	#1/4-20	-	-	UNC		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
17		A	Base		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
16	C	Hole Depth	Caliper	0.25	0.23	0.27	In		
17	D	Hole Diameter	Fastener	#1/4-20	-	-	UNC		
18	D	Hole Depth	Caliper	0.25	0.23	0.27	In		
19	E	Hole Diameter	Fastener	#1/4-20	-	-	UNC		
20	E	Hole Depth	Caliper	0.25	0.23	0.27	In		
21	G	Hole Diameter	Fastener	#10-24	-	-	UNC		
22	G	Hole Depth	Caliper	0.25	0.23	0.27	In		
23	G	Hole Diameter	Fastener	#10-24	-	-	UNC		
24	G	Hole Depth	Caliper	0.25	0.23	0.27	In		
25	F	Hole Diameter	Caliper	0.190	0.185	0.180	In		
26	F	Hole Diameter	Caliper	0.190	0.185	0.180	In		
27	F	Hole Diameter	Caliper	0.190	0.185	0.180	In		
28	F	Hole Diameter	Caliper	0.190	0.185	0.180	In		
29	H	Hole Location	Caliper	1.125	1.120	1.130	In		
30	H	Hole Location	Caliper	3.375	3.370	3.380	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
17		A	Base		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
31	H	Hole Location	Caliper	1.125	1.120	1.130	In		
32	H	Hole Location	Caliper	3.375	3.370	3.380	In		
33	I	Part Thickness	Caliper	1.0	0.95	1.05	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
18		A	Blade		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Hole Location	Caliper	0.25	0.23	0.27	In		
2	A	Hole Location	Caliper	3.75	3.73	3.77	In		
3	A	Part Length	Caliper	4.0	3.95	4.05	In		
4	B	Hole Location	Caliper	0.5	0.45	0.55	In		
5	B	Hole Location	Caliper	0.5	0.45	0.55	In		
6	B	Part Width	Caliper	1.0	0.95	1.05	In		
7	C	Hole Diameter	Fastener	#10-24	-	-	UNC		
8	D	Hole Diameter	Fastener	#10-24	-	-	UNC		
8	E	Part Thickness	Caliper	1.0	0.95	1.05	In		
9	F	Blade Tip Location	Caliper	0.5	0.45	0.55	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
19		A	Clevis Bearing		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Hole Location	Caliper	0.300	0.295	0.305	In		
2	A	Hole Location	Caliper	1.200	1.195	1.205	In		
3	A	Part Length	Caliper	1.5	1.45	1.55	In		
4	B	Hole Location	Caliper	0.625	0.620	0.630	In		
5	B	Hole Location	Caliper	0.625	0.620	0.630	In		
6	B	Part Width	Caliper	1.250	1.245	1.255	In		
7	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
8	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
9	B	Surface Location	Caliper	0.500	0.495	0.505	In		
10	B	Surface Location	Caliper	0.750	0.745	0.755	In		
11	E	Surface Location	Caliper	0.480	0.475	0.485	In		
12	E	Part Thickness	Caliper	1.250	1.245	1.255	In		
13	E	Hole Location	Caliper	0.160	0.155	0.165	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
20		A	Input Arm		10-C		Evan Farnan		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Part length	Caliper	2.5	2.45	2.55	In		
2	A	Hole location	Caliper	2.25	2.23	2.27	In		
3	A	Slot end location	Caliper	1.75	1.73	1.77	In		
4	A	Slot start location	Caliper	0.25	0.23	0.27	In		
5	B	Part width	Caliper	1.0	0.95	1.05	In		
6	B	Slot width start	Caliper	0.375	0.370	0.380	In		
7	B	Slot width end	Caliper	0.625	0.620	0.630	In		
8	B	Hole location	Caliper	0.5	0.45	0.55	In		
9	C	Slot width	Caliper	0.250	0.245	0.255	In		
10	D	Threaded fastener	Fastener	#8-32	-	-	UNC		
11	E	Part thickness	Caliper	0.25	0.23	0.27	In		
12									
13									
14									
15									
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:		Evan Farnan						☐ Rework	
Group Member 2:		Marshall Leone						☐ Engineering Change	
Group Member 3		Garrett Wallace		TA Signature					
Group Member 4		Ryan Lowe							

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
21		A	Output Arm		10-C		Evan Farnan		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Part length	Caliper	3.2	3.15	3.25	In		
2	A	Hole location	Caliper	2.95	2.93	2.97	In		
3	A	Hole location	Caliper	0.25	0.23	0.27	In		
4	B	Part width	Caliper	1.0	0.95	1.05	In		
5	C	Threaded fastner	Fastener	#8-32	-	-	UNC		
6	C	Threaded fastener	Fastener	#8-32	-	-	UNC		
7	D	Part thickness	Caliper	0.25	0.23	0.27	In		
8									
9									
10									
11									
12									
13									
14									
15									
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:		Evan Farnan						☐ Rework	
Group Member 2:		Marshall Leone						☐ Engineering Change	
Group Member 3		Garrett Wallace		TA Signature					
Group Member 4		Ryan Lowe							

EML 2322L MANUFACTURING INSPECTION RECORD

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
22		A	Piston Plate		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Surface Location	Caliper	1.875	1.870	1.880	In		
2	A	Hole Location	Caliper	2.0	1.95	2.05	In		
3	A	Hole Location	Caliper	2.0	1.95	2.05	In		
4	A	Surface Location	Caliper	2.125	2.120	2.130	In		
5	A	Part Length	Caliper	4.0	3.95	4.05	In		
6	B	Feature Width	Caliper	0.25	0.23	0.27	In		
7	B	Hole Location	Caliper	1.55	1.53	1.57	In		
8	B	Hole Location	Caliper	2.45	2.43	2.47	In		
9	B	Part Width	Caliper	4.0	3.95	4.05	In		
10	B	Surface Location	Caliper	4.25	4.23	4.27	In		
11	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
12	D	Hole Diameter	Fastener	#8-32	-	-	UNC		
13	E	Part Thickness	Caliper	1.0	0.95	1.05	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
23		A	Backing Plate		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Hole Location	Caliper	0.5	0.45	0.55	In		
2	A	Hole Location	Caliper	0.5	0.45	0.55	In		
3	A	Hole Location	Caliper	3.0	2.95	3.05	In		
4	A	Hole Location	Caliper	5.5	5.45	5.55	In		
5	A	Hole Location	Caliper	5.5	5.45	5.55	In		
6	A	Part Width	Caliper	6.0	5.95	6.05	In		
7	B	Hole Location	Caliper	0.5	0.45	0.55	In		
8	B	Hole Location	Caliper	0.5	0.45	0.55	In		
9	B	Hole Location	Caliper	4.5	4.45	4.55	In		
10	B	Hole Location	Caliper	4.5	4.45	4.55	In		
11	B	Hole Location	Caliper	4.5	4.45	4.55	In		
12	B	Part Length	Caliper	5.0	4.95	5.05	In		
13	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
14	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
15	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
23		A	Backing Plate		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
16	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
17	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
24		A	Piston Arm		10-C		Evan Farnan		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Part length	Caliper	4.0	3.95	4.05	In		
2	A	Hole location	Caliper	3.5	3.45	3.55	In		
3	A	Hole location	Caliper	0.5	0.45	0.55	In		
4	B	Part width	Caliper	1.0	0.95	1.05	In		
5	C	Threaded fastener	Fastener	#8-32	-	-	UNC		
6	C	Threaded fastener	Fastener	#8-32	-	-	UNC		
7	D	Part thickness	Caliper	0.25	0.23	0.27	In		
8									
9									
10									
11									
12									
13									
14									
15									
RESULT:								PASS	
Inspector Signature:								FAIL	☐ Remanufacture
Group Member 1:		Evan Farnan							☐ Rework
Group Member 2:		Marshall Leone							☐ Engineering Change
Group Member 3		Garrett Wallace		TA Signature					
Group Member 4		Ryan Lowe							

EML 2322L MANUFACTURING INSPECTION RECORD

Part Number	Revision	Part Name	Team Number		Machinist:				
25	A	Wall(Flipped)	10-C		Ryan Lowe				
					Inspector:				
					Michael Madden				
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Surface Location	Caliper	2.850	2.845	2.855	In		
2	A	Surface Location	Caliper	3.100	3.095	3.105	In		
3	A	Surface Location	Caliper	4.75	4.73	4.77	In		
4	A	Part Length	Caliper	5.0	4.95	5.05	In		
5	B	Surface Location	Caliper	4.00	3.98	4.02	In		
6	B	Hole Location	Caliper	4.50	4.48	4.52	In		
7	B	Part Width	Caliper	6.60	6.58	6.62	In		
8	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
9	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
10	C	Hole Depth	Caliper	0.25	0.23	0.27	In		
11	C	Hole Depth	Caliper	0.25	0.23	0.27	In		
12	A	Hole Location	Caliper	0.500	0.495	0.505	In		
13	A	Hole Location	Caliper	4.250	4.245	4.255	In		
14	F	Hole Location	Caliper	0.125	0.120	0.130	In		
15	F	Hole Location	Caliper	0.125	0.120	0.130	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
25		A	Wall(Flipped)		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
16	F	Part Thickness	Caliper	0.250	0.245	0.255	In		
17	D	Hole Diameter	Caliper	#8-32	-	-	UNC		
18	E	Hole Diameter	Caliper	#1/4-20	-	-	UNC		
19	E	Hole Depth	Caliper	0.50	0.48	0.52	In		
20	B	Hole Location	Caliper	0.250	0.245	0.255	In		
21	F	Hole Location	Caliper	0.125	0.120	0.130	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
26		A	Wall		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Surface Location	Caliper	2.850	2.845	2.855	In		
2	A	Surface Location	Caliper	3.100	3.095	3.105	In		
3	A	Surface Location	Caliper	4.75	4.73	4.77	In		
4	A	Part Length	Caliper	5.0	4.95	5.05	In		
5	B	Surface Location	Caliper	4.00	3.98	4.02	In		
6	B	Hole Location	Caliper	4.50	4.48	4.52	In		
7	B	Part Width	Caliper	6.6	6.55	6.65	In		
8	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
9	C	Hole Diameter	Fastener	#8-32	-	-	UNC		
10	C	Hole Depth	Caliper	0.25	0.23	0.27	In		
11	C	Hole Depth	Caliper	0.25	0.23	0.27	In		
12	A	Hole Location	Caliper	0.500	0.495	0.505	In		
13	A	Hole Location	Caliper	4.250	4.245	4.255	In		
14	F	Hole Location	Caliper	0.125	0.120	0.130	In		
15	F	Hole Location	Caliper	0.125	0.120	0.130	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
26		A	Wall		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
16	F	Part Thickness	Caliper	0.250	0.245	0.255	In		
17	D	Hole Diameter	Fastener	#8-32	-	-	UNC		
18	E	Hole Diameter	Fastener	#1/4-20	-	-	UNC		
19	E	Hole Depth	Caliper	0.50	0.48	0.52	In		
20	B	Hole Location	Caliper	0.250	0.245	0.255	In		
21	F	Hole Location	Caliper	0.125	0.120	0.130	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

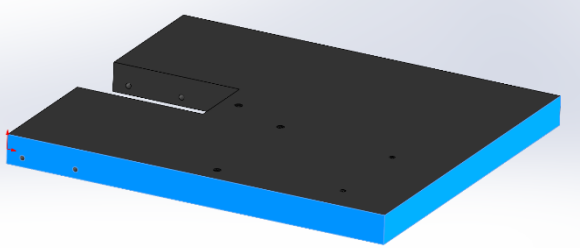
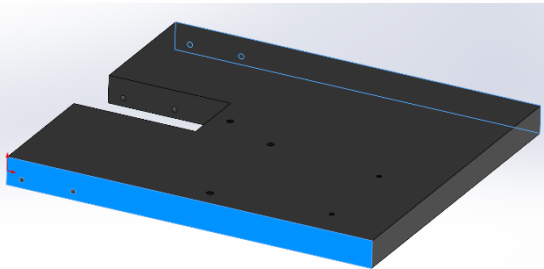
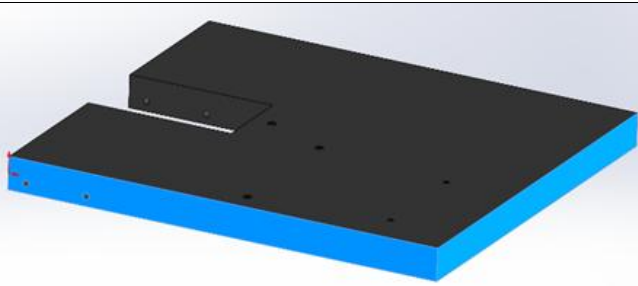
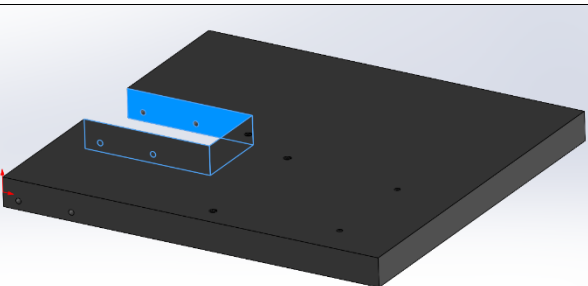
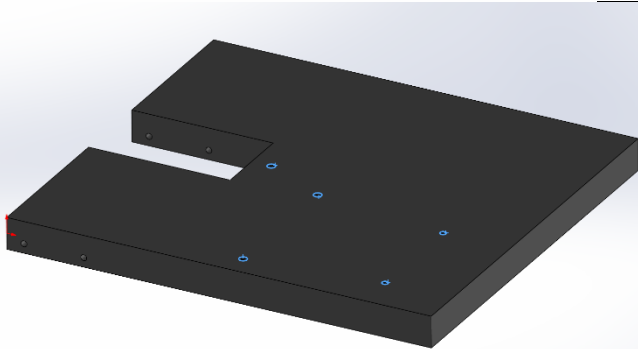
EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
30		A	Blade Plate		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
1	A	Hole Location	Caliper	0.375	0.370	0.380	In		
2	A	Hole Location	Caliper	3.875	3.870	3.880	In		
3	A	Part Length	Caliper	4.250	4.245	4.255	In		
4	D	Hole Depth	Caliper	0.25	0.23	0.27	In		
5	D	Hole Diameter	Caliper	0.136	0.131	0.141	In		
6	D	Hole Depth	Caliper	0.25	0.23	0.27	In		
7	D	Hole Diameter	Caliper	0.136	0.131	0.141	In		
8	B	Hole Location	Caliper	0.750	0.745	0.755	In		
9	F	Hole Location	Caliper	0.125	0.120	0.130	In		
10	B	Hole Location	Caliper	0.750	0.745	0.755	In		
11	F	Hole Location	Caliper	0.125	0.120	0.130	In		
12	F	Part Thickness	Caliper	0.250	0.245	0.255	In		
13	A	Hole Location	Caliper	2.125	2.120	2.130	In		
14	E	Hole Diameter	Caliper	0.136	0.131	0.141	In		
15	E	Hole Depth	Caliper	0.25	0.23	0.27	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

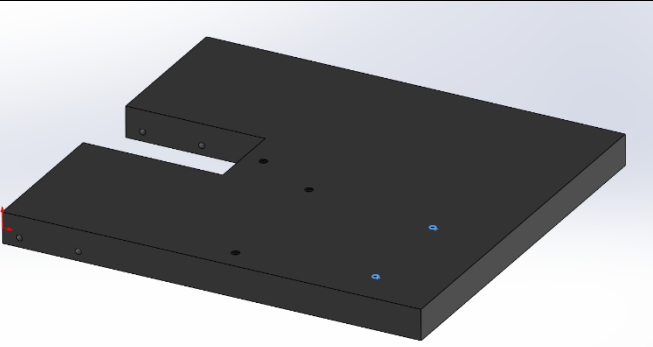
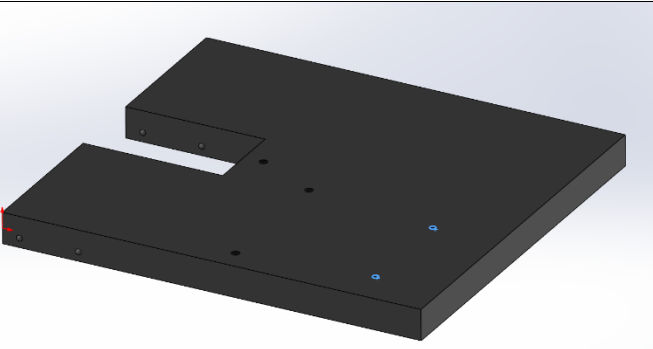
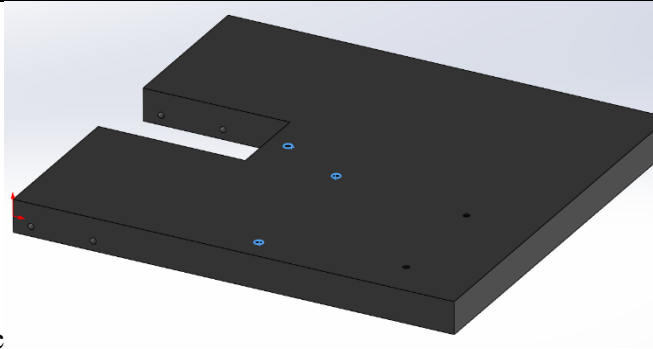
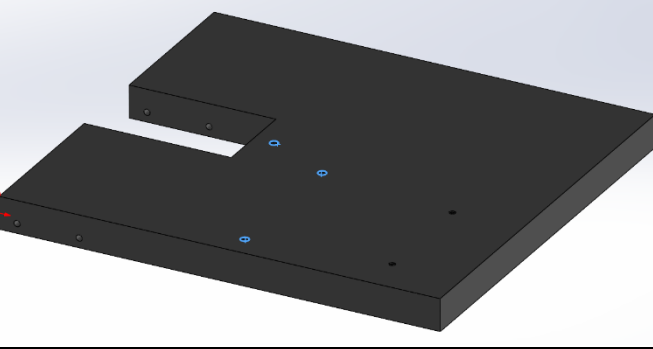
EML 2322L MANUFACTURING INSPECTION RECORD									
Part Number		Revision	Part Name		Team Number		Machinist:		
30		A	Blade Plate		10-C		Ryan Lowe		
							Inspector:		
							Michael Madden		
No.	Ref. Location	Feature Type	Measurement Tool/Type	Requirement	Lower Bound	Upper Bound	Units	Results	Comments
16	B	Hole Location	Caliper	0.50	0.48	0.52	In		
17	B	Hole Location	Caliper	0.50	0.48	0.52	In		
18	B	Part Width	Caliper	2.600	2.595	2.605	In		
19	C	Hole Diameter	Caliper	0.157	0.152	0.162	In		
20	C	Hole Diameter	Caliper	0.157	0.152	0.162	In		
21	F	Hole Location	Caliper	0.125	0.120	0.130	In		
RESULT:								PASS	
Inspector Signature:							FAIL	☐ Remanufacture	
Group Member 1:								☐ Rework	
Group Member 2:								☐ Engineering Change	
Group Member 3				TA Signature					
Group Member 4									

Appendix C:

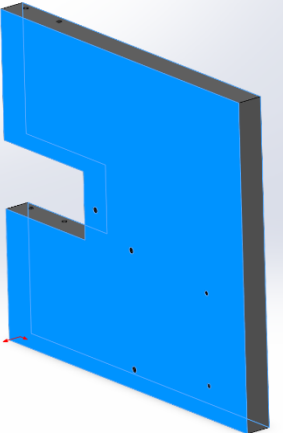
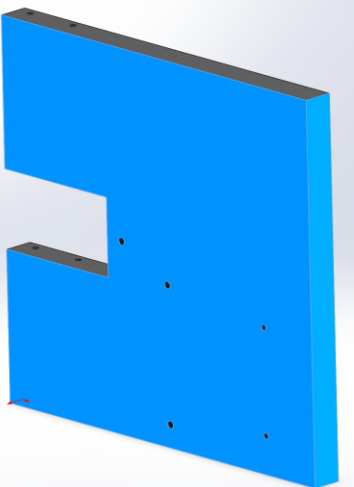
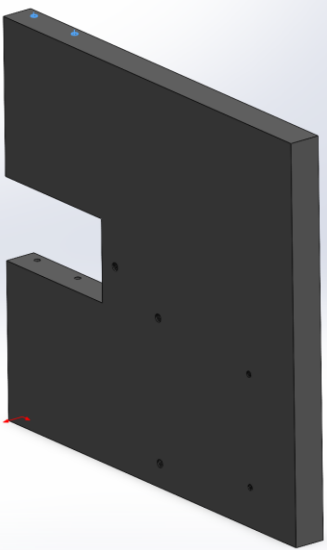
Manufacturing Process Outlines

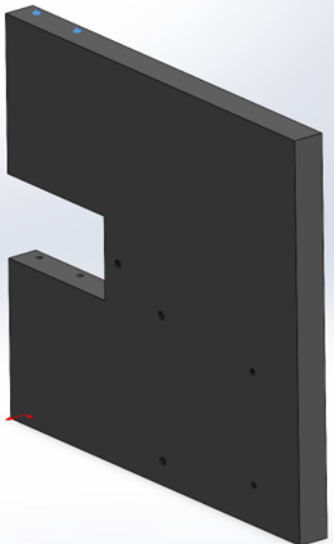
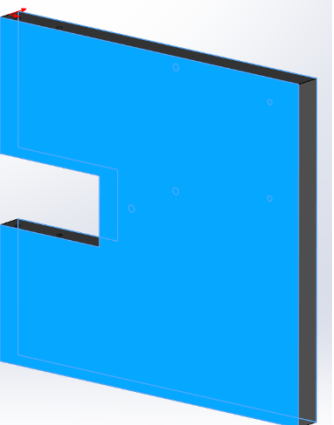
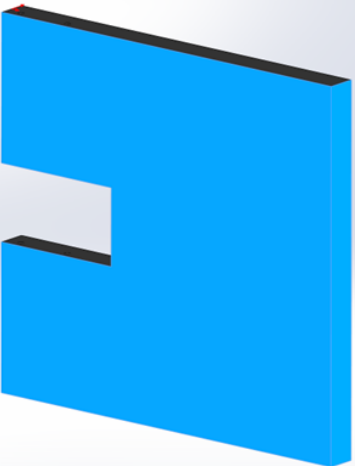
Manufacturing Process Outline
Part #17 –Base

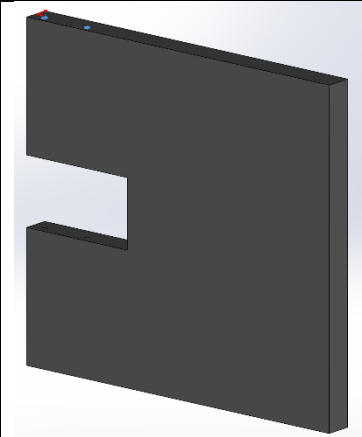
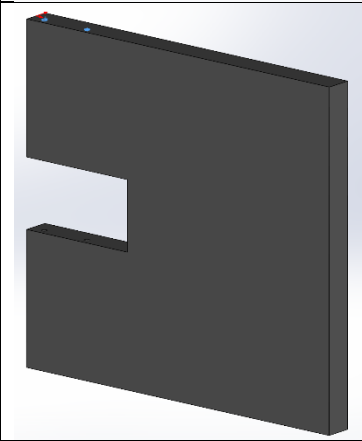
Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a 12.5"x13.5" section on a 24"x24"x0.75" HDPE sheet, then use the marks to align and cut a 12.5"x13.5" rectangle (2 cuts required)	
2	Install the workpiece horizontally on the manual mill, clamping along the edges	
3	Use a cylindrical edge finder to find the x and y zeros	
4	Machine the 4.5"x2.6" thru slot with a 1" endmill, and tighten the fillets on the corners using a 0.25" endmill (it is acceptable to leave a small fillet on the inner corners of the slot)	
5	Center drill for 5 holes on the top surface	

6	Tap drill the 2 x #10-24 holes using a 0.157" drill to a depth of 0.5"	
7	Tap the 2 x #10-24 holes, reaching a depth of 0.5"	
8	Tap drill the 3 x 1/4-20 holes using a 0.201" drill to a depth of 0.5"	
9	Tap the 3 x 1/4-20 holes, reaching a depth of 0.5"	

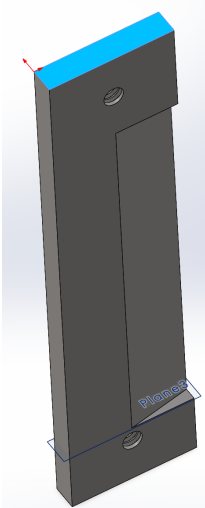
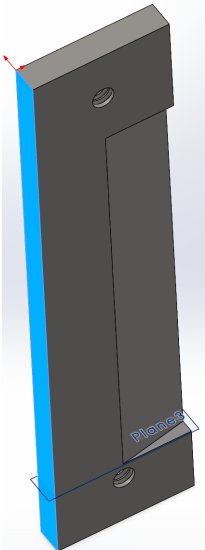
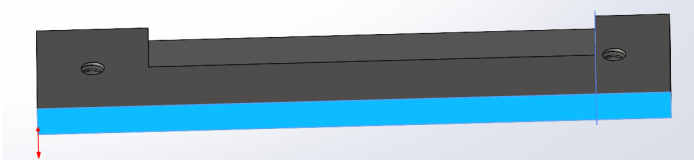
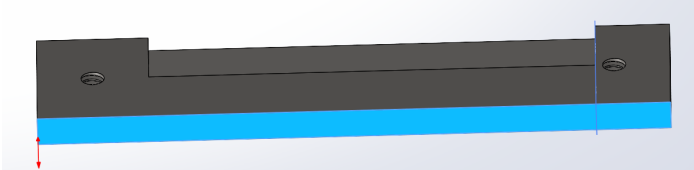
c

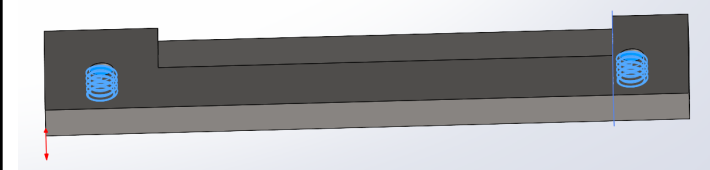
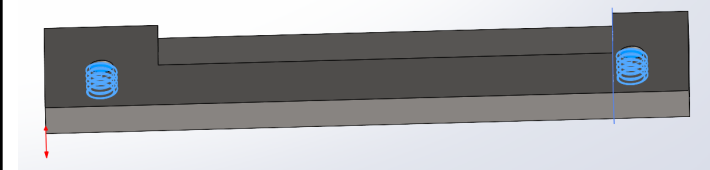
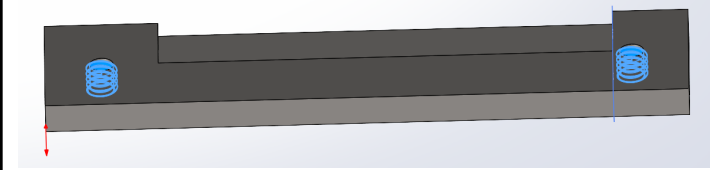
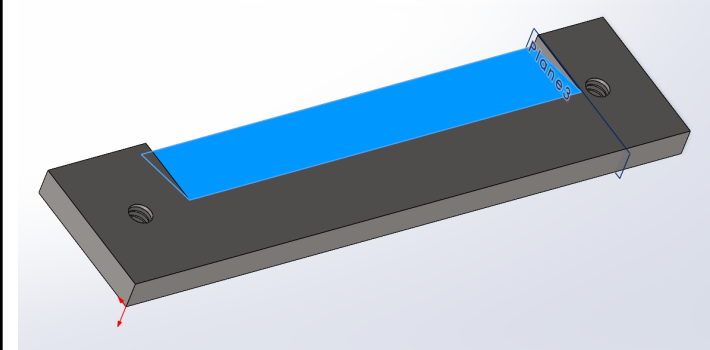
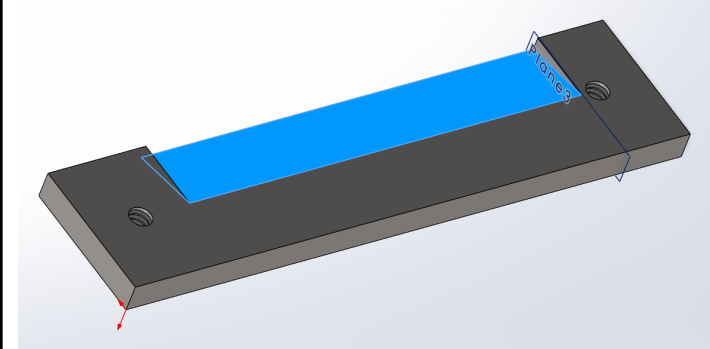
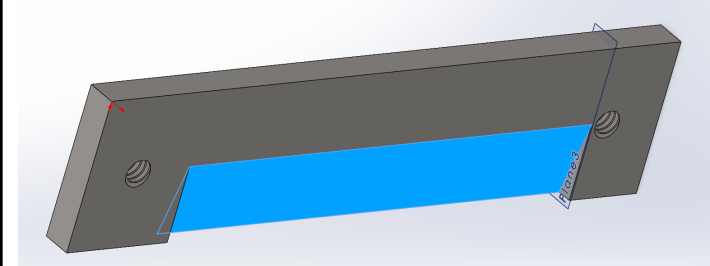
10	Flip the workpiece in the manual mill, clamping on the faces of the base	
11	Use a cylindrical edge finder to find the x and y zeros	
12	Center drill for each of the 2 x 0.190" thru holes	

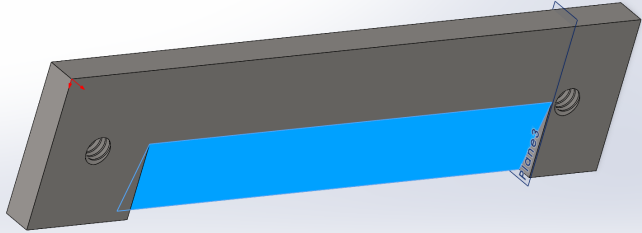
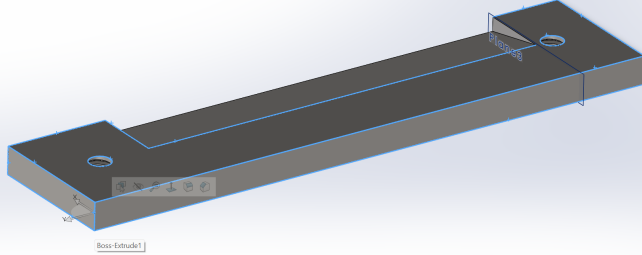
13	Drill to a depth of 5" in each hole location with the 0.190" drill bit.	
14	Flip the workpiece in the manual mill, clamping on the faces of the base	
15	Use a cylindrical edge finder to find the x and y zeros	

16	Center drill for each of the 2 x 0.190" thru holes	
17	Drill to a depth of 5" in each hole location with the 0.190" drill bit.	

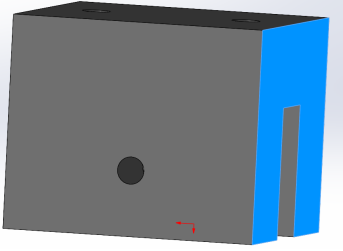
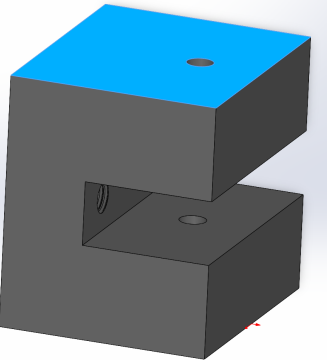
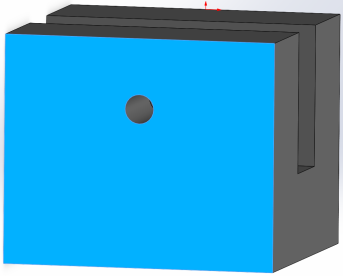
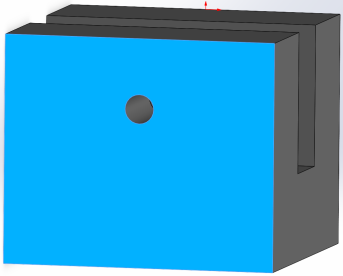
Manufacturing Process Outline
Part #18 – Blade

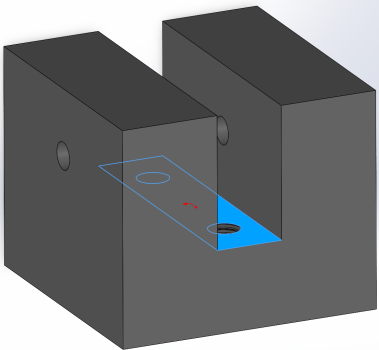
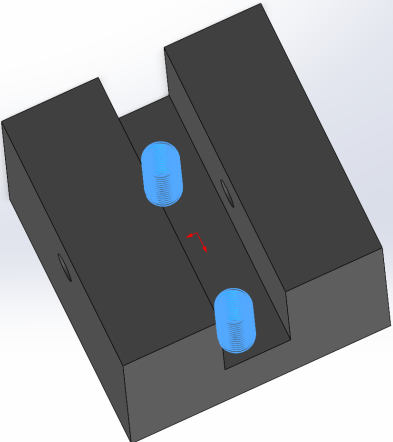
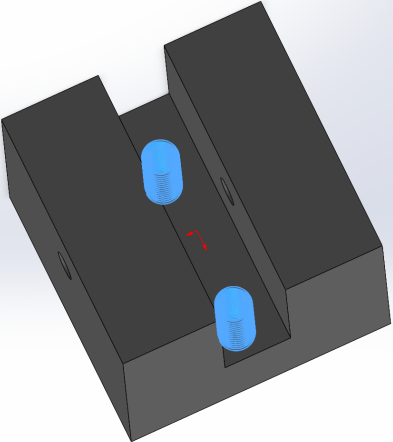
Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~4.25" section on a 6"x6"x1" 304 stainless steel sheet, then use the mark to align and cut a ~4.25" piece on the bandsaw	
2	Flip the previously cut part and use a marker to mark off a ~1" section on the now 5"x6"x0.25" HDPE sheet. Then, use the mark to align and cut a ~1" piece on the bandsaw	
3	Install the workpiece horizontally on the manual mill, clamping on the long edges	
4	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	

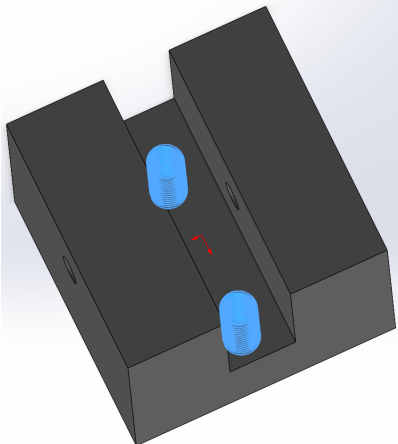
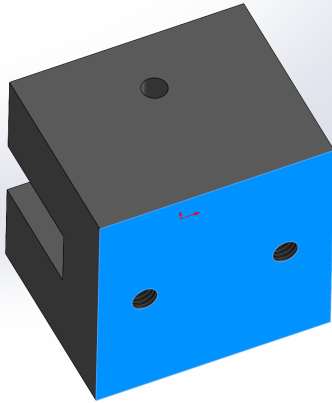
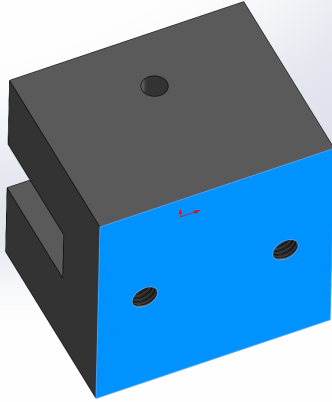
5	Center drill for each #8-32 hole	
6	Tap drill the #8-32 holes	
7	Tap the #8-32 holes	
8	Install the workpiece into the CNC machine, clamping on the long edge.	
9	Select designated facing profile on the CNC machine to machine the top-face of the cutting portion of the blade.	
10	Install the workpiece into the CNC machine on the opposite side of step 8, clamping on the long edge.	

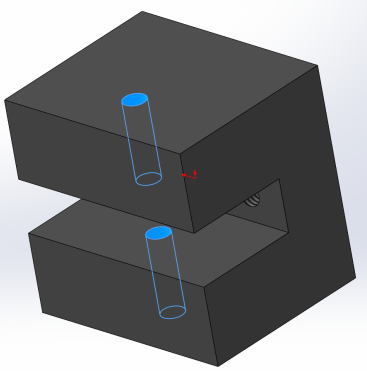
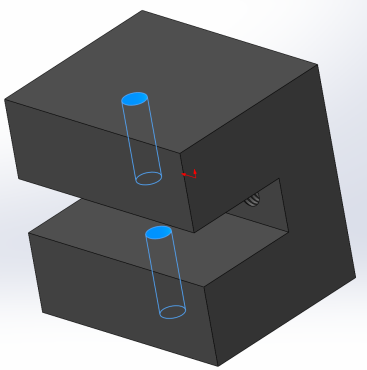
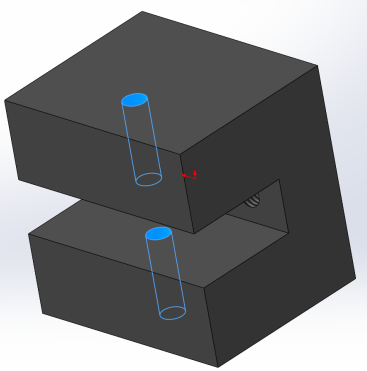
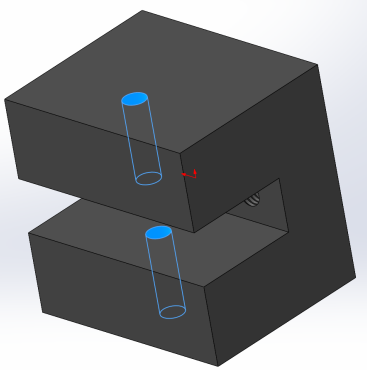
11	Select designated facing profile on the CNC machine to machine the bottom-face of the cutting portion of the blade.	 A 3D CAD model of a blade. The cutting portion, which is the central, wider section, is highlighted in blue. The handle and mounting tabs are in a dark grey color. There are two circular holes, one on each side of the handle. A red arrow points to the top-left corner of the handle. A blue line with an arrow points to the right edge of the blue cutting portion, labeled 'Profile3'.
12	File all sharp edges & deburr holes	 A 3D CAD model of the same blade. The edges and the two circular holes are highlighted in blue, indicating they are selected for a fillet or deburring operation. The rest of the model is dark grey. A small toolbar with icons for fillet, chamfer, and other edge operations is visible near the bottom-left corner. The text 'Boss-Extrude1' is visible at the bottom left of the model.

Manufacturing Process Outline
Part #19 – Clevis Bearing

Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~1.5” section on a 48”x2”x1.5” 6061 Aluminum Sheet, then use the mark to align and cut a ~1.5” piece on the bandsaw	
2	Flip the previously cut part and use a marker to mark off a ~1.25” section on the now 48”x1.5”x1.5” 6061 Aluminum Sheet. Then, use the mark to align and cut a ~1.25” piece on the bandsaw. This then gives a square of 1.25”x1.5”x1.5”	
3	Install the workpiece horizontally on the manual mill, clamping on the long edges	
4	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	

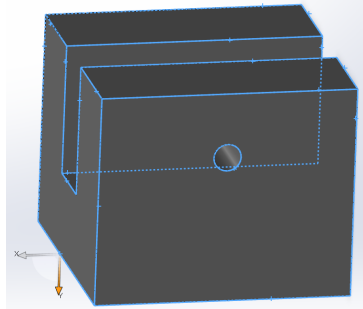
5	Use an 0.38" diameter end mill to face the middle-most rectangular hole in the manual mill machine. Go at 0.100" increments until reaching a desired depth of ~0.77"	
6	Center drill for each #8-32 hole	
7	Tap drill the #8-32 holes	

8	Tap the #8-32 holes	
9	Install the workpiece vertically on the manual mill, clamping on the long edges	
10	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	

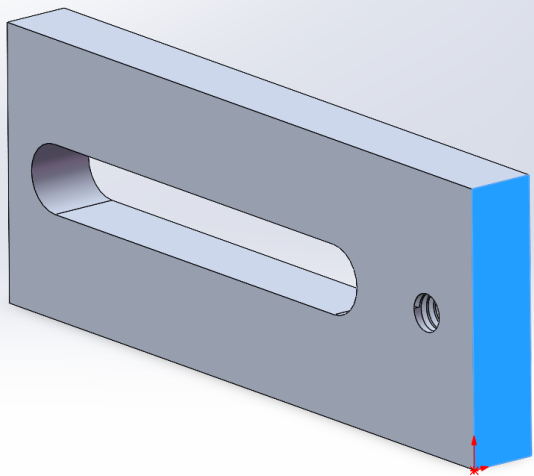
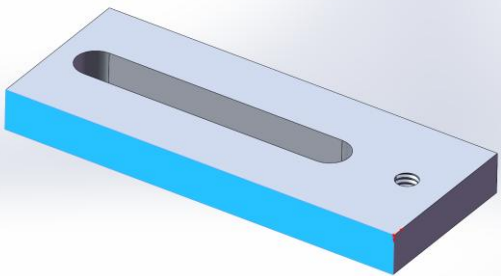
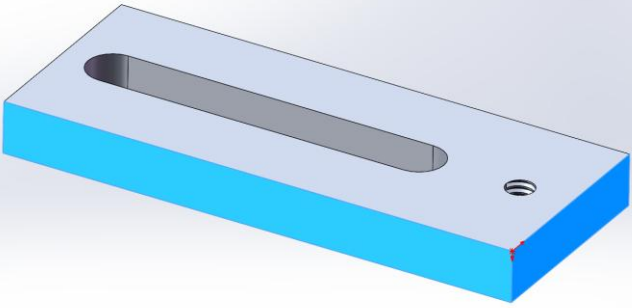
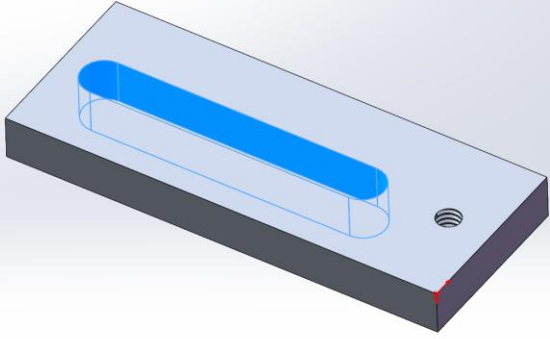
11	Center drill for top-most #8-32 hole	
12	Drill the top-most #8-32 hole	
13	Center drill for bottom-most #8-32 hole	
14	Drill the bottom-most #8-32 hole	

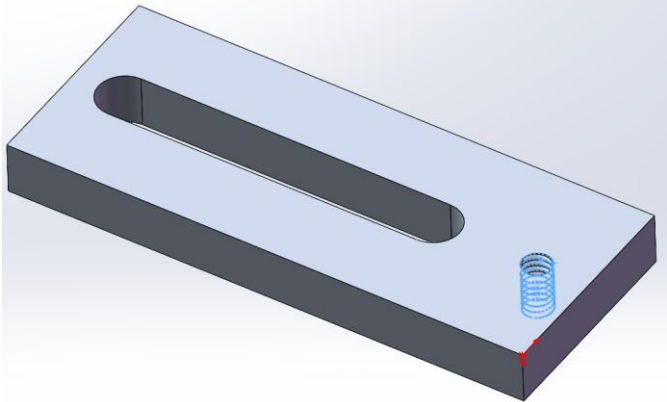
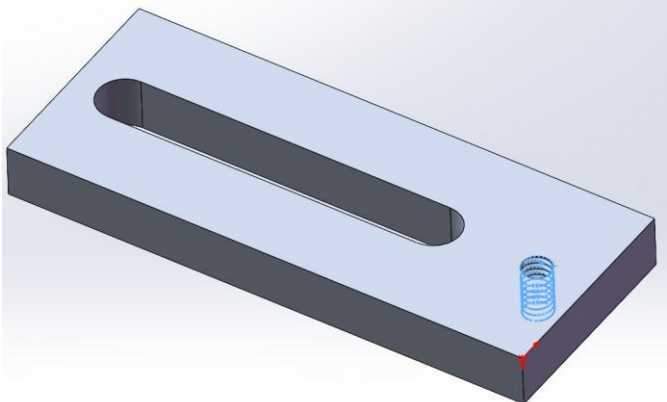
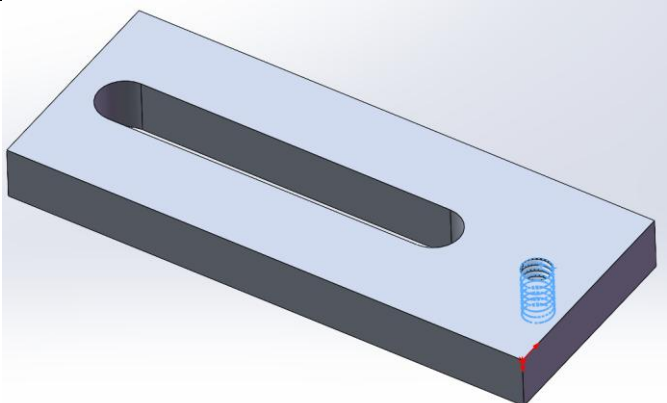
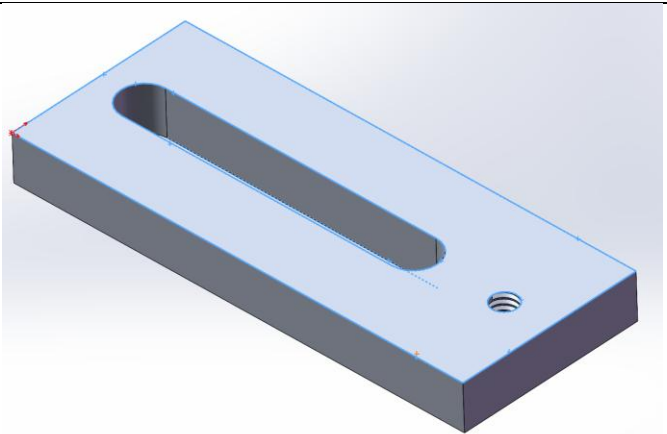
15

File all sharp edges & deburr holes

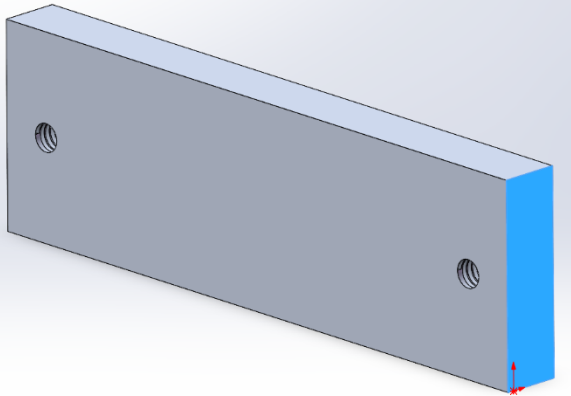
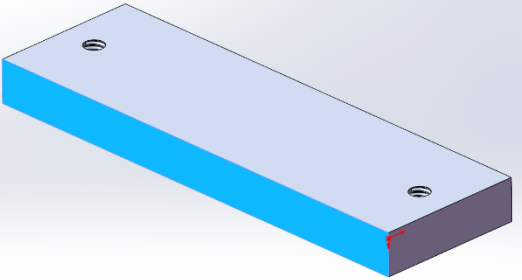
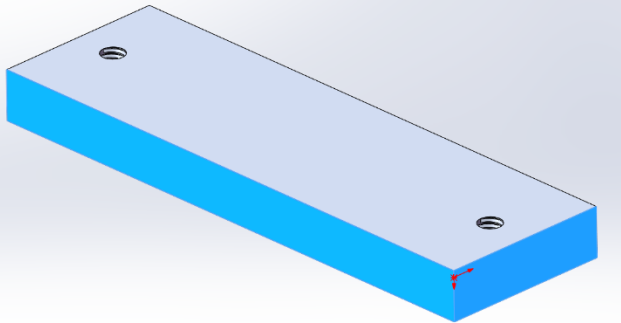
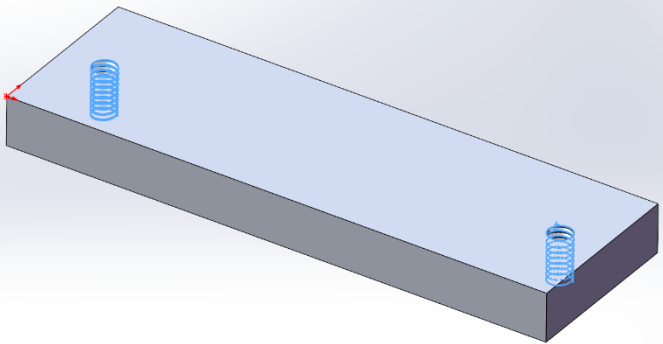


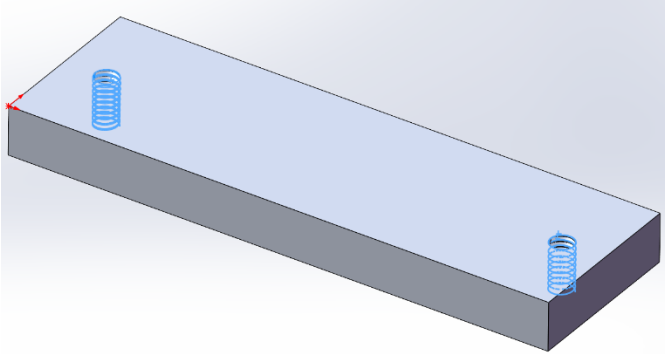
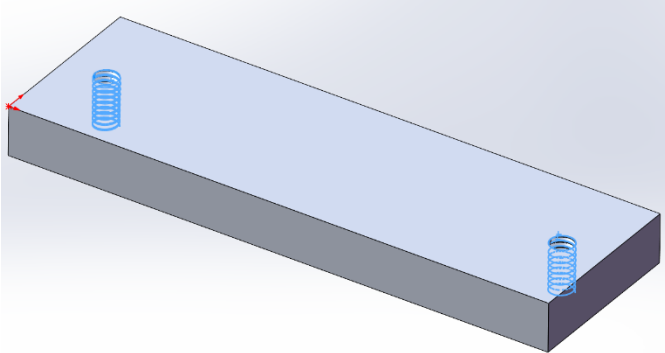
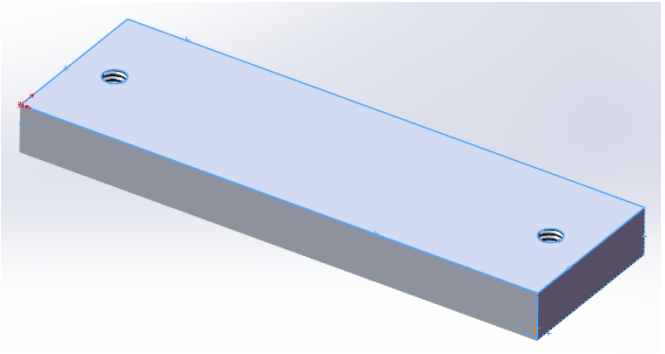
Manufacturing Process Outline
Part #20 – Input Arm

Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~2.5" section on a 6"x1"x0.25" 6061 Aluminum Bar, then use the mark to align and cut a ~2.5" piece on the bandsaw	
2	Install the workpiece horizontally on the manual mill, clamping on the long edges	
3	Use a cylindrical edge finder to find the x and y zeros.	
4	Machine the 1.5" long thru slot with a 0.25" endmill	

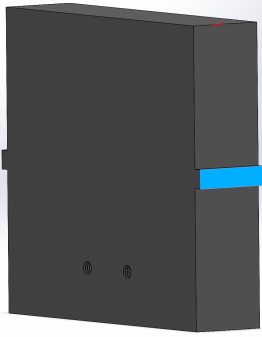
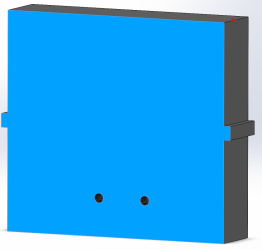
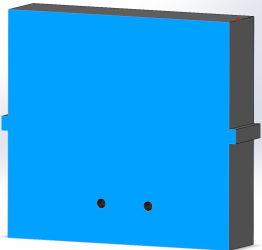
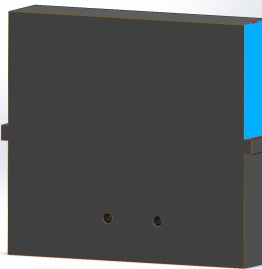
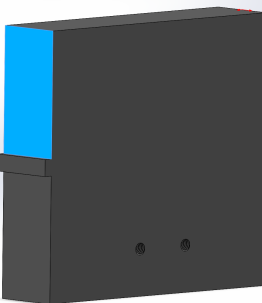
5	Center drill for the #8-32 hole	
6	Tap drill the #8-32 hole	
7	Tap the #8-32 hole	
9	File all sharp edges & deburr holes / inner contours	

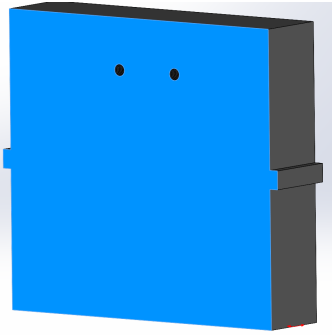
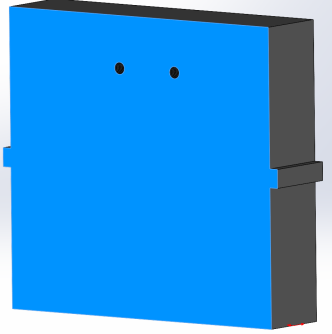
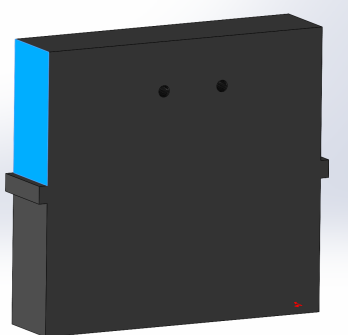
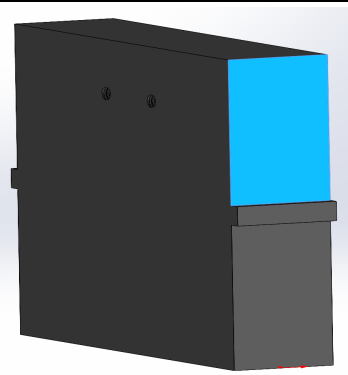
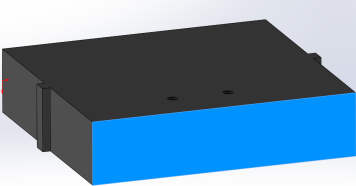
Manufacturing Process Outline
Part #21 – Output Arm

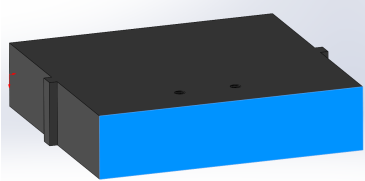
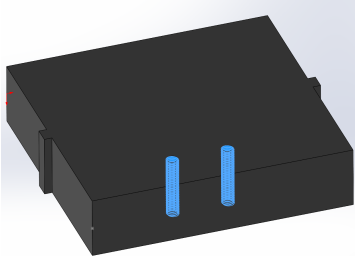
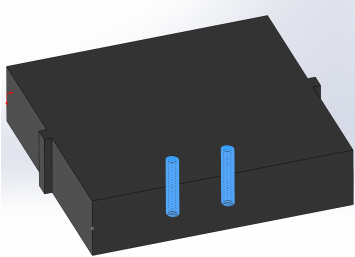
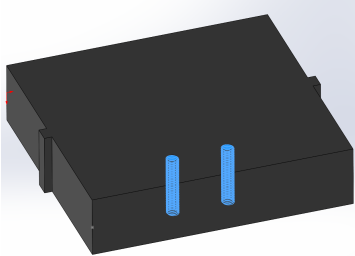
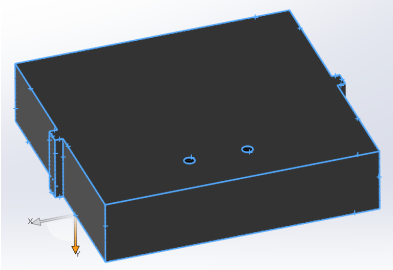
Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~3.2" section on a 6"x1"x0.25" 6061 Aluminum Bar, then use the mark to align and cut a ~3.2" piece on the bandsaw	
2	Install the workpiece horizontally on the manual mill, clamping on the long edges	
3	Use a cylindrical edge finder to find the x and y zeros.	
4	Center drill for each #8-32 hole	

5	Tap drill each #8-32 hole	
6	Tap each #8-32 hole	
7	File all sharp edges & deburr holes	

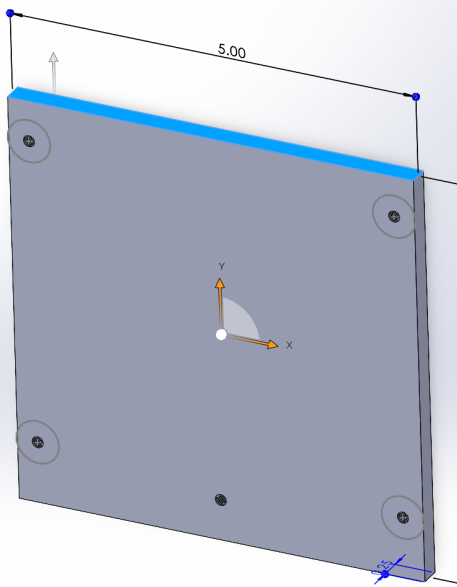
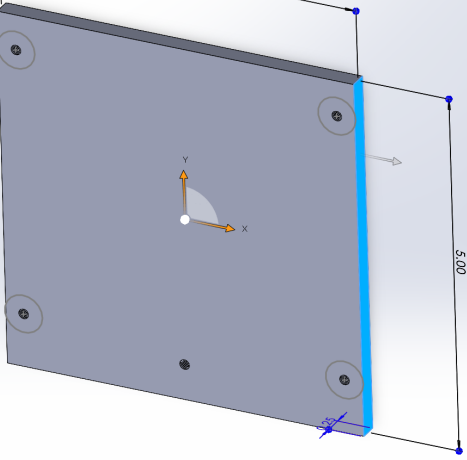
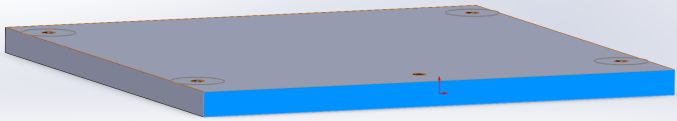
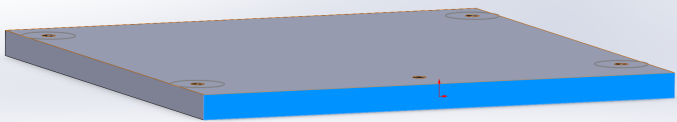
Manufacturing Process Outline
Part #22 – Piston Plate

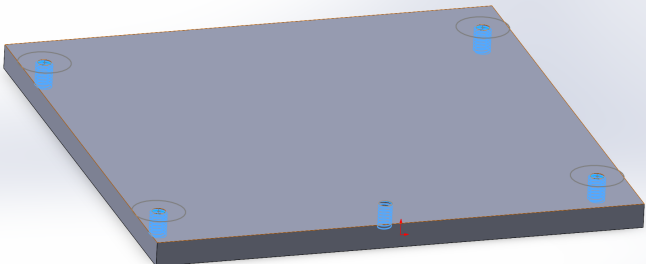
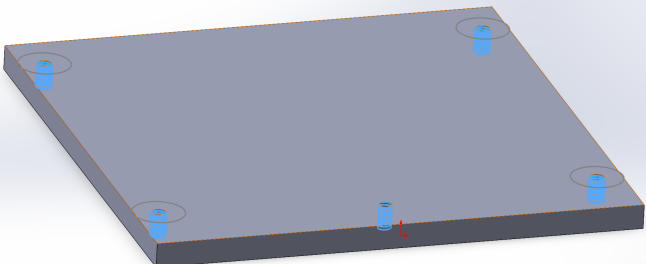
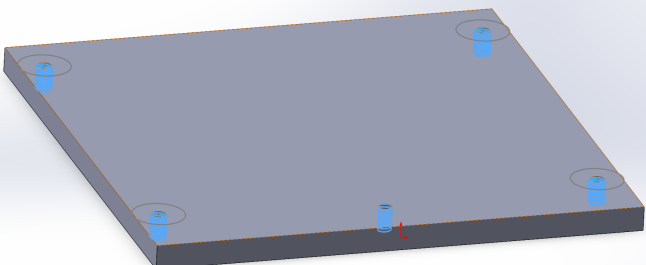
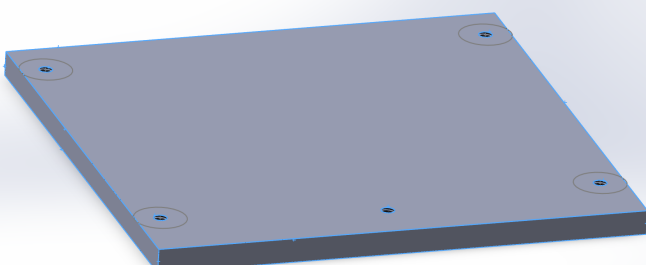
Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~4.5” section on a 12”x4”x1” HDPE sheet, then use the mark to align and cut a ~4.5” piece on the bandsaw. The small edges on each side will later be faced, leaving a 4.5”x4”x1” rectangle	
	Install the workpiece vertically on the manual mill, clamping on the long edges	
	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	
	Use an 1” diameter end mill to face the right-most side of the rectangle in the manual mill machine. Go at 0.100” increments until reaching a desired depth of 0.125”	
	Use an 1” diameter end mill to face the left-most side of the rectangle in the manual mill machine. Go at 0.100” increments until reaching a desired depth of 0.125”	

	Install the workpiece vertically on the manual mill, clamping on the long edges	
	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	
	Rotate the workpiece 180 degrees vertically then use an 1" diameter end mill to face the left-most side of the rectangle in the manual mill machine. Go at 0.100" increments until reaching a desired depth of 0.125"	
	Use an 1" diameter end mill to face the right-most side of the rectangle in the manual mill machine. Go at 0.100" increments until reaching a desired depth of 0.125"	
	Install the workpiece horizontally on the manual mill, clamping on the long edges	

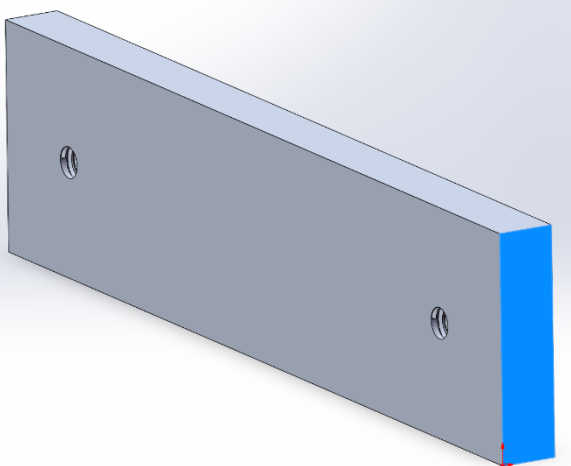
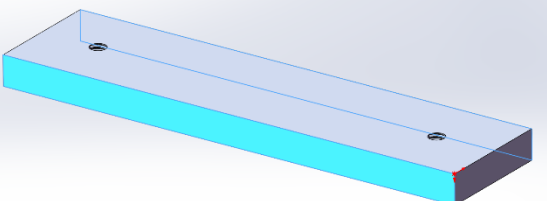
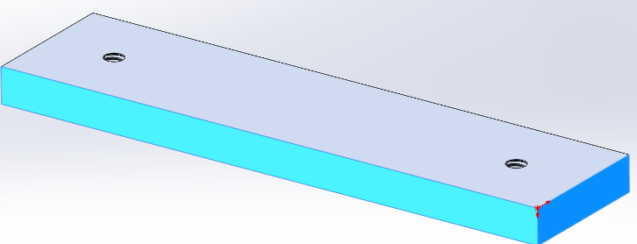
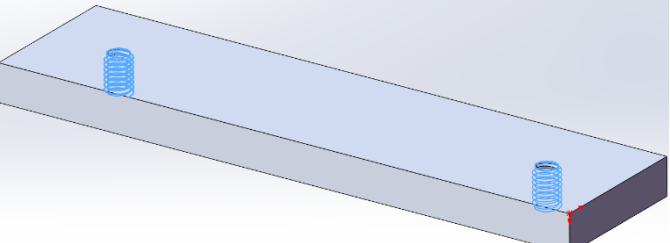
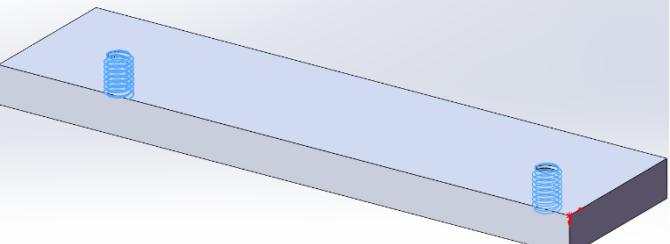
	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	
	Center drill for each #8-32 hole	
	Tap drill the #8-32 holes	
	Tap the #8-32 holes	
	File all sharp edges & deburr holes	

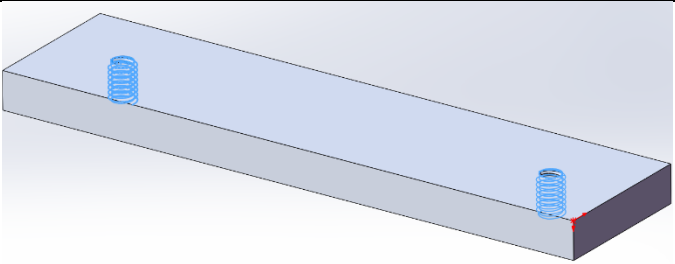
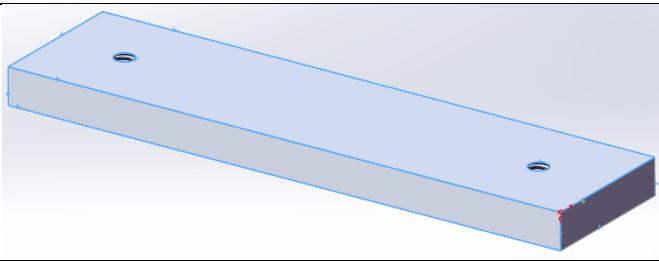
Manufacturing Process Outline
Part #23 – Backing Plate

Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~5" section on a 12"x6"x0.25" HDPE sheet, then use the mark to align and cut a ~5" piece on the bandsaw	
2	Flip the previously cut part and use a marker to mark off a ~5" section on the now 5"x6"x0.25" HDPE sheet. Then, use the mark to align and cut a ~5" piece on the bandsaw	
3	Install the workpiece horizontally on the manual mill, clamping on the long edges	
4	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	

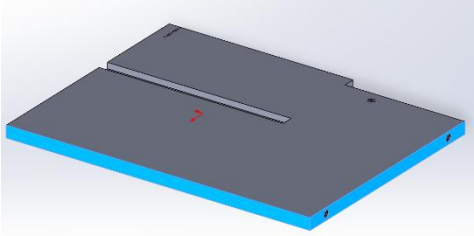
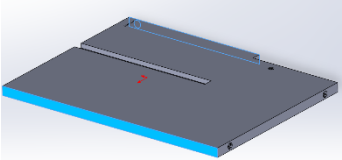
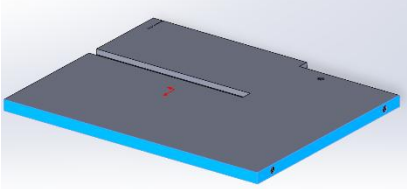
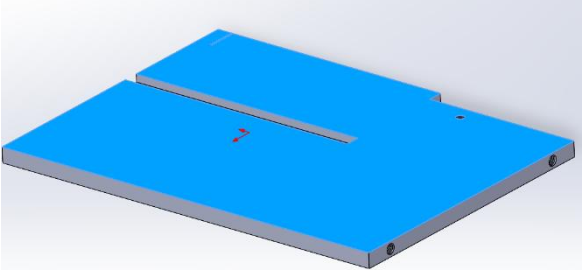
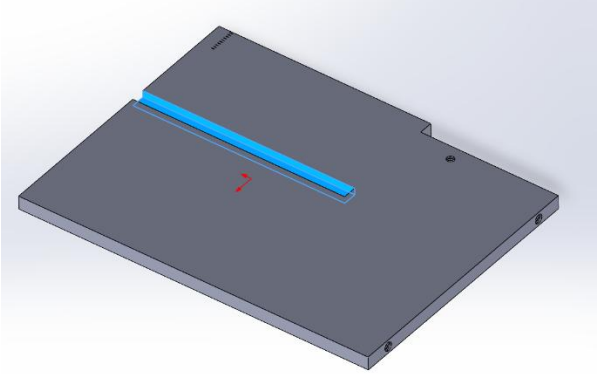
5	Center drill for each #8-32 hole	
6	Tap drill the #8-32 holes	
7	Tap the #8-32 holes	
8	File all sharp edges & deburr holes	

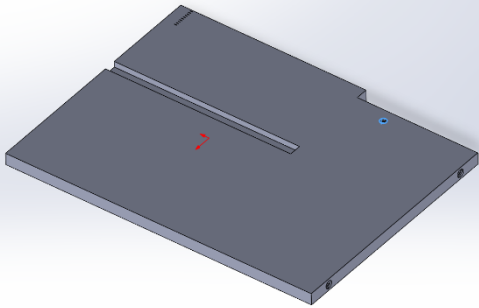
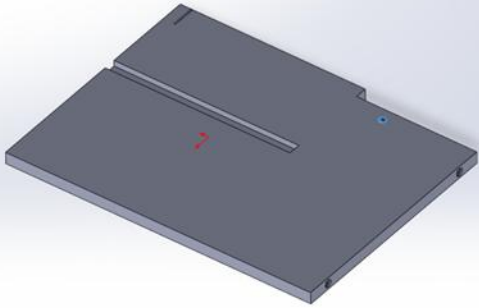
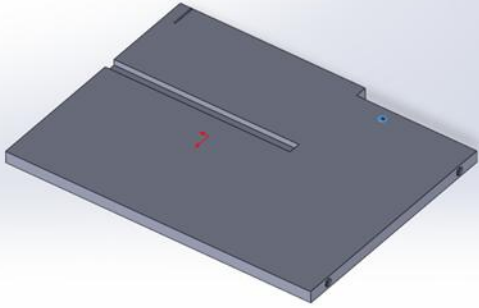
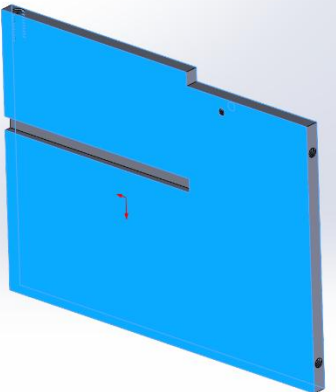
Manufacturing Process Outline
Part #24 – Piston Arm

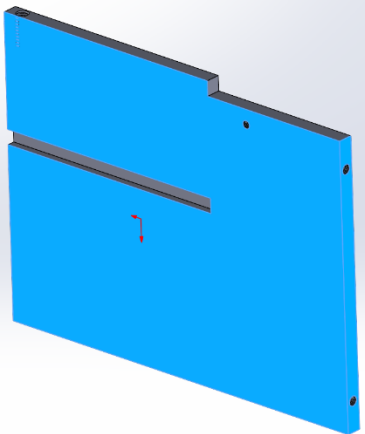
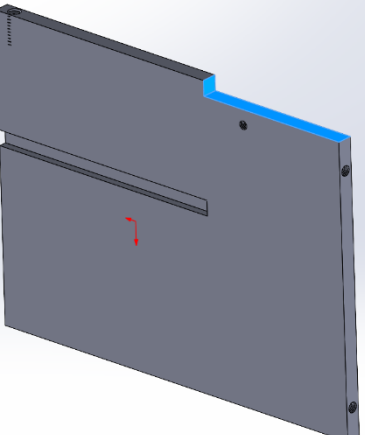
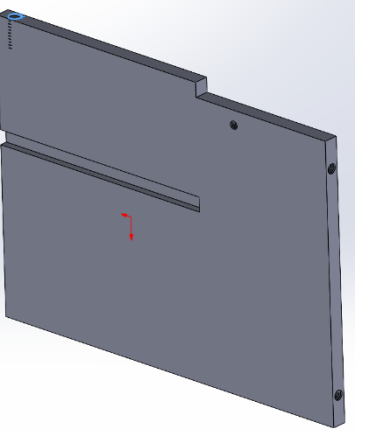
Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~4" section on a 6"x1"x0.25" 6061 Aluminum Bar, then use the mark to align and cut a ~4" piece on the bandsaw	
2	Install the workpiece horizontally on the manual mill, clamping on the long edges	
3	Use a cylindrical edge finder to find the x and y zeros.	
5	Center drill for each #8-32 hole	
6	Tap drill the #8-32 holes	

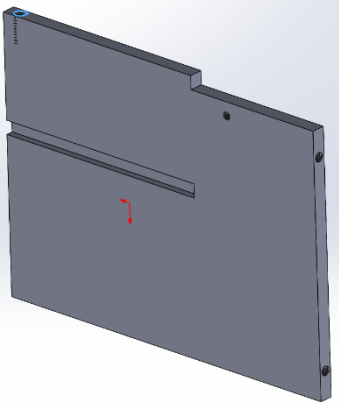
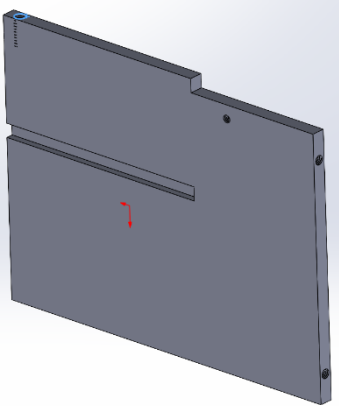
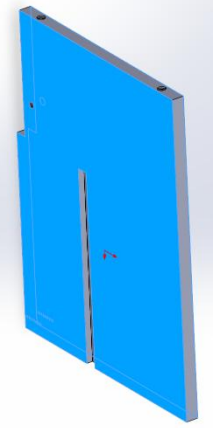
7	Tap the #8-32 holes	
9	File all sharp edges & deburr holes	

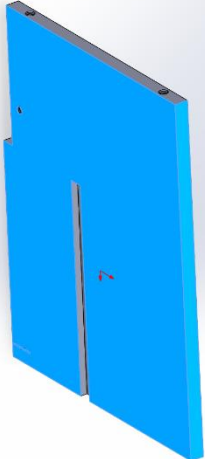
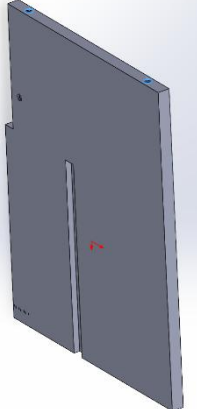
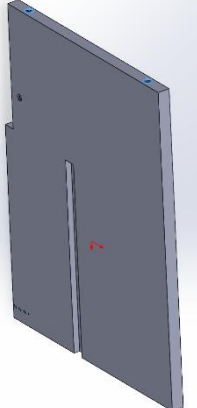
Manufacturing Process Outline
Part #25 –Flipped Wall

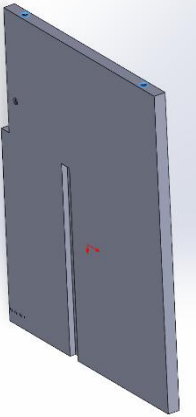
Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a 6.6"x5.0" section on a 24"x12"x0.5" HDPE sheet, then use the marks to align and cut a 6.6"x5.0" rectangle (2 cuts required)	
2	Install the workpiece horizontally on the manual mill, clamping along the edges	
3	Use a cylindrical edge finder to find the x and y zeros	
4	Use a 2" face mill to take a destructive zero on the z-axis, and machine the workpiece until it reaches the intended thickness of 0.25"	
4	Machine the slot with a 0.25" endmill, reaching a depth of 0.125"	

5	Center drill for the #8-32 hole	
6	Tap drill for the #8-32 thru hole with a 0.136" drill bit.	
7	Tap the #8-32 thru hole with a #8-32 tap.	
8	Flip the workpiece in the manual mill, clamping on the faces of the wall	

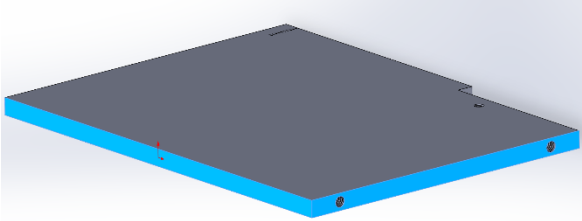
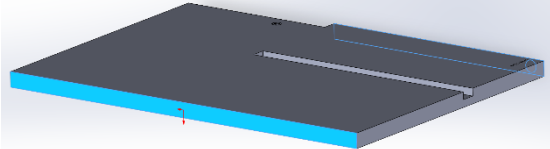
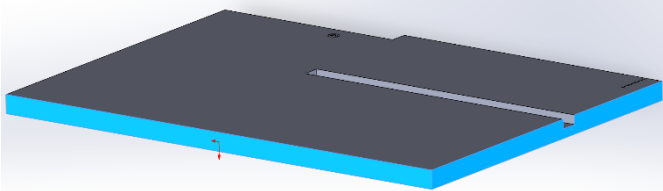
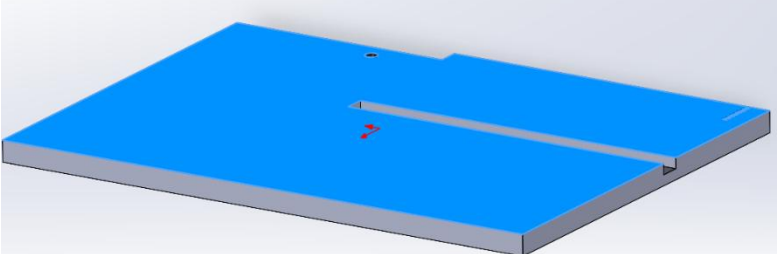
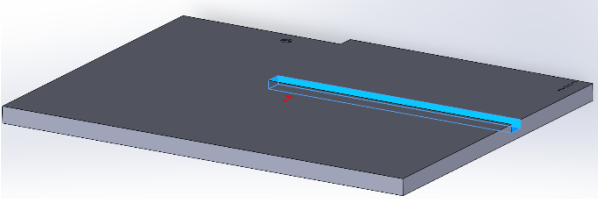
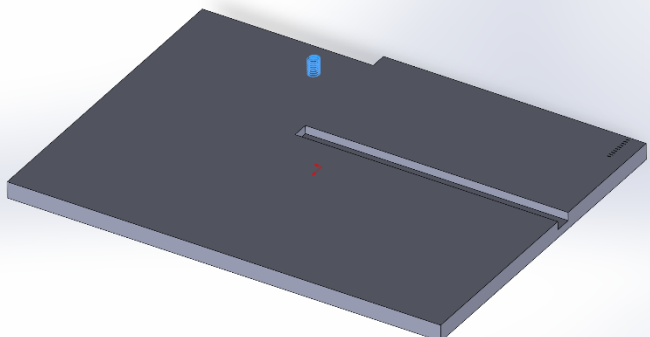
9	Use a cylindrical edge finder to find the x and y zeros.	
10	Use a 0.25" endmill to create the 0.25" deep cutout.	
11	Center drill for the 1/4 - 20 hole	

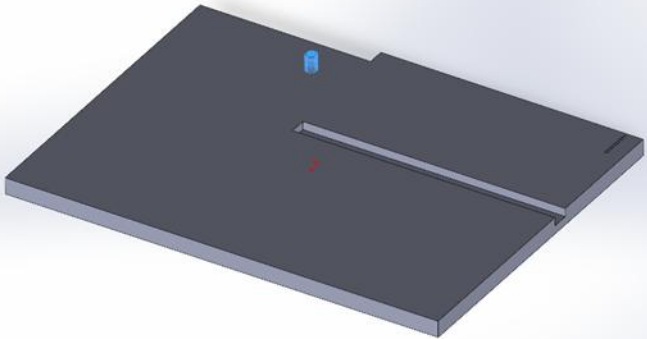
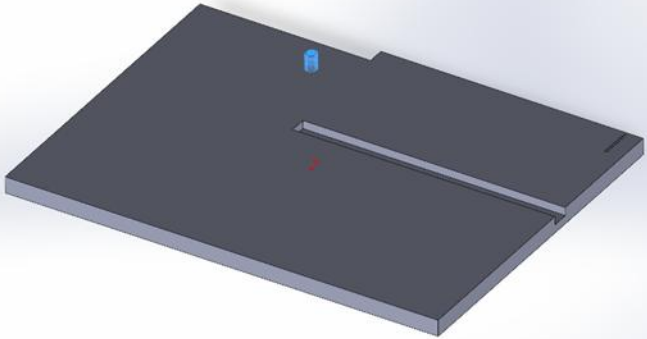
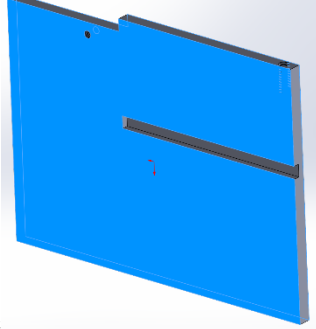
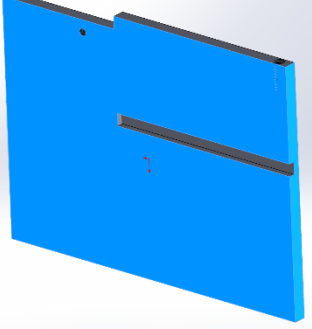
12	Tap drill for the $\frac{1}{4}$ - 20 hole with a 0.201" drill, reaching a depth of 0.5"	
13	Tap the $\frac{1}{4}$ - 20 hole with a $\frac{1}{4}$ - 20 tap, reaching a depth of 0.5"	
14	Flip the workpiece in the manual mill, clamping on the faces of the wall	

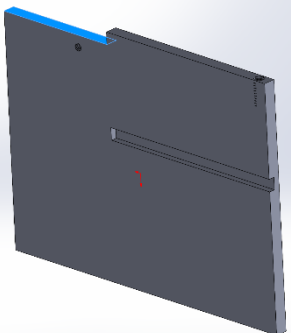
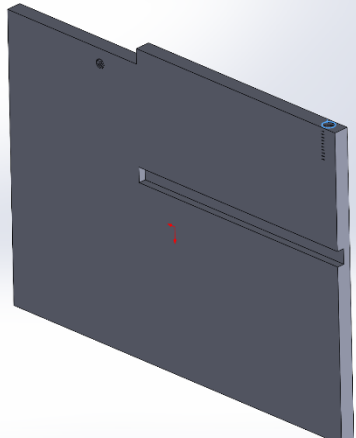
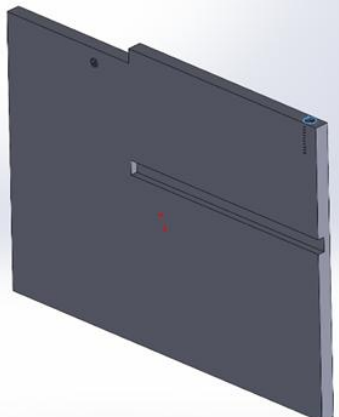
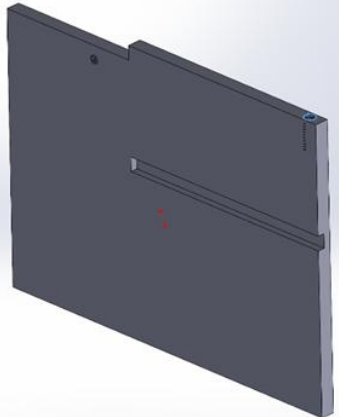
15	Use a cylindrical edge finder to find the x and y zeros	
16	Center drill for each of the #8-32 holes	
17	Tap drill to a depth of 0.25" in each hole location with the 0.136" drill bit.	

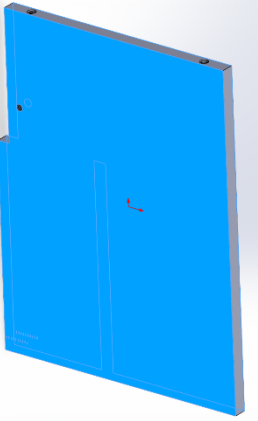
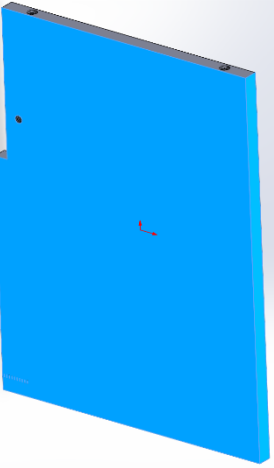
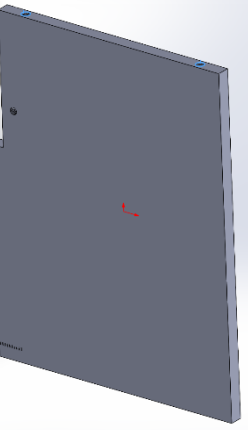
18	Tap each hole with a #8-32 tap, reaching a depth of 0.25"	 A 3D CAD model of a rectangular metal plate. The plate is dark gray with a lighter gray top surface. It features a central vertical slot and two circular holes, one on each side of the slot. A red arrow points to the right hole. The plate is shown from a perspective view, highlighting its thickness and the positions of the slot and holes.
----	---	--

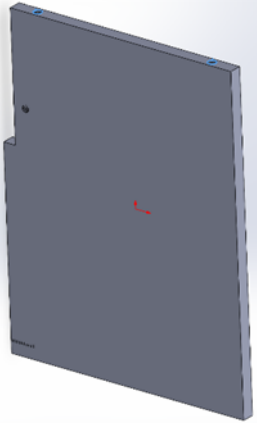
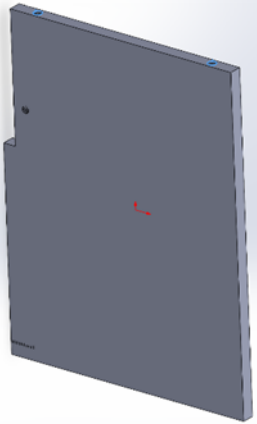
Manufacturing Process Outline
Part #26 –Wall

Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a 6.6"x5.0" section on a 24"x12"x0.5" HDPE sheet, then use the marks to align and cut a 6.6"x5.0" rectangle (2 cuts required)	
2	Install the workpiece horizontally on the manual mill, clamping along the edges	
3	Use a cylindrical edge finder to find the x and y zeros	
4	Use a 2" face mill to take a destructive zero on the z-axis, and machine the workpiece until it reaches the intended thickness of 0.25"	
4	Machine the slot with a 0.25" endmill, reaching a depth of 0.125"	
5	Center drill for the #8-32 hole	

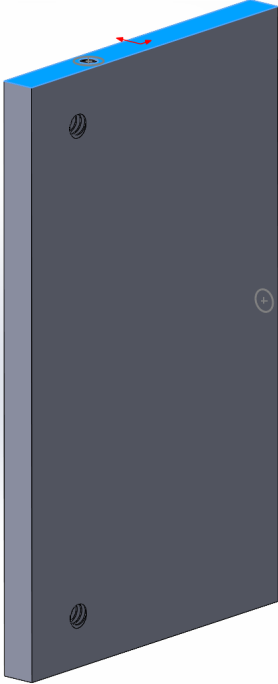
6	Tap drill for the #8-32 thru hole with a 0.136" drill bit.	
7	Tap the #8-32 thru hole with a #8-32 tap.	
8	Flip the workpiece in the manual mill, clamping on the faces of the wall	
9	Use a cylindrical edge finder to find the x and y zeros.	

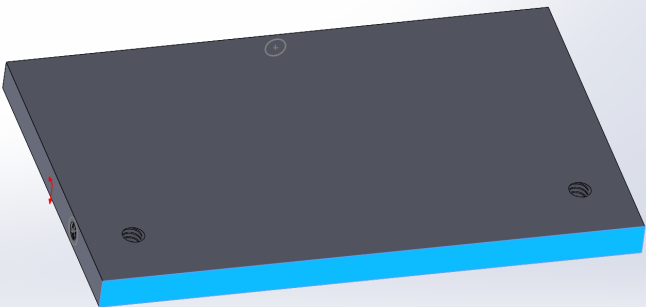
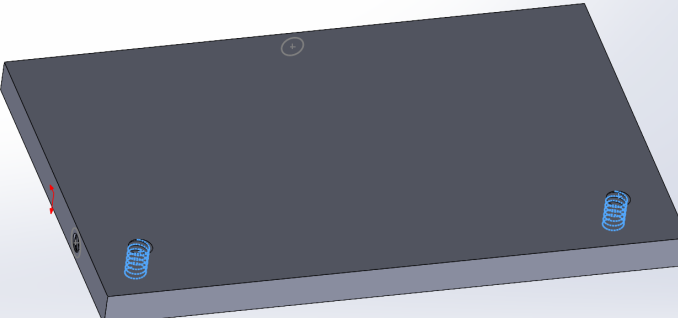
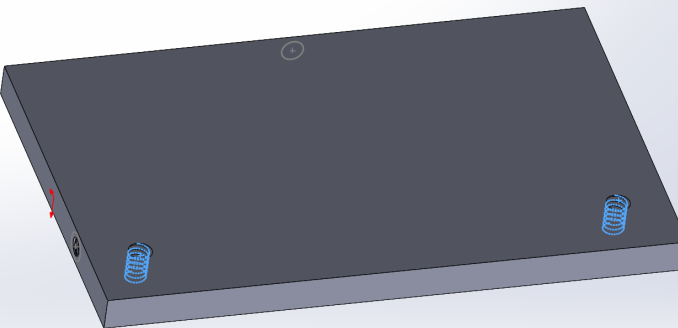
10	Use a 0.25" endmill to create the 0.25" deep cutout.	
11	Center drill for the 1/4 - 20 hole	
12	Tap drill for the 1/4 - 20 hole with a 0.201" drill, reaching a depth of 0.5"	
13	Tap the 1/4 - 20 hole with a 1/4 - 20 tap, reaching a depth of 0.5"	

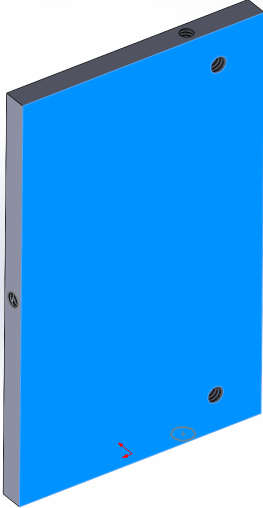
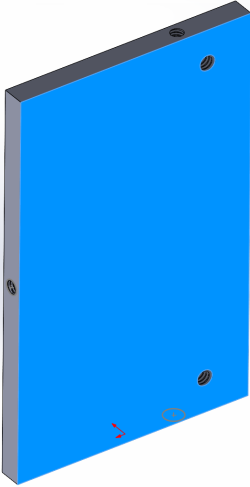
14	Flip the workpiece in the manual mill, clamping on the faces of the wall	
15	Use a cylindrical edge finder to find the x and y zeros	
16	Center drill for each of the #8-32 holes	

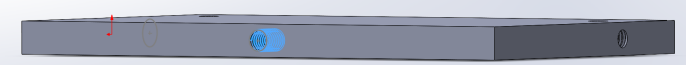
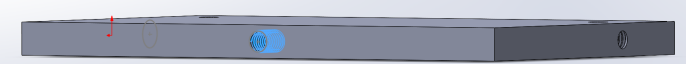
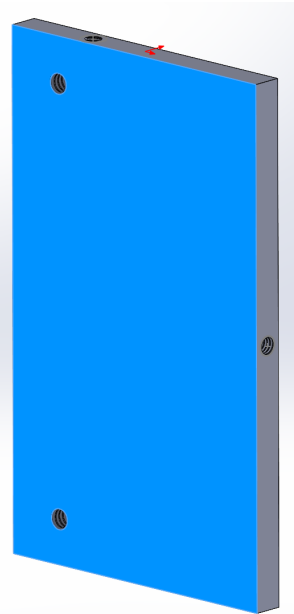
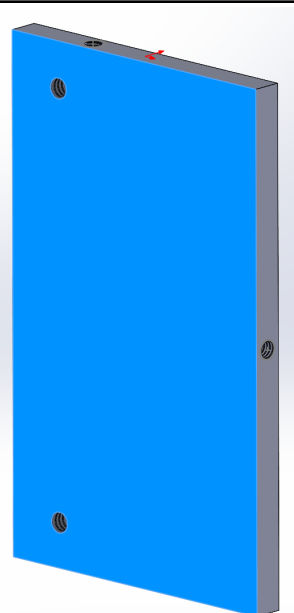
17	Tap drill to a depth of 0.25" in each hole location with the 0.136" drill bit.		
18	Tap each hole with a #8-32 tap, reaching a depth of 0.25"		

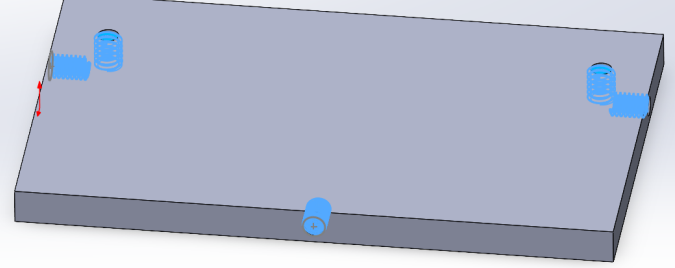
Manufacturing Process Outline
Part #30 – Blade Plate

Step	Manufacturing Process	Process Setup
1	Use a marker to mark off a ~4.25" section on a 12"x6"x0.25" HDPE sheet, then use the mark to align and cut a ~4.25" piece on the bandsaw	
2	Flip the previously cut part and use a marker to mark off a ~2.6" section on the now 4.25"x6"x0.25" HDPE sheet. Then, use the mark to align and cut a ~2.6" piece on the bandsaw	

3	Install the workpiece horizontally on the manual mill, clamping on the long edges	
4	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	
5	Center drill for each #8-32 hole	
6	Tap drill the #8-32 holes	

7	Install the workpiece vertically on the manual mill, clamping on the long edges	
8	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	
9	Center drill for each #8-32 hole	
10	Tap drill the #8-32 holes	
11	Install the workpiece vertically on the manual mill, clamping on the long edges	

12	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	
13	Center drill for each #8-32 hole	
14	Tap drill the #8-32 holes	
15	Install the workpiece vertically on the manual mill, clamping on the long edges	
16	Use a cylindrical edge finder to find the x and y zeros from the top-rightmost corner.	

17	Center drill for each #8-32 hole	
18	Tap drill the #8-32 holes	
19	Tap the #8-32 holes	
20	File all sharp edges & deburr holes	