EML2322L – Design and Manufacturing Laboratory

Design Report 3R

Team 8B

Vincent Furey (1)
Colton Mays (2)
Cyril Moran (3)

Instructor: Sean Niemi
TA: Juliana Mishur

Summer 2021

7/22/2021

Written Description

The final design was created by reviewing the designs from all group members and determining the most effective concept to solve the design challenge. This was done using a decision matrix to review the mobile platform, ball manipulator, and ball hopper subassemblies. After reviewing the decision matrix, it was decided that design 3 possessed the best attributes. The model was created using the drawings from DR1 and some changes to improve the design.

The first subsystem is the mobile platform which is framed with 80/20 aluminum extrusion. This 80/20 is the basis for the rest of the robot. The total length is 27.1 inches, height of 22.1 inches, and a width of 18.5 inches. This will allow the robot to fit in the 30x30 inch starting area. Connected to this frame is the wheel and motor assemblies. The motor is a 44 rpm Entstort Motor with 8-inch wheels attached. This combination was chosen as it provides the high level of maneuvering that is needed for the robot trajectory and positioning. It is connected using a motor mount and wheel hub. The motor mount is made of aluminum to in order to make it easier to manufacture. The motor mount is what connects to the 80/20 frame as well as the motor. The wheel hub is the connection from the motor to the actual wheel. Both the hub and mount will be manufactured using lightweight aluminum. To ensure the least amount of friction strict tolerances will be used on these parts, especially with the fasteners. The robot turns using differential steering allowing for the robot to turn with a very small radius. A caster wheel at the rear of the robot is used to balance it out as well as allow the robot to use the differential steering to turn. The motor mount is mounted on the left side of the robot and to counteract its weight one 15 lb plate from one of our home gyms will be strapped to the right side to balance out the robot.

The ball manipulator is the next subsystem. This is made up of a lever arm as well as the manipulator itself. The lever arm is 80/20 that is positioned 7 inches vertically from the mobile platform and is secured using 80/20 angle brackets. Attached to the lever arm is a 15 rpm SEI Gear Motor and its corresponding mount. The mount attaches to the 5-inch 80/20 on the lever arm as well as the motor. The motor is then connected to another piece of 80/20 which is what rotates up and down. The motor allows this arm to be rotated 90 degrees to first grab the ball at a horizontal position and then deposit it at a vertical one. The arm is one inch taller than the hopper to ensure no balls are missed or are dropped from too high. At the end of this 80/20 is the actual ball grabber that is designed out of 16-gauge sheet metal. This gauge was chosen to provide the stability and strength to grab balls. This grabber uses two arms that are 2 inches apart to secure a ball with bands of sheet metal on the bottom. The robot will use its differential steering to put the robot in a place where the grabber can

secure a ball. This ball grabber design effectively solves the design challenge of picking up tennis balls from the source tree and depositing them in the hopper for storage.

The ball hopper is what the balls are deposited into before they are released into the final bucket. It is attached to the mobile platform using 2 80/20 vertical extrusions that is then fastened to the hopper itself. The hopper is constructed using 16-gauge sheet metal to ensure it is strong enough to support all the balls. The hopper is a walled ramp that allows the balls to roll down to the release gate to wait until it is time to be deposited. The hopper is designed to hold 6 balls to fulfill the design challenge in case there is any error when depositing into the final bucket.

The release gate is connected to the back of the ball hopper by using a piece of 80/20 extruding vertically from the mobile platform. This release gate is controlled via a 15 rpm SEI Gear Motor. It is connected by welding the motor mount to the actual release gate. The clearance between the ball hopper opening and the release gate is 1 inch which secures the tennis balls until the robot is in position over the bucket.When the motor is activated the release, gate rotates downwards allowing the tennis balls to flow out into the deposit bucket. This allows for many balls to be deposited at a rapid pace into the deposit bucket.

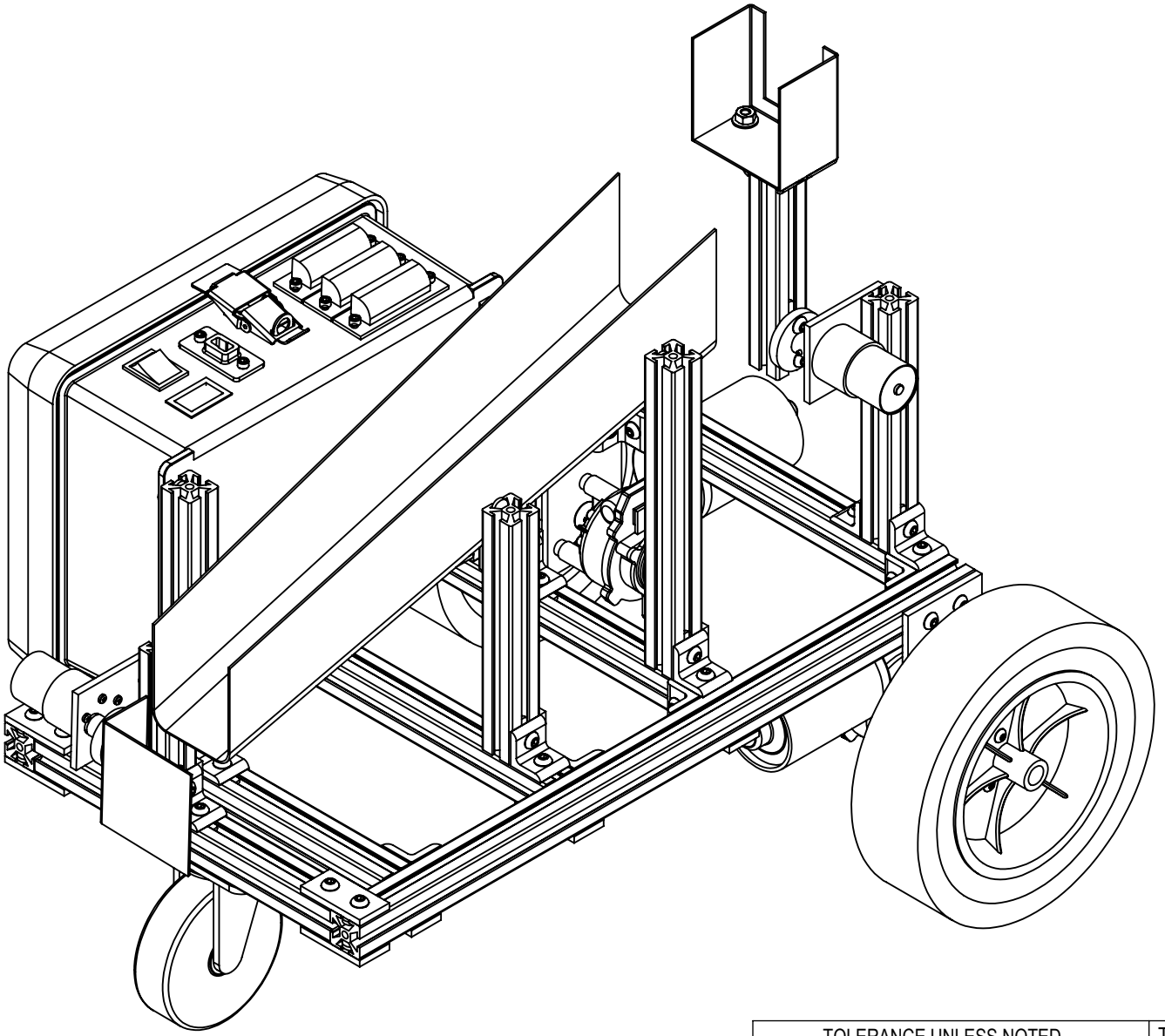
The mobile platform, ball grabber, ball hopper, and release mechanism subsystems come together to create an effective robot to solve the design challenge. The balanced mobile platform creates a base for the other components to sit securely on. The ball grabber combined with the tight turn radius allows the robot to pickup the balls and deposit them using the lever arm. The ball hopper can hold more than enough balls to satisfy the design challenge and the release gate is able to hold the balls until it is ready to be deposited.

Project Schedule for Team 8B

Week	Task Description	Responsibility	Est. Time
7/15/2021	Submit DR3R Before Lab	Whole Team	-
	Submit Purchase Orders	Whole Team	-
	Welding Demonstration	Whole Team	45 min.
	Fabricate the wheel hubs for Enstort Motor (Start)	Cyril Moran	110 min.
	Fabricate motor mounts for Enstort Motor (Start)	Colton Mays	110 min.
	Fabricate motor mount for 15 RPM SEI Motor for Lever Arm	Vincent Furey	75 min
	Fabricate wheel hub for 15 RPM SEI Motor for Release Gate	Vincent Furey	35min.
	Lab clean up	Whole Team	10 min.
	Meet outside lab to work through problems & review who's doing what next week, and prepare any necessary paperwork (POs, ECNs, etc.)	*whole team*	-
7/22/2021	Fabricate the wheel hubs for Enstort Motor (Finish)	Cyril Moran	155 min.
	Fabricate the wheel hubs for Enstort Motor (Finish)	Vincent Furey	145 min.
	Fabricate motor mounts for Enstort Motor (Finish)	Colton Mays	45 min.
	Fabricate motor mount for Release Gate (Start)	Vincent Furey	10 min.
	Fabricate the Ball Hopper	Colton Mays	70 min.
	Fabricate the Release Gate	Colton Mays	40 min.
	Lab Clean up	Whole Team	10 min.
	Meet outside lab to work through problems & review who's doing what next week, and prepare any necessary paperwork (POs, ECNs, etc.)	*whole team*	-
7/29/2021	Fabricate the Ball Manipulator sheetmetal part	Cyril Moran	60 min.
	Assemble the Ball Manipulator	Cyril Moran	30 min.
	Fabricate wheel hub for 15 RPM SEI Motor for Lever Arm	Colton Mays	55 min.
	Assemble the Mobile Platform by cutting and fastening all of the 80/20 and attatching the control box	Colton Mays	100 min.
	Assemble the Lever Arm by attaching the motor mount, wheel hub, the caster wheel, and 15 RPM SEI Motor to 80/20 and the Mobile Platform	Cyril Moran	65 min.
	Attach the wheel hub, motor mount, wheels, and Enstort Motors to the Mobile Platform	Vincent Furey	30 min.
	Attach the Ball Hopper to the Mobile Platform	Vincent Furey	45 min.
	Fabricate motor mount for Release Gate (Finish)	Vincent Furey	40 min.
	Assemble the Release Gate Mechanism by attatching the motor mount, wheel hub, and 15 RPM SEI Motor to the Release Gate and 80/20 support	Vincent Furey	40 min.
	Lab clean up	Whole Team	10 min.
	Meet outside lab to work through problems & review who's doing what next week, and prepare any necessary paperwork (POs, ECNs, etc.)	Whole Team	-
8/5/2021	Attach the Release gate Mechanism to the Mobile Platform	Cyril Moran	30 min.
	Attatch Ball Manipulator to Lever Arm	Colton Mays	30 min.
	Check all of the fasteners to ensure safety during testing	Vincent Furey	30 min.
	Testing	Whole Team	125 min.
	Lab clean up	Whole Team	10 min.
	Meet outside lab to work through problems and troubleshoot issues found during tesing.	Whole Team	-
8/12/2021	Competition Day	Whole Team	155 min.
	Lab clean up	Whole Team	10 min.

Complete BOM for Team 8B

Item No.	Part Number	Decription	Qty.
1	EML2322L-OTS-6	1/4-20 T-Nut	70
2	EML2322L-OTS1	Control Box	1
3	EML2322L-OTS20	5" Caster Wheel	1
4	EML2322L-OTS-7	1/4-20 x 1/2 inch BHCS	86
5	EML2322L-005	1/4" Washer	6
7	EML2322L-007	80-20 Extrusion, 20.9"	2
8	EML2322L-008	80-20 Extrusion, 10.0"	5
9	EML2322L-OTS-13	80/20 Straight Bracket	17
10	EML2322L-OTS-12	80/20 90 Degree Angle Bracket	17
11	EML2322-011	80-20 Extrusion 7.8"	2
12	EML2322-OTS-22	8" Wheel Type 1	2
13	EML2322L-013	Entstort Wheel Hub	2
14	EML2322L-014	10-24 1inch Button Head Screw	6
15	EML2322L-OTS-31	44 RPM Entstort Right Angle Gear Motor	2
16	EML2322L-016	Entstort Motor Mount	2
17	EML2322L-017	M6-20mm Hex Head Screw	6
18	EML2322L-018	M8 x 1.25 Hex Nut	2
19	EML2322L-019	M3 X 10mm Screw	8
20	EML2322L-OTS-29	15 RPM SEI Gear Motor	2
21	EML2322L-021	80-20 Extrusion 7.0"	2
22	EML2322L-022	80-20 Extrusion 6.5"	1
23	EML2322L-023	15 RPM SEI Gear Motor Mount	2
24	EML2322L-024	15 RPM SEI Gear Wheel Hub Lever Arm	1
25	EML2322L-025	Ball Grabber	1
26	EML2322L-026	1/4-20 Hex Nut	2
27	EML2322L-027	1/4-20 X 3/8" BHCS	4
28	EML2322L-028	80-20 Extrusion 9"	1
29	EML2322L-029	Ball Hopper Part	1
30	EML23221L-030	4-40 1/4" Set Screw	2
31	EML2322L-031	15 RPM SEI Gear Motor Hub Release Gate	1
32	EML2322L-032	Release Gate Part	1
33	EML2322L-A-001	Mobile Platform	1
34	EML2322L-A-002	Drive Assembly	2
35	EML2322-A-003	Frame Assembly	1
36	EML2322L-A-004	Release Gate	1
37	EML2322L-A-005	Lever Arm	1
38	EML2322L-A-006	Ball Hopper	1
39	EML2322L-A-007	Final Assembly	1



NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Final Assembly		
OPERATION	PLACES IN DIMENSION					
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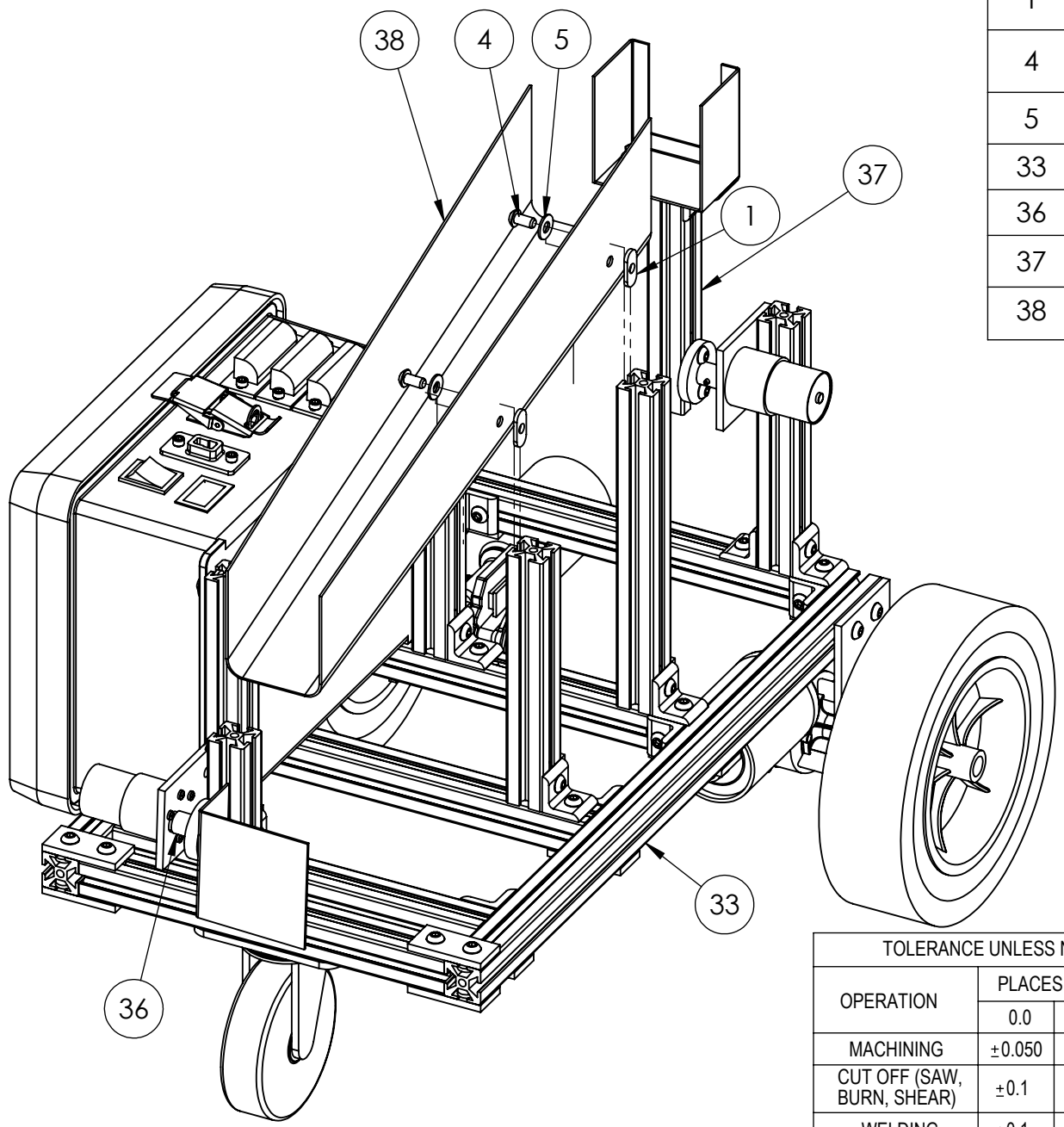
MACHINING	±0.050	±0.020	±0.005	DESIGNED	CYRIL MORAN	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-A-007	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 1 OF 7

5 4 3 2 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	2
4	EML2322L-OTS7	1/4-20 X1/2 BHCS	2
5	EML2322L-005	1/4" Washer	2
33	EML2322L-A-001	Mobile Platform	1
36	EML2322L-A-004	Release Gate	1
37	EML2322L-A-005	Lever Arm	1
38	EML2322L-A-006	Ball Hopper	1

NOTES:
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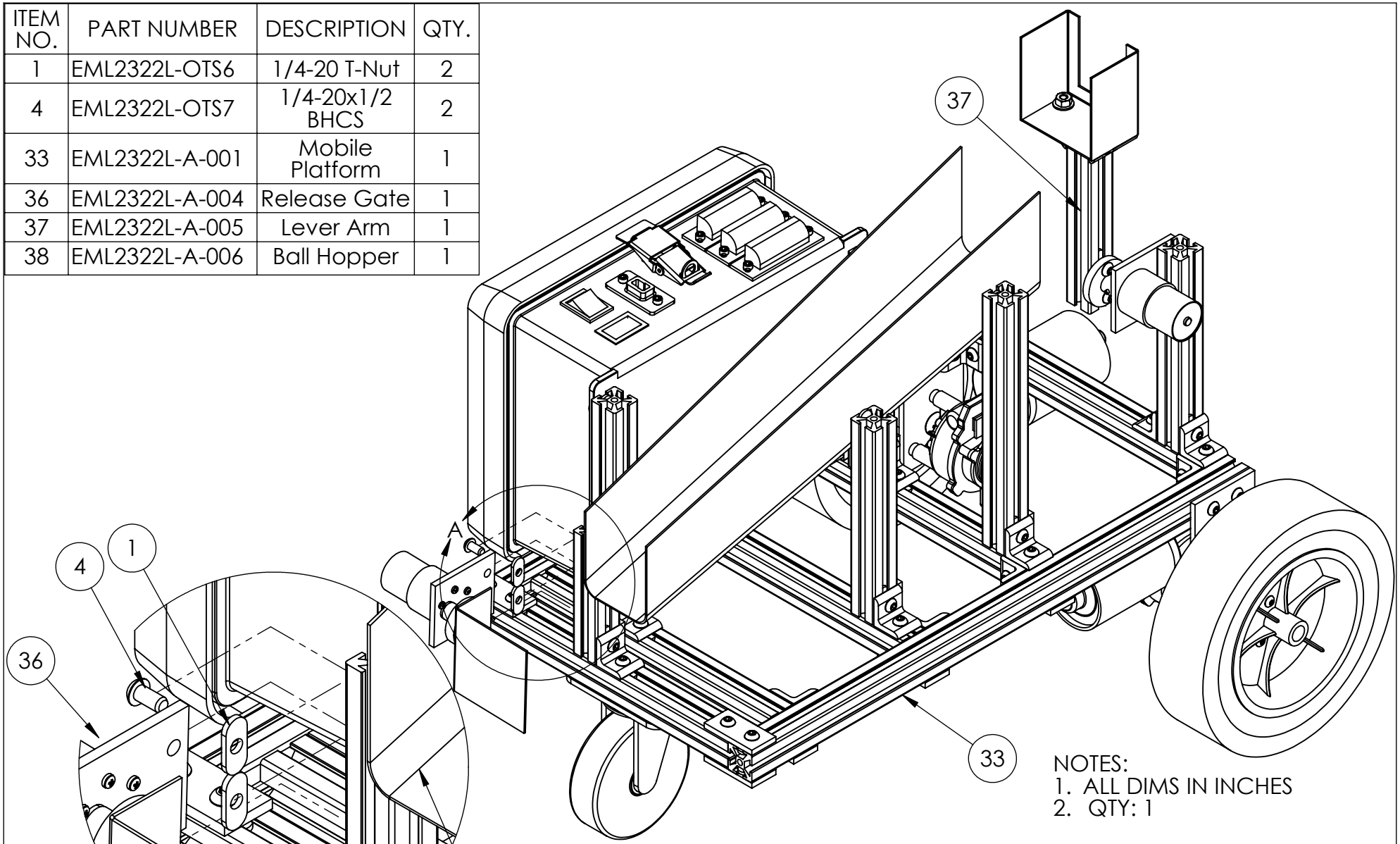
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Final Assembly		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-007	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 2 OF 7

5 4 3 2 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	2
4	EML2322L-OTS7	1/4-20x1/2 BHCS	2
33	EML2322L-A-001	Mobile Platform	1
36	EML2322L-A-004	Release Gate	1
37	EML2322L-A-005	Lever Arm	1
38	EML2322L-A-006	Ball Hopper	1



DETAIL A
SCALE 1 : 2

NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Final Assembly		
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MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-007	REV B
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ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 3 OF 7

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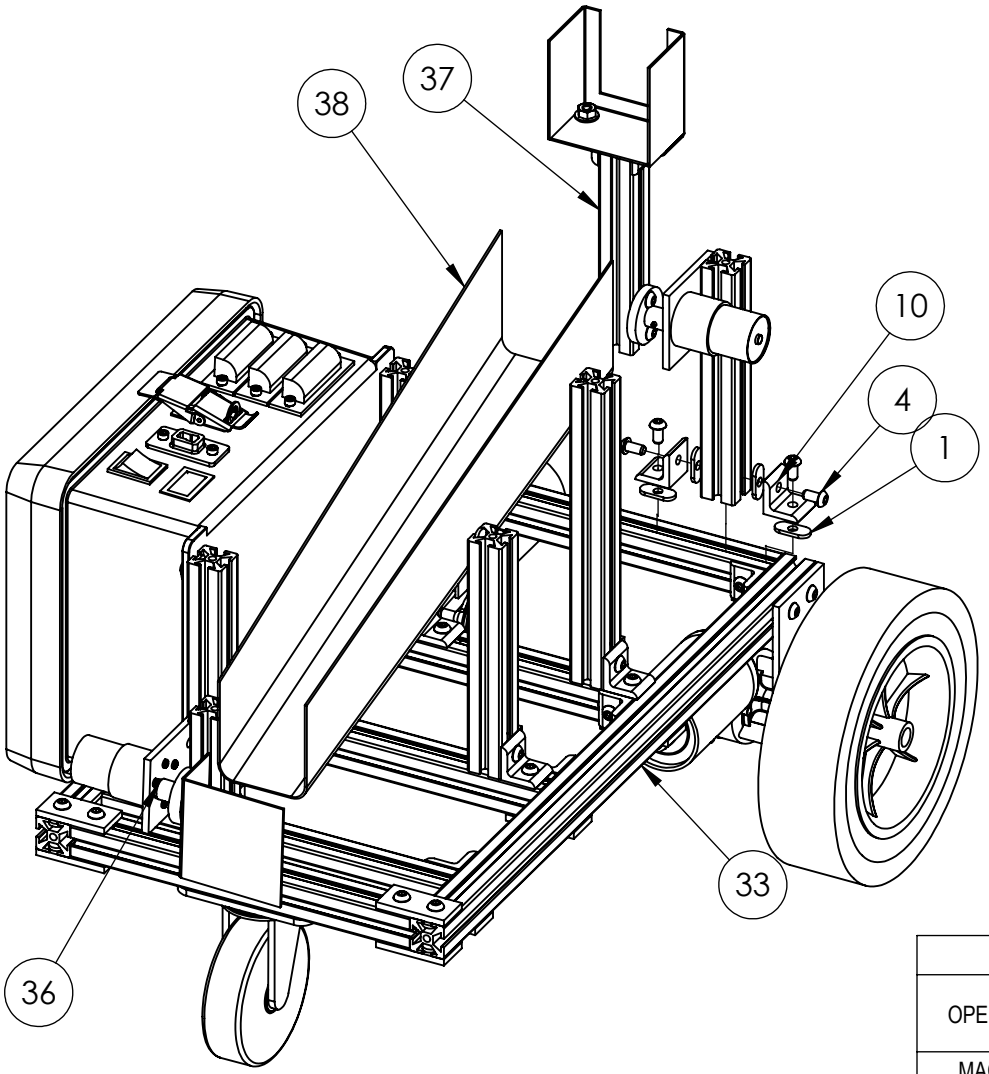

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	4
4	EML2322L-OTS7	1/4-20 X1/2 BHCS	4
10	EML2322L-OTS12	80/20 90 Degree Angle Bracket	2
33	EML2322L-A-001	Mobile Platform	1
36	EML2322L-A-004	Release Gate	1
37	EML2322L-A-005	Lever Arm	1
38	EML2322L-A-006	Ball Hopper	1

NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Final Assembly		
OPERATION	PLACES IN DIMENSION					
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MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-007	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 4 OF 7

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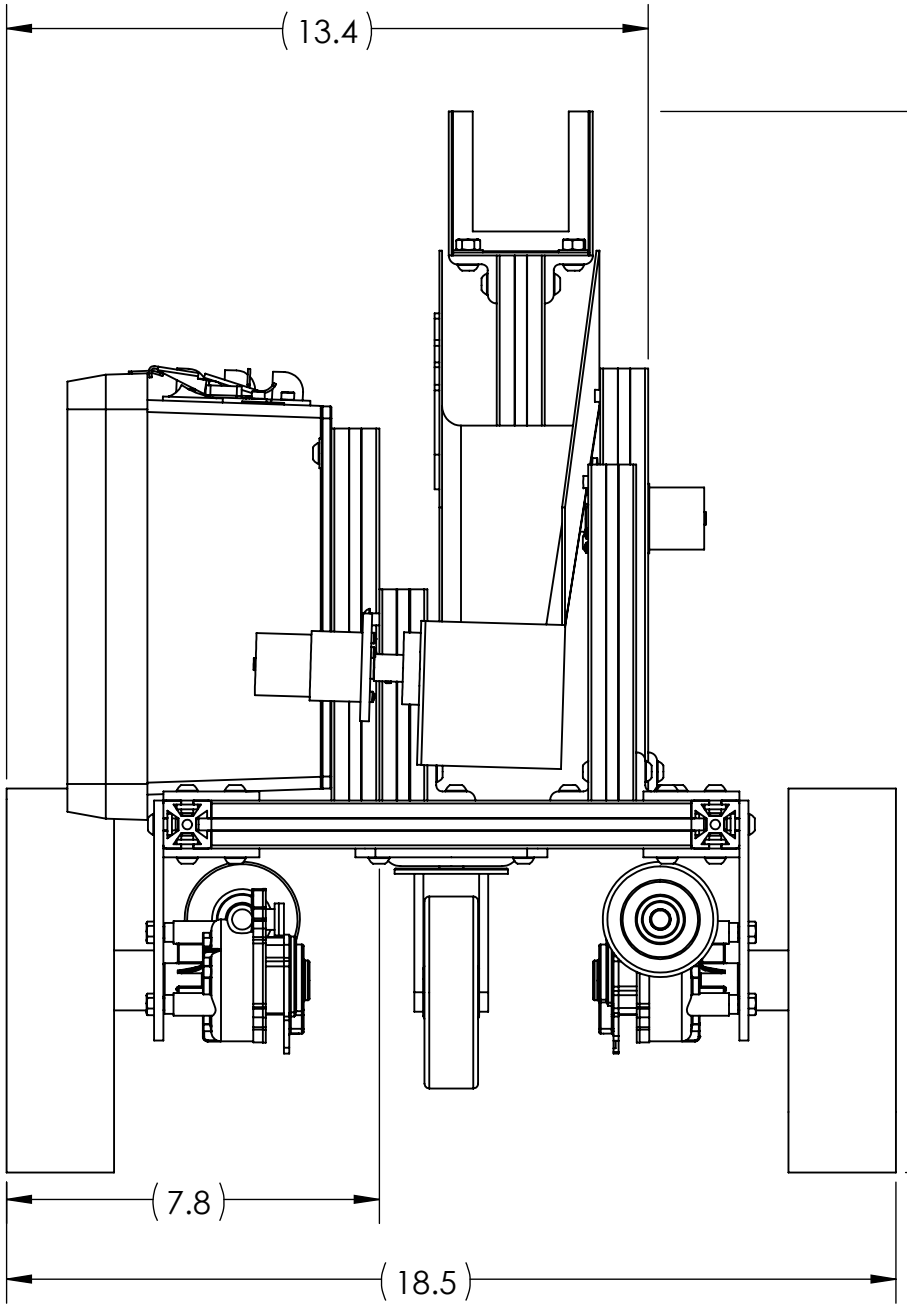

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CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-007	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 5 OF 7

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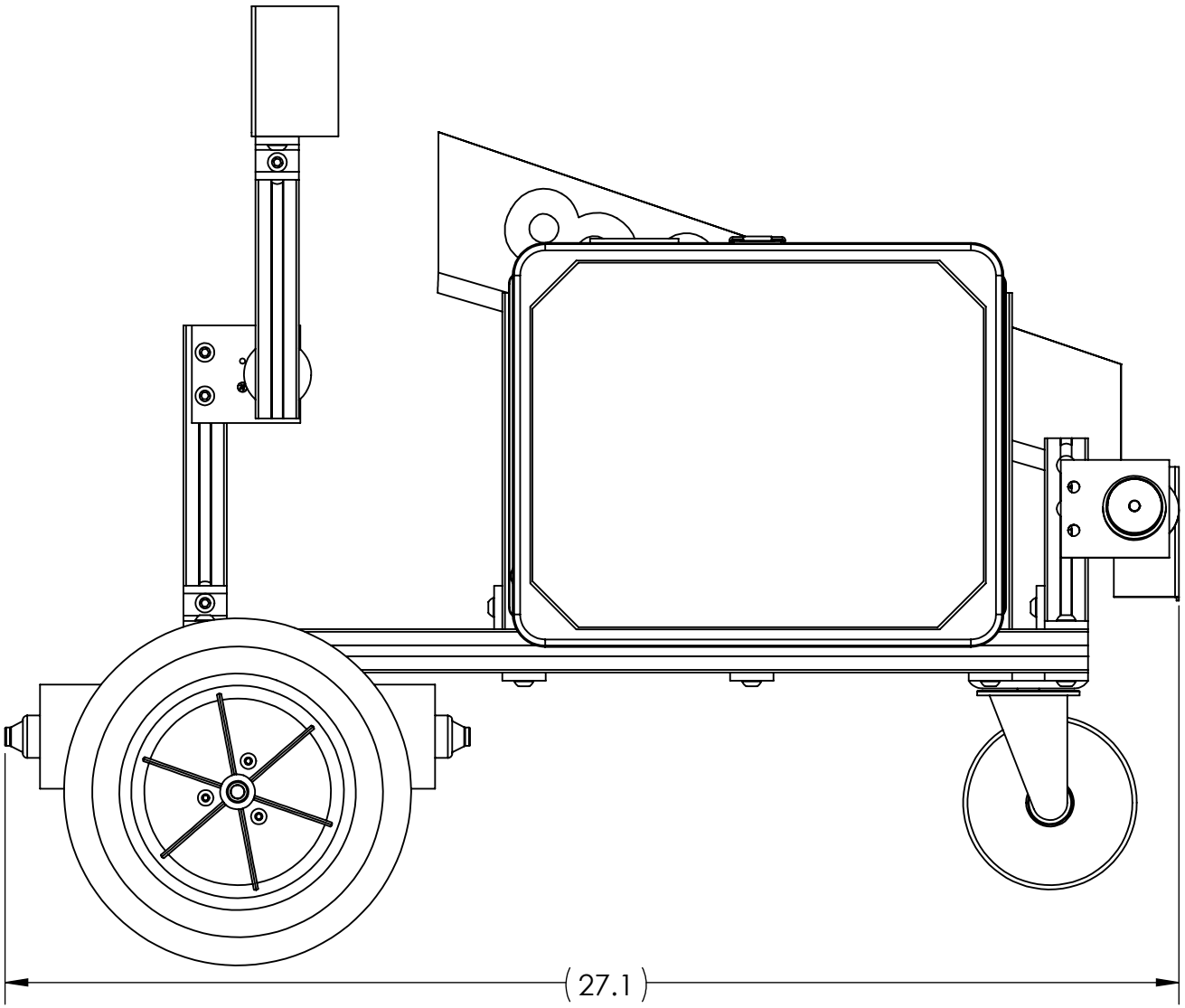

NOTES:
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TOLERANCE UNLESS NOTED				TITLE: Final Assembly		
OPERATION	PLACES IN DIMENSION					
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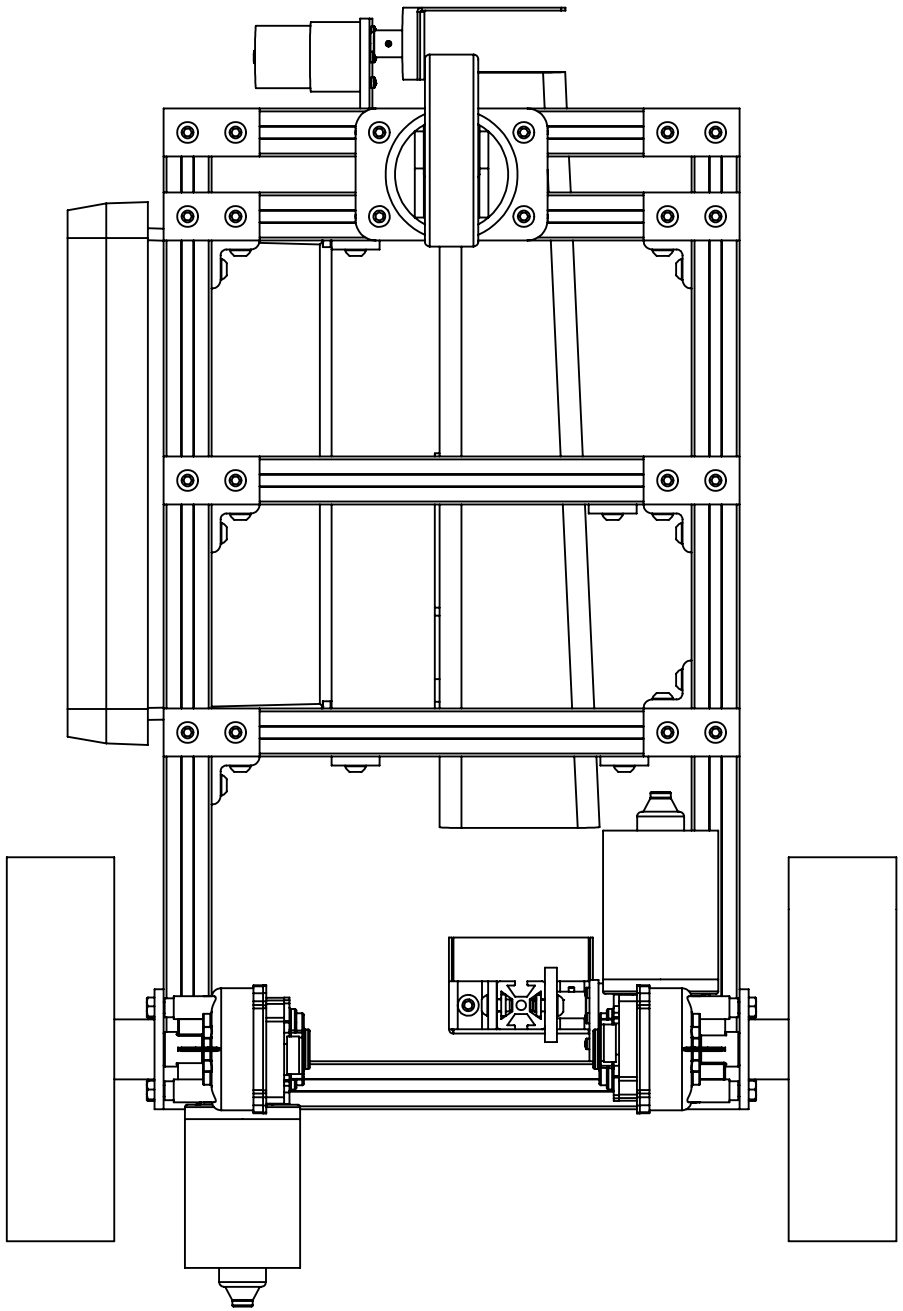
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-007	REV A
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 6 OF 7

5 4 3 2 1



NOTES:
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TOLERANCE UNLESS NOTED				TITLE: Final Assembly		
OPERATION	PLACES IN DIMENSION					
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MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-007	REV A
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 7 OF 7

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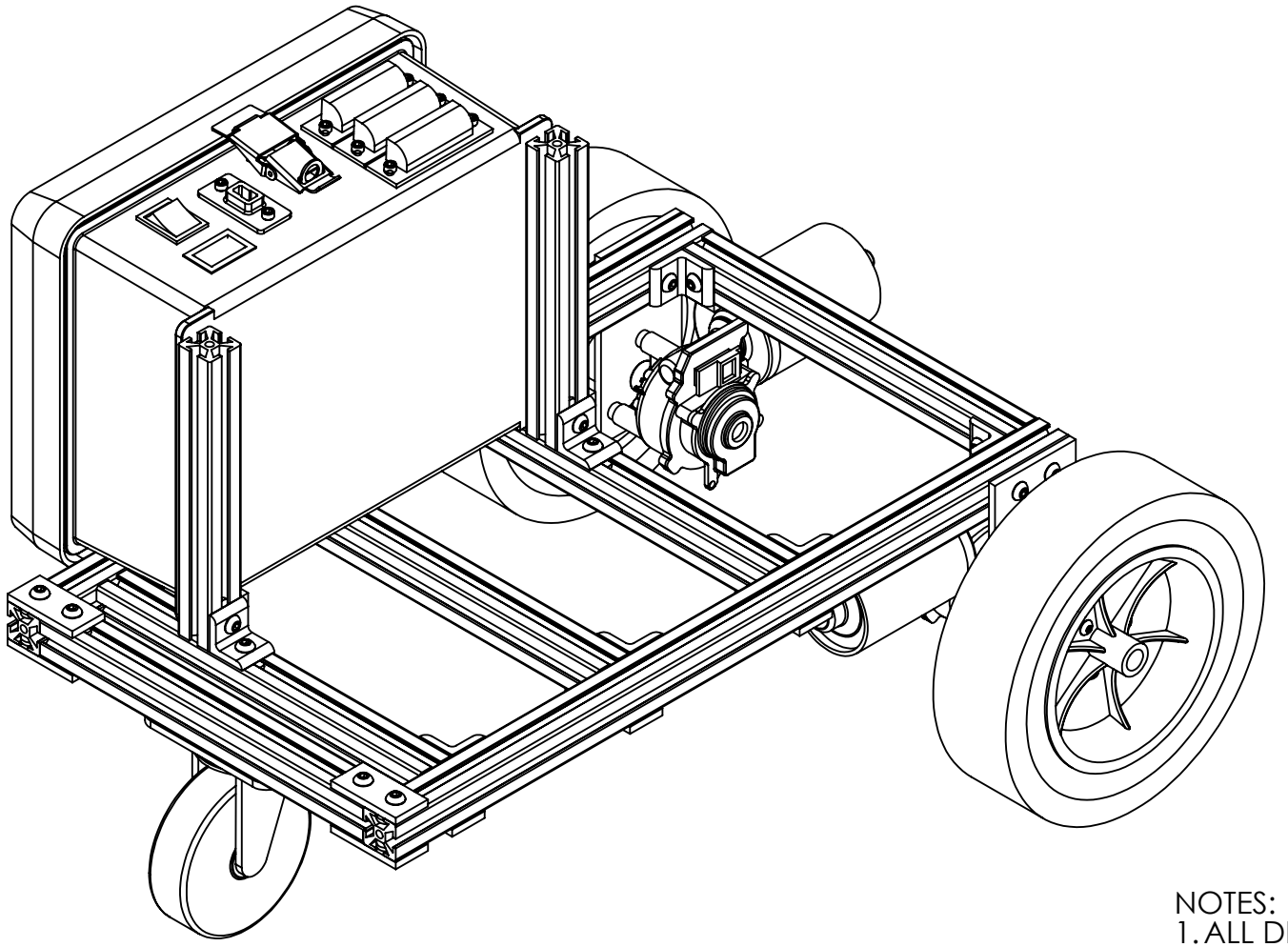

NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Mobile Platform		
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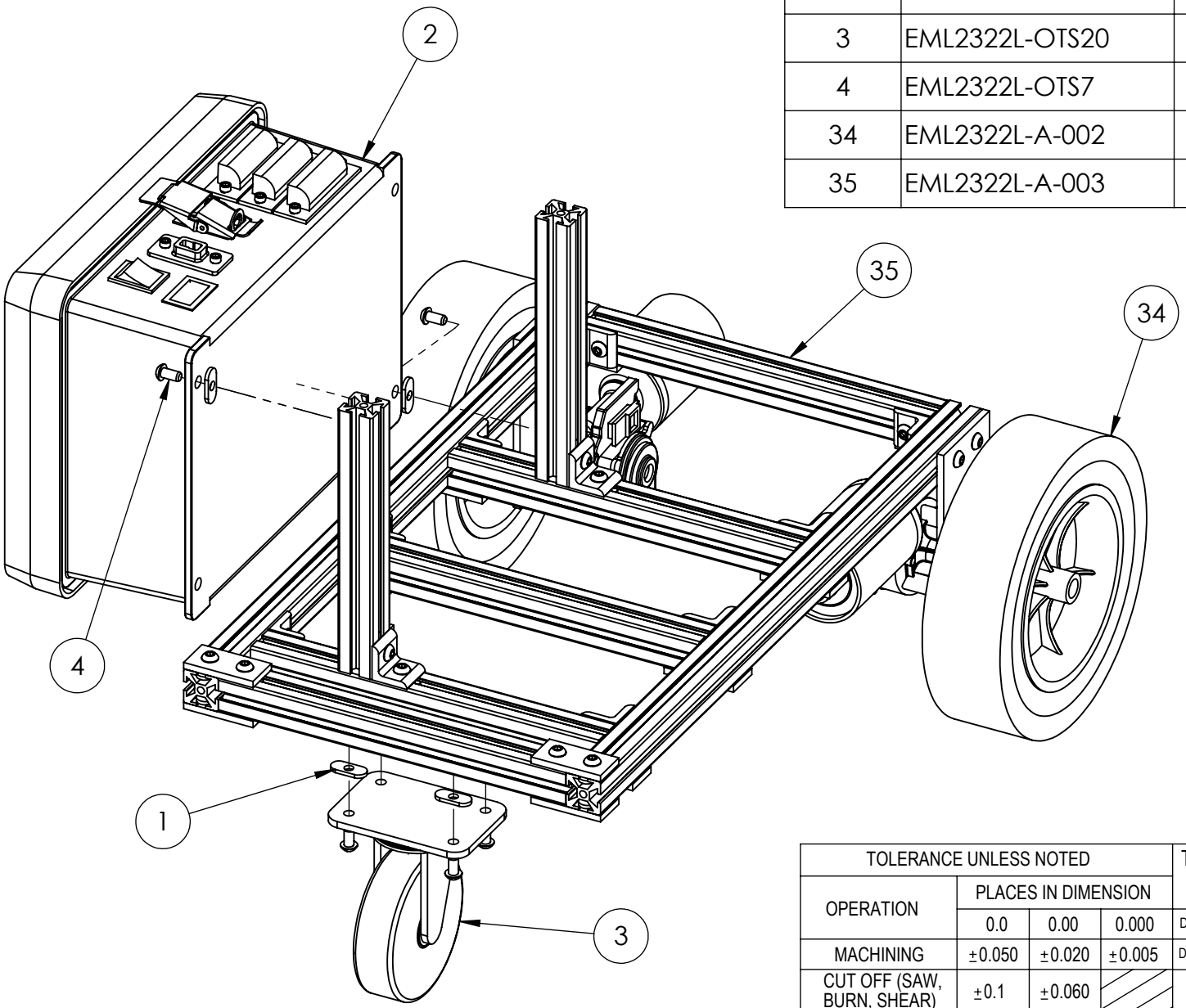
MACHINING	±0.050	±0.020	±0.005	DESIGNED	Cyril Moran	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-A-001	A
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 1 OF 6

5 4 3 2 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	6
2	EML2322L-OTS1	CONTROL BOX	1
3	EML2322L-OTS20	5" CASTER WHEEL	1
4	EML2322L-OTS7	1/4-20 X 1/2 BHCS	6
34	EML2322L-A-002	DRIVE ASSEMBLY	2
35	EML2322L-A-003	FRAME ASSEMBLY	1



NOTES:
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TOLERANCE UNLESS NOTED				TITLE: Mobile Platform		
OPERATION	PLACES IN DIMENSION					
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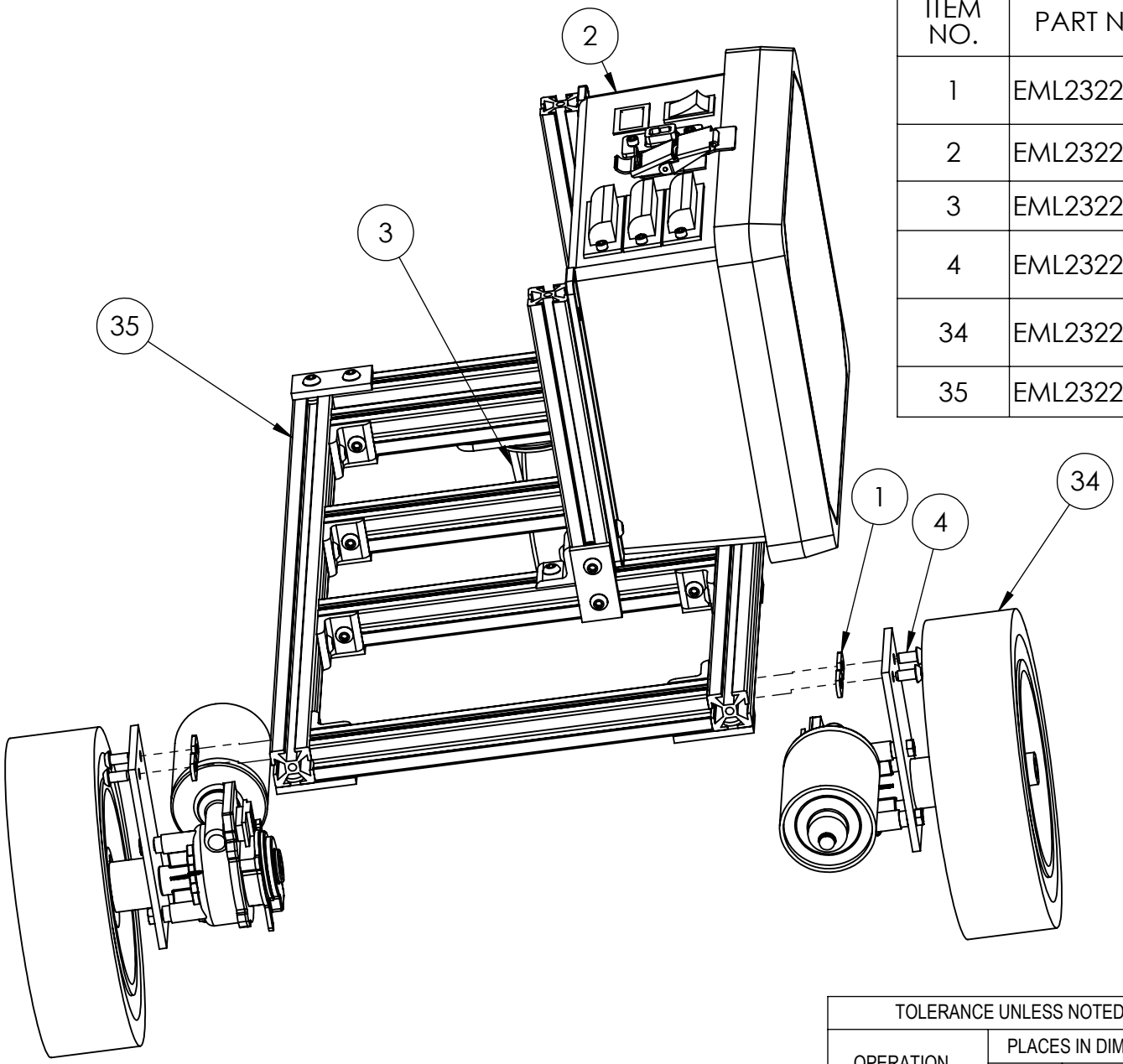
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-001	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 2 OF 6

5 4 3 2 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	4
2	EML2322L-OTS1	CONTROL BOX	1
3	EML2322L-OTS20	5" CASTER WHEEL	1
4	EML2322L-OTS7	1/4-20 x 1/2" BHCS	4
34	EML2322L-A-002	DRIVE ASSEMBLY	2
35	EML2322L-A-003	FRAME ASSEMBLY	1

NOTES:
1. ALL DIMS INCHES
2. QTY:1

TOLERANCE UNLESS NOTED				TITLE: Mobile Platform		
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	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-001	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 3 OF 6

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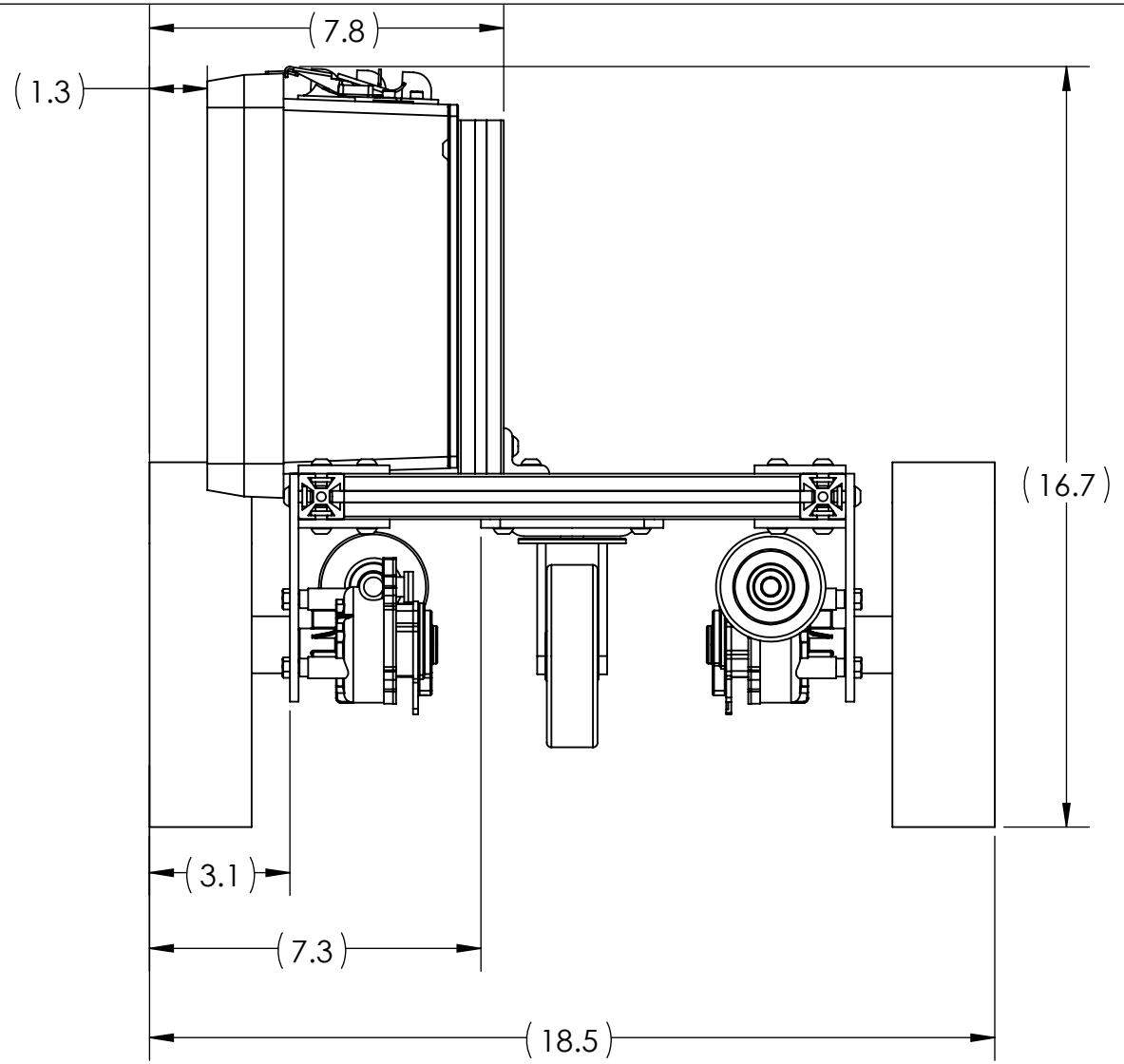

NOTES:
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TOLERANCE UNLESS NOTED				TITLE: Mobile Platform		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	CYRIL MORAN	
MACHINING	±0.050	±0.020	±0.005	DESIGNED	CYRIL MORAN	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-A-001	B
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 4 OF 6

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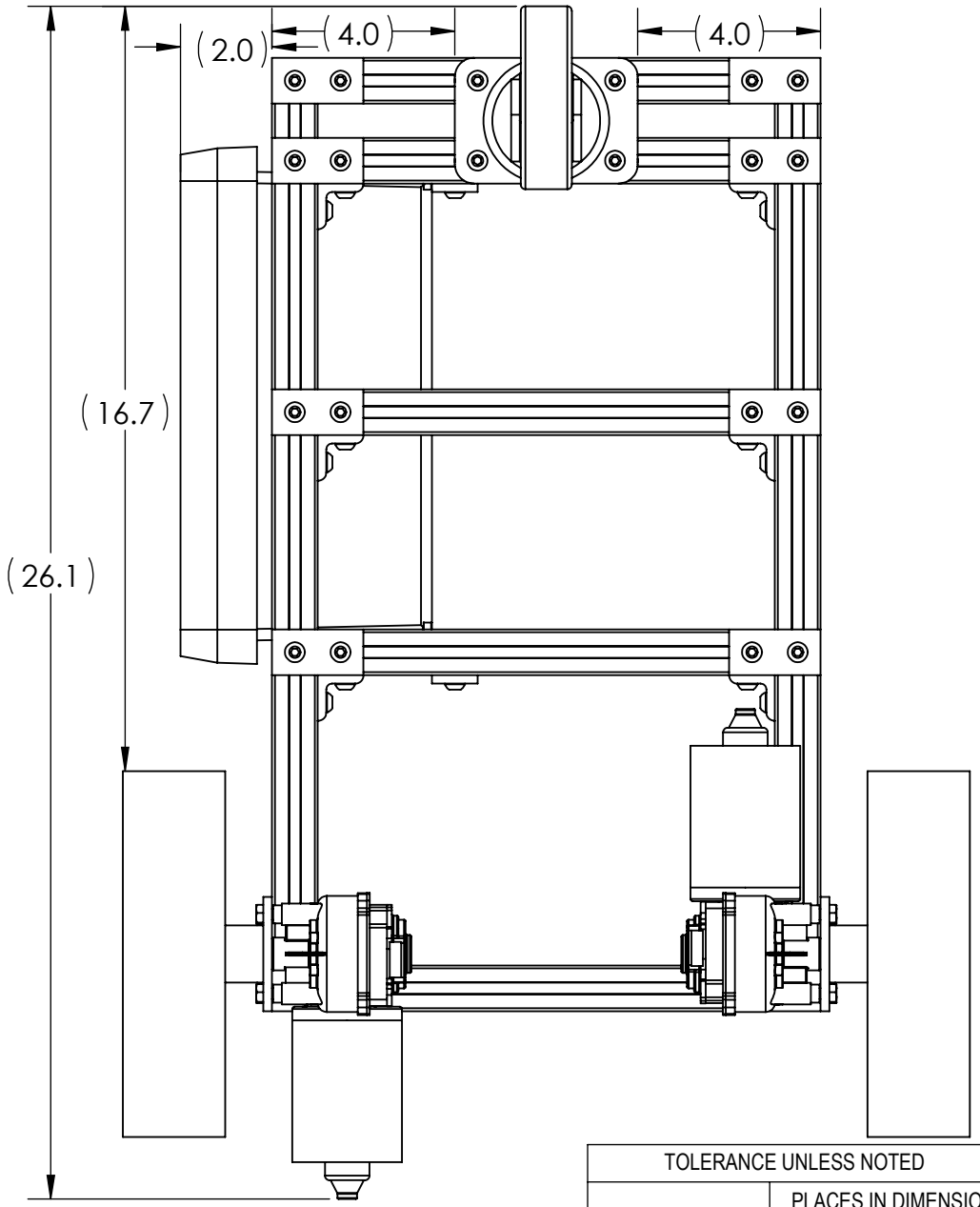

NOTES:
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OPERATION	PLACES IN DIMENSION					
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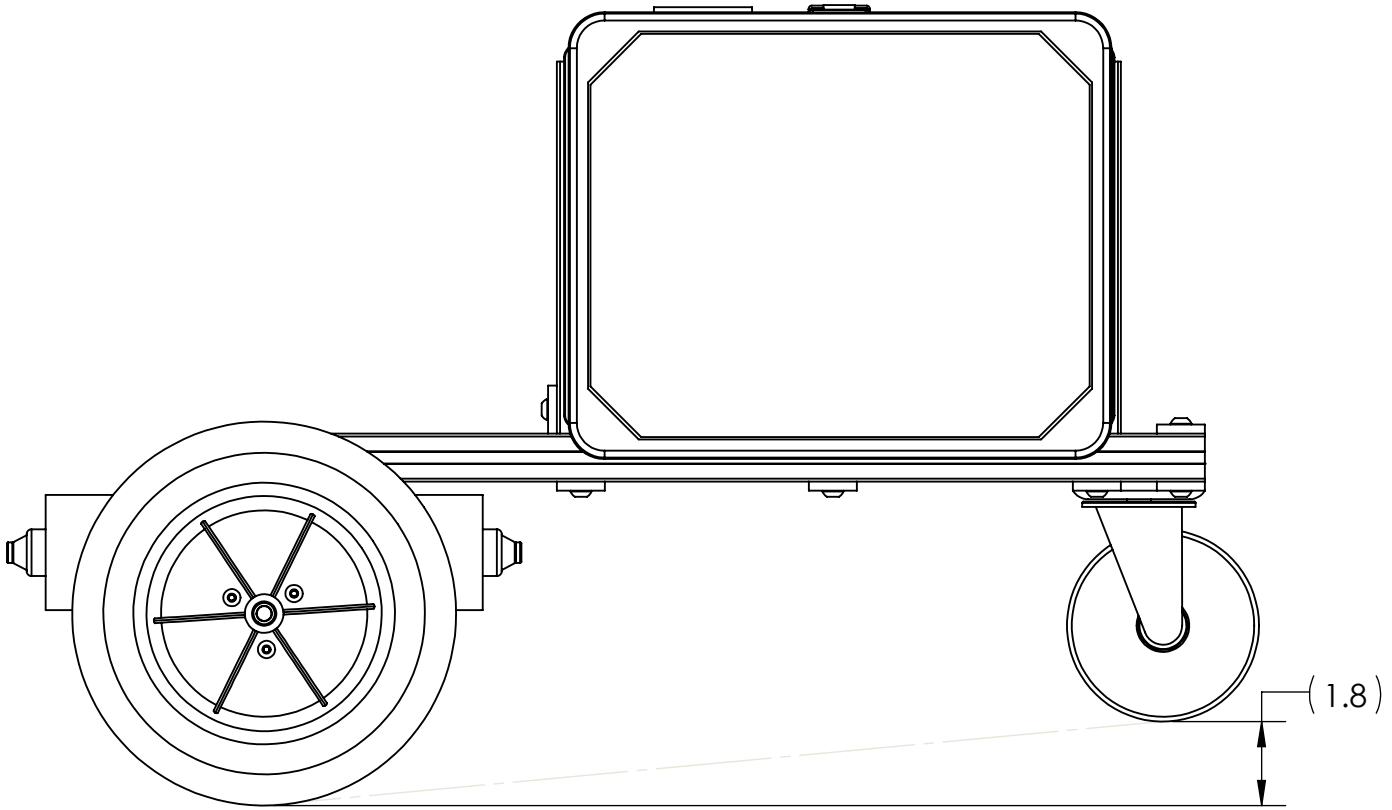
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-001	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 5 OF 6

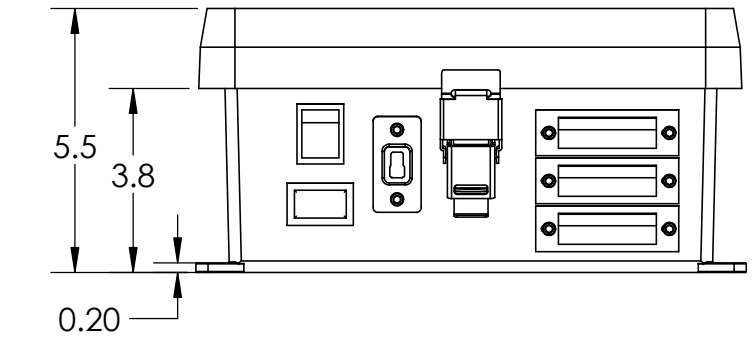
5 4 3 2 1

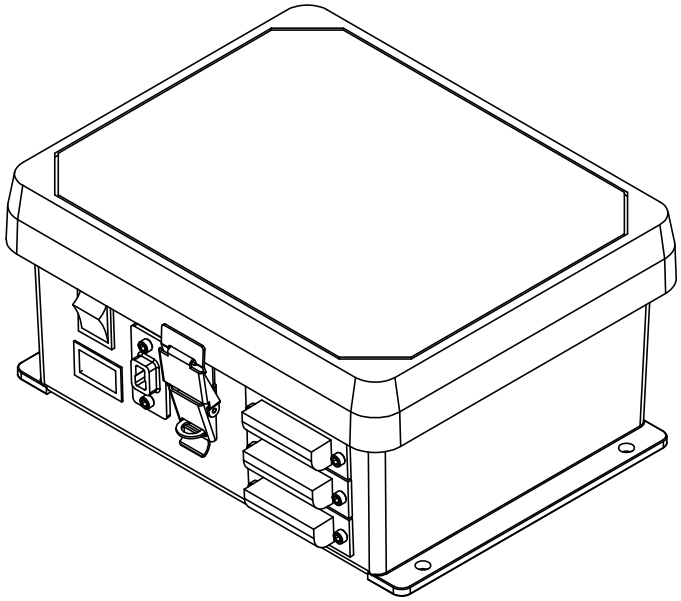


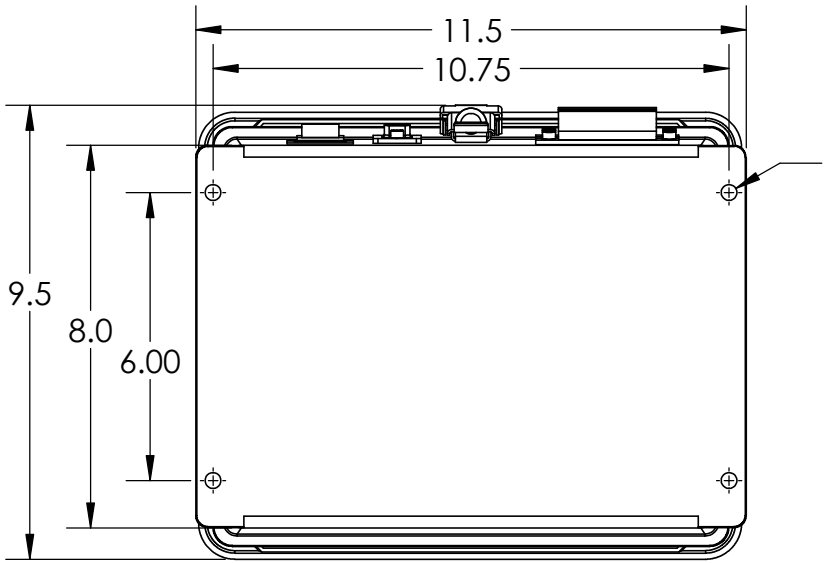
NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Mobile Platform		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-001	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 6 OF 6

5 4 3 2 1



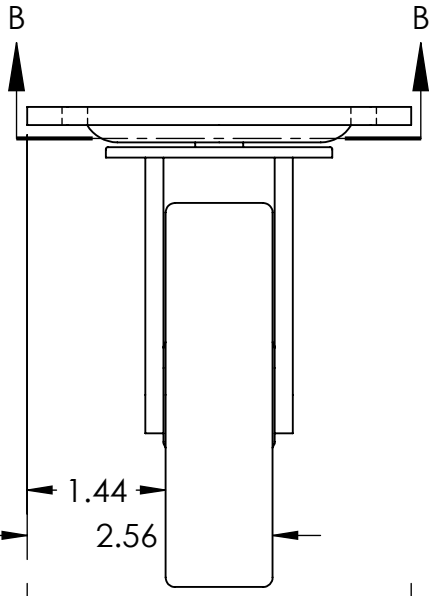


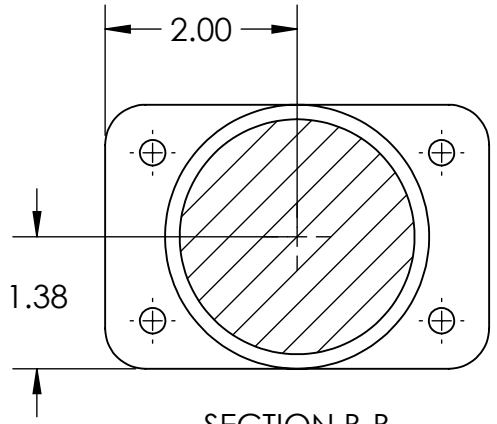


∅0.328 THRU;
4 PLACES

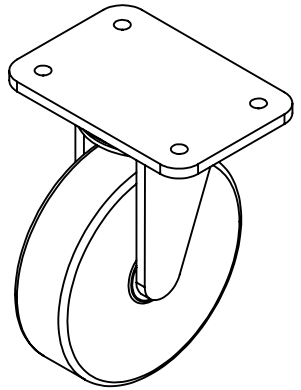
NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIM AND MAT'L SPECIFIED BY MANUFACTURER

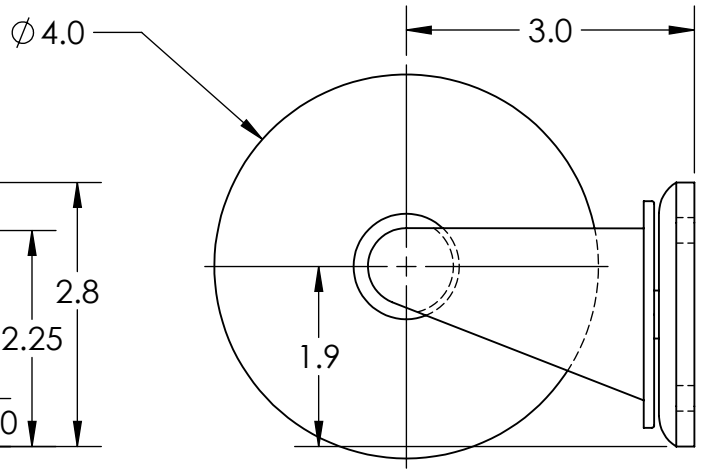
TOLERANCE UNLESS NOTED				TITLE: Control Box		
MEASURING INSTRUMENT	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	KRISTIN BROOKER	
CALIPERS			±0.005	DESIGNED	VYNCKIER ENCLOSURES	
PRECISION RULER		±0.015		SIZE	DWG. NO.	REV
TAPE MEASURE	±0.030			A	EML2322L-OTS1	B
PROTRACTOR	±10	±5	±2	SCALE: 1:4		SHEET 1 OF 1





SECTION B-B

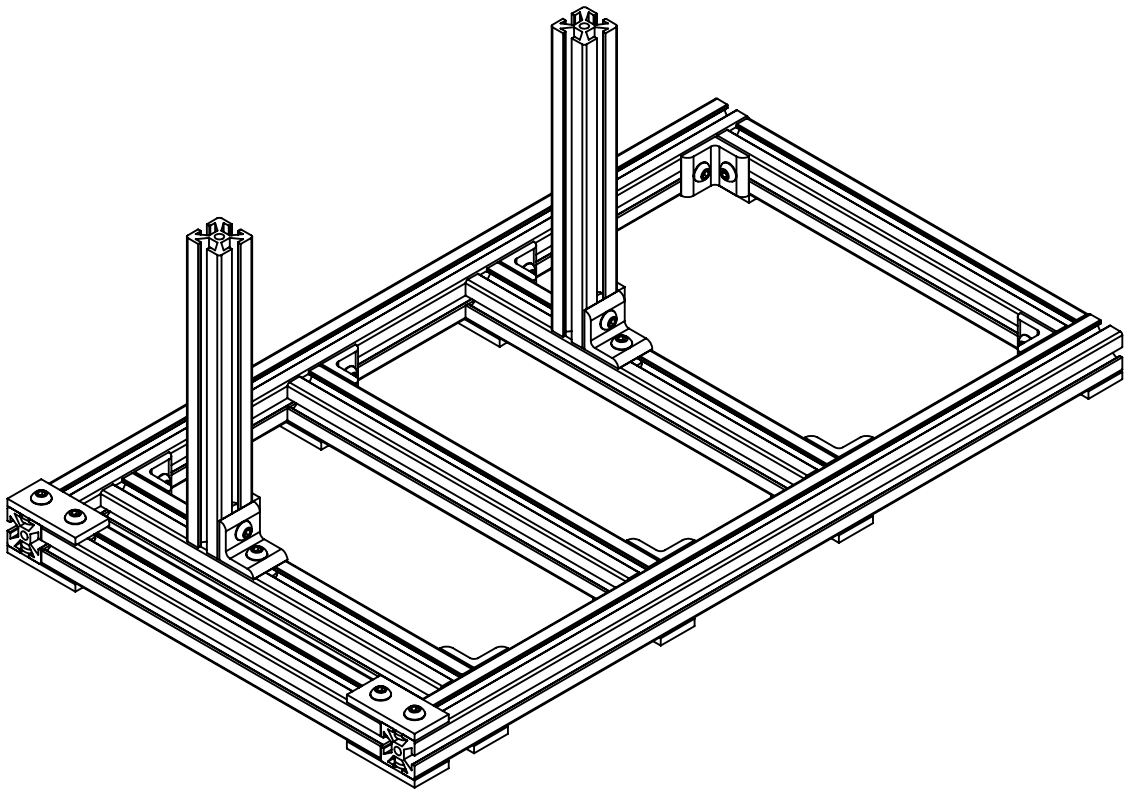




NOTES:
1. DIMS IN INCHES
2. QUANTITY: 1
3. DIMS AND MAT'L SPECIFIED BY MANUFACTURER

TOLERANCE UNLESS NOTED				TITLE: Caster Wheel		
MEASURING INSTRUMENT	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	DRAWER'S NAME	
CALIPERS			±0.005	DESIGNED	ARNOLD	
PRECISION RULER		±0.015		SIZE	DWG. NO.	REV
TAPE MEASURE	±0.030			A	EML2322L-OTS20	B
PROTRACTOR	±10	±5	±2	SCALE: 1:2		SHEET 1 OF 1

5 4 3 2 1

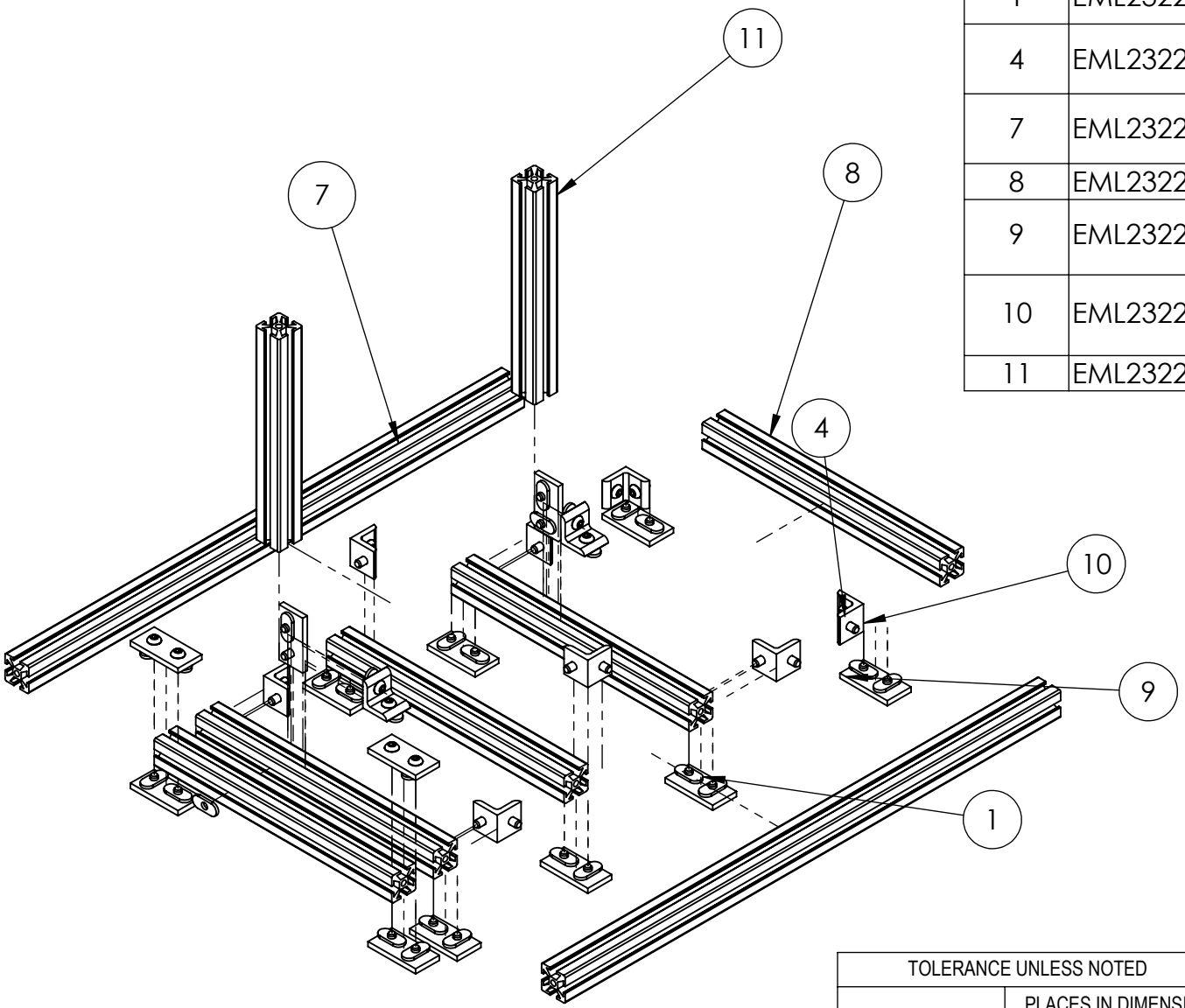


NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Frame Assembly		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-003	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 1 OF 5

5 4 3 2 1

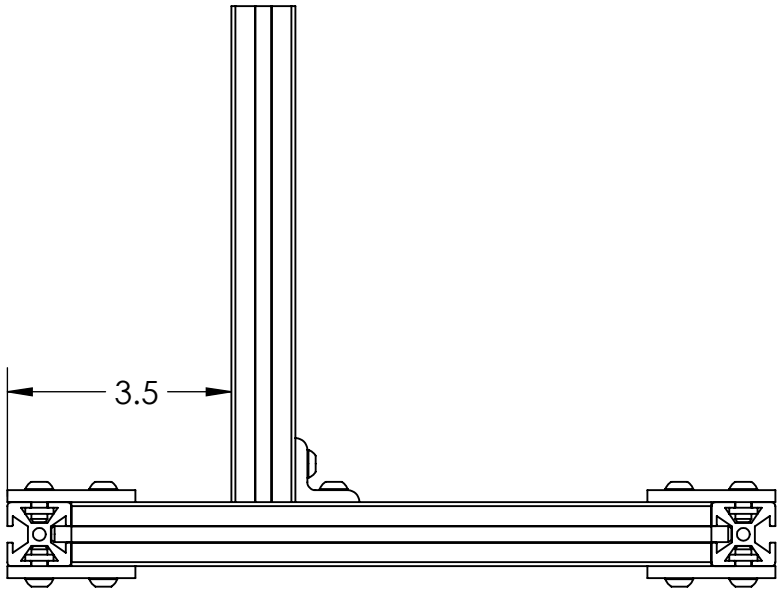
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	48
4	EML2322L-OTS7	1/4-20 X 1/2 inch BHCS	48
7	EML2322L-007	80-20 Extrusion, 20.9"	2
8	EML2322L-008	80-20 Extrusion, 10.0"	5
9	EML2322L-OTS13	80/20 Straight Bracket	14
10	EML2322L-OTS12	80/20 90 Degree Angle Bracket	10
11	EML2322L-011	80-20 Extrusion 7.8"	2



NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Frame Assembly		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-003	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:5		SHEET 2 OF 5

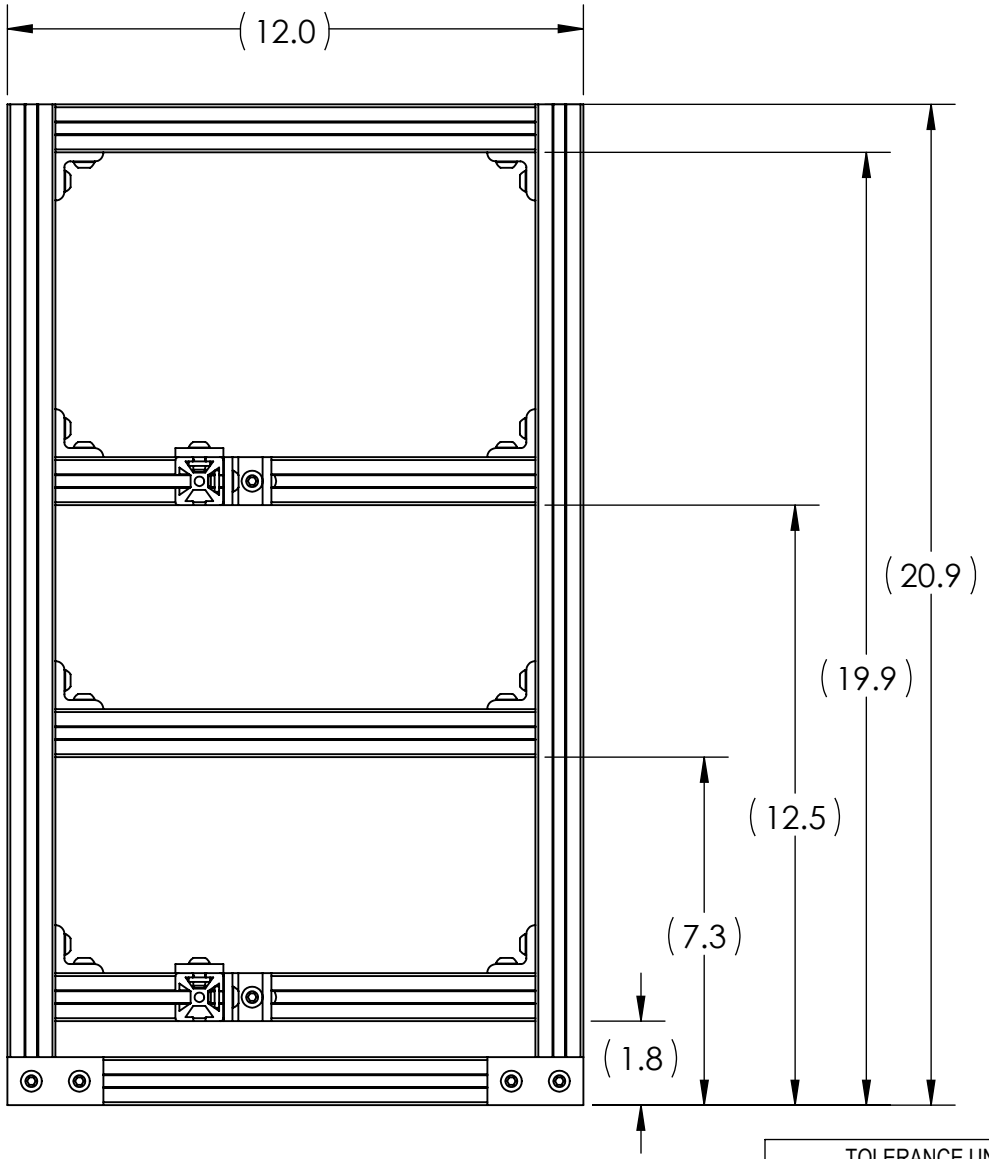
5 4 3 2 1



NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Frame Assembly		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-003	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:3		SHEET 3 OF 5

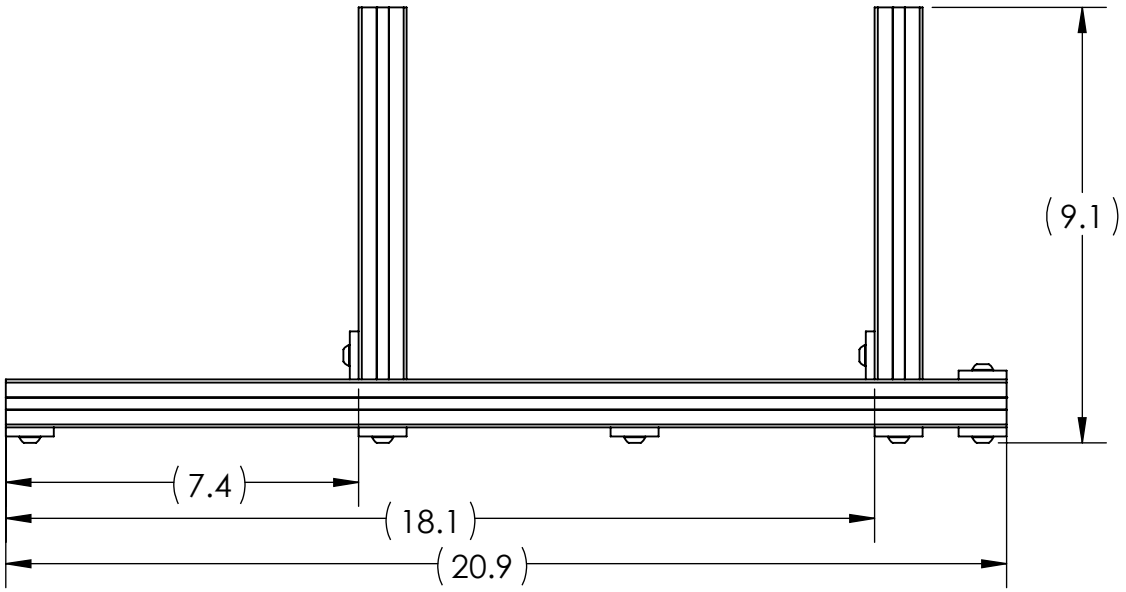
5 4 3 2 1



NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TOLERANCE UNLESS NOTED				TITLE: Frame Assembly		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-A-003	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 4 OF 5

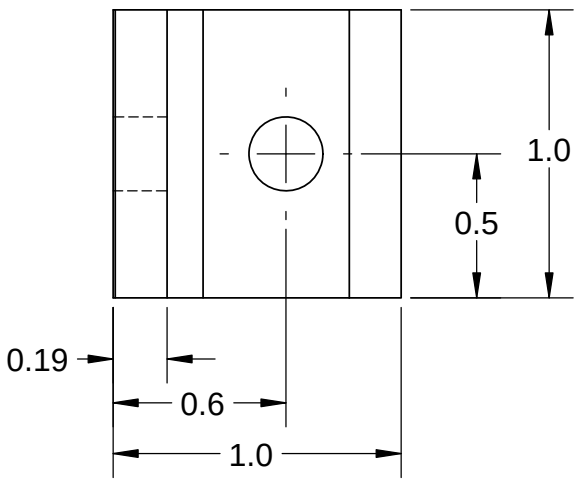
5 4 3 2 1

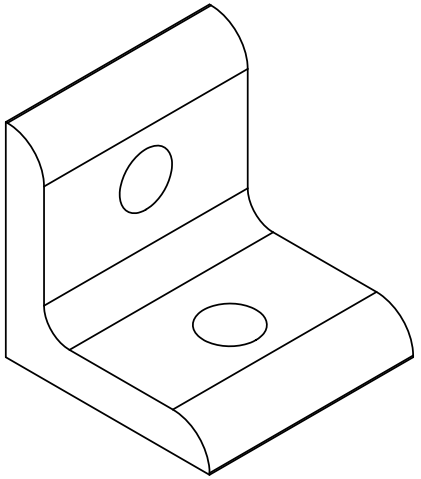


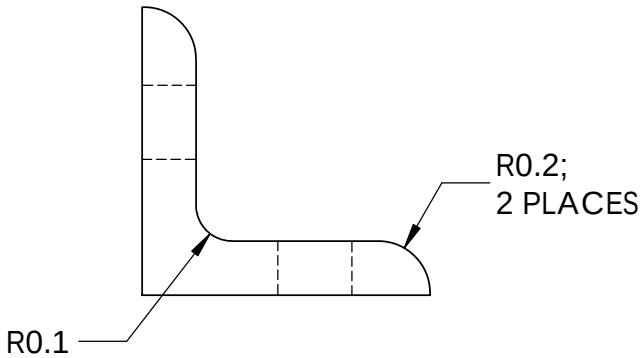
NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

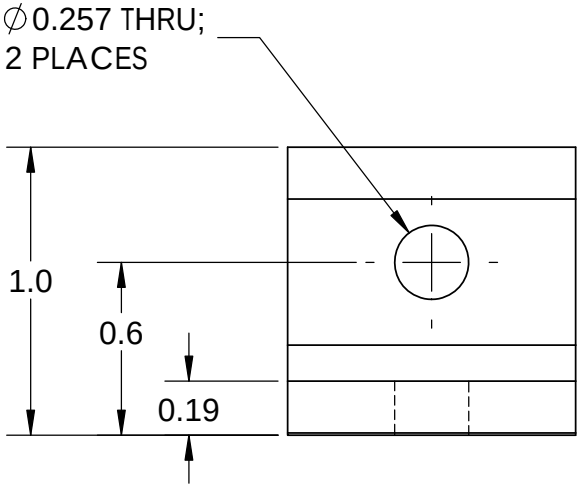
TOLERANCE UNLESS NOTED				TITLE: Frame Assembly		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	CYRIL MORAN	
MACHINING	±0.050	±0.020	±0.005	DESIGNED	CYRIL MORAN	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-A-003	B
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:4		SHEET 5 OF 5

5 4 3 2 1



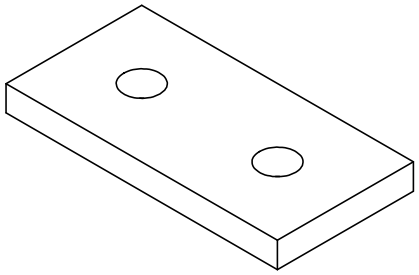


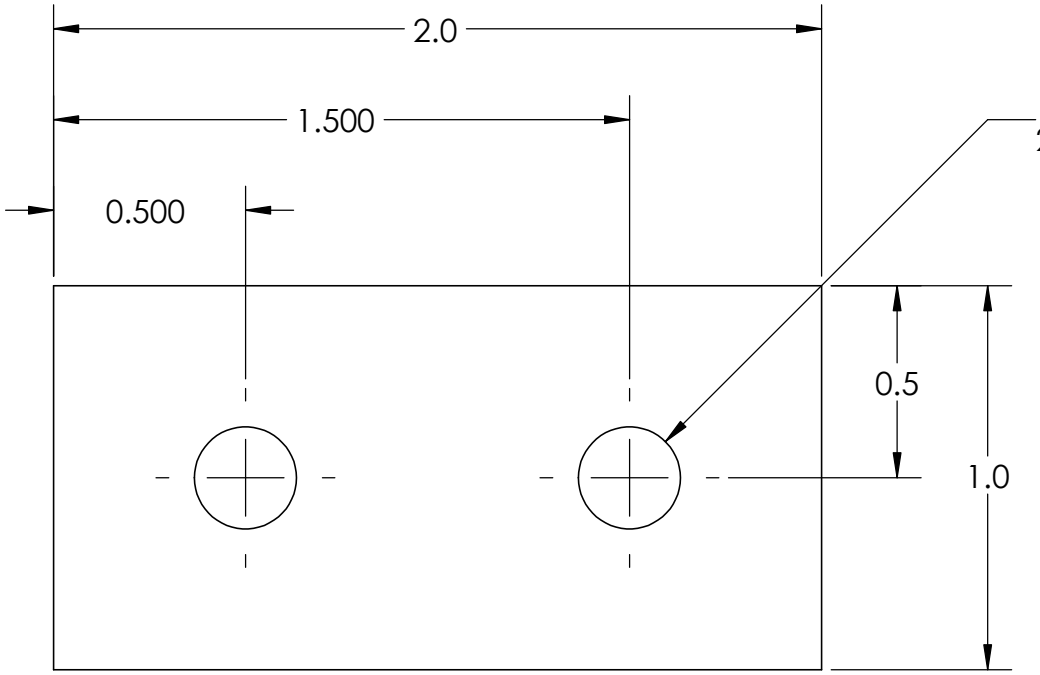




NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIMS SPECIFIED BY MANUFACTURER
4. MAT'L: ALUMINUM

TOLERANCE UNLESS NOTED				TITLE: 80/20 90 Degree Angle Bracket		
MEASURING INSTRUMENT	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	J. DERSCH	
CALIPERS			±0.005	DESIGNED	80/20 INC.	
PRECISION RULER		±0.015		SIZE	DWG. NO.	REV
TAPE MEASURE	±0.030			A	EML2322L-OTS12	A
PROTRACTOR	±10	±5	±2	SCALE: 1.5:1		SHEET 1 OF 1



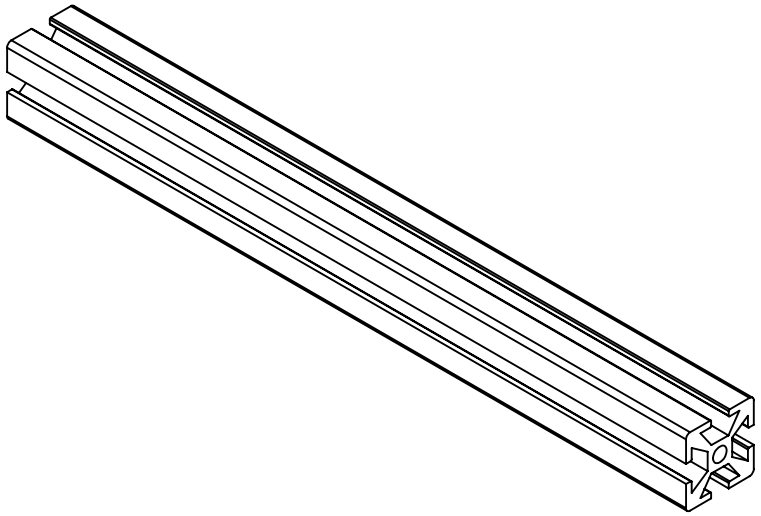


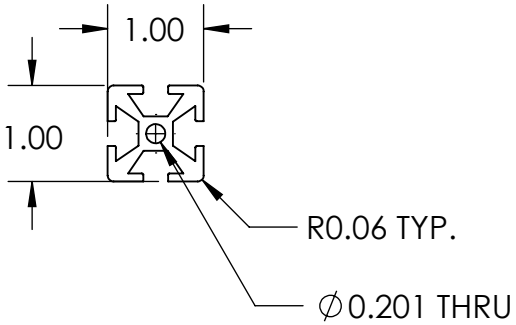
NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIMS SPECIFIED BY MANUFACTURER
4. MAT'L: ALUMINUM

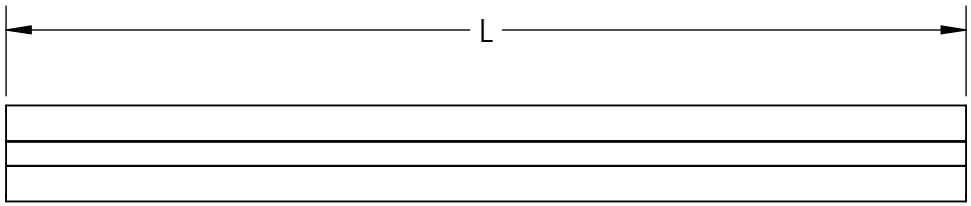
TOLERANCE UNLESS NOTED				TITLE: 80-20 Straight Bracket		
MEASURING INSTRUMENT	PLACES IN DIMENSION			DRAWN	J. DERSCH	
	0.0	0.00	0.000			
CALIPERS			±0.005	DESIGNED	80/20 INC.	
PRECISION RULER		±0.015		SIZE	DWG. NO.	REV
TAPE MEASURE	±0.030			A	EML2322L-OTS13	A
PROTRACTOR	±10	±5	±2	SCALE: 2:1		SHEET 1 OF 1

4 3 2 1

Part Number	Length (in.)	Quantity
EML2322L-007	20.9	2
EML2322L-008	10.0	5
EML2322L-011	7.8	2
EML2322L-021	7.0	2
EML2322L-022	6.5	1
EML2322L-028	9.0	1



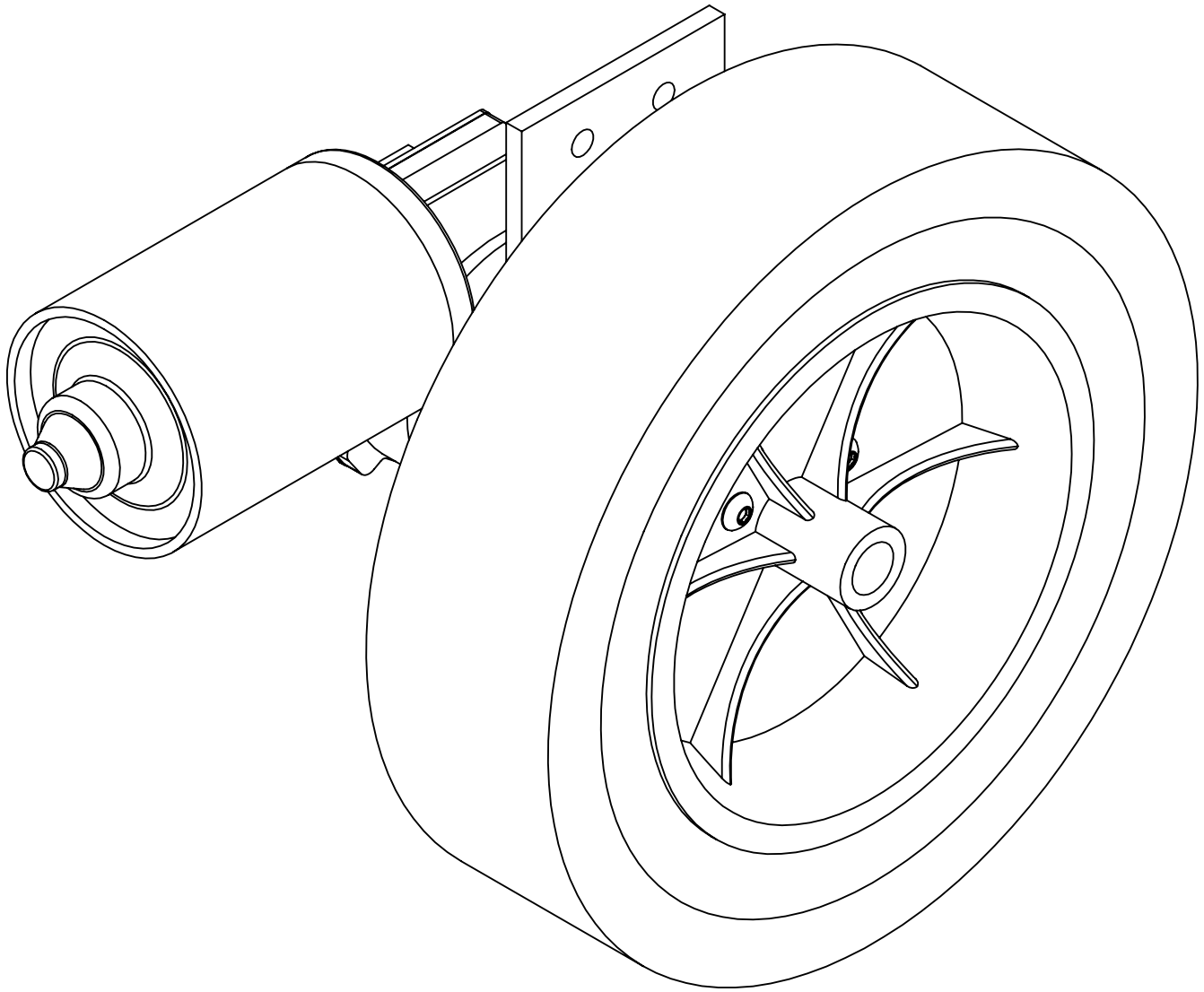




NOTES:
1. DIMS IN INCHES
2. MAT'L: 80/20 AL EXTRUSION
3. BREAK CUT ENDS
4. FINISH NO SURFACES
5. QTY SPECIFIED IN TABLE
6. USE CUT OFF TOLERANCES

TOLERANCE UNLESS NOTED				TITLE: 80/20 Extrusion (simplified)		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	DRAWER'S NAME	
MACHINING	±0.050	±0.020	±0.005	DESIGNED	I. WIDJAJA	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-000	B
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:2		SHEET 1 OF 1

5 4 3 2 1

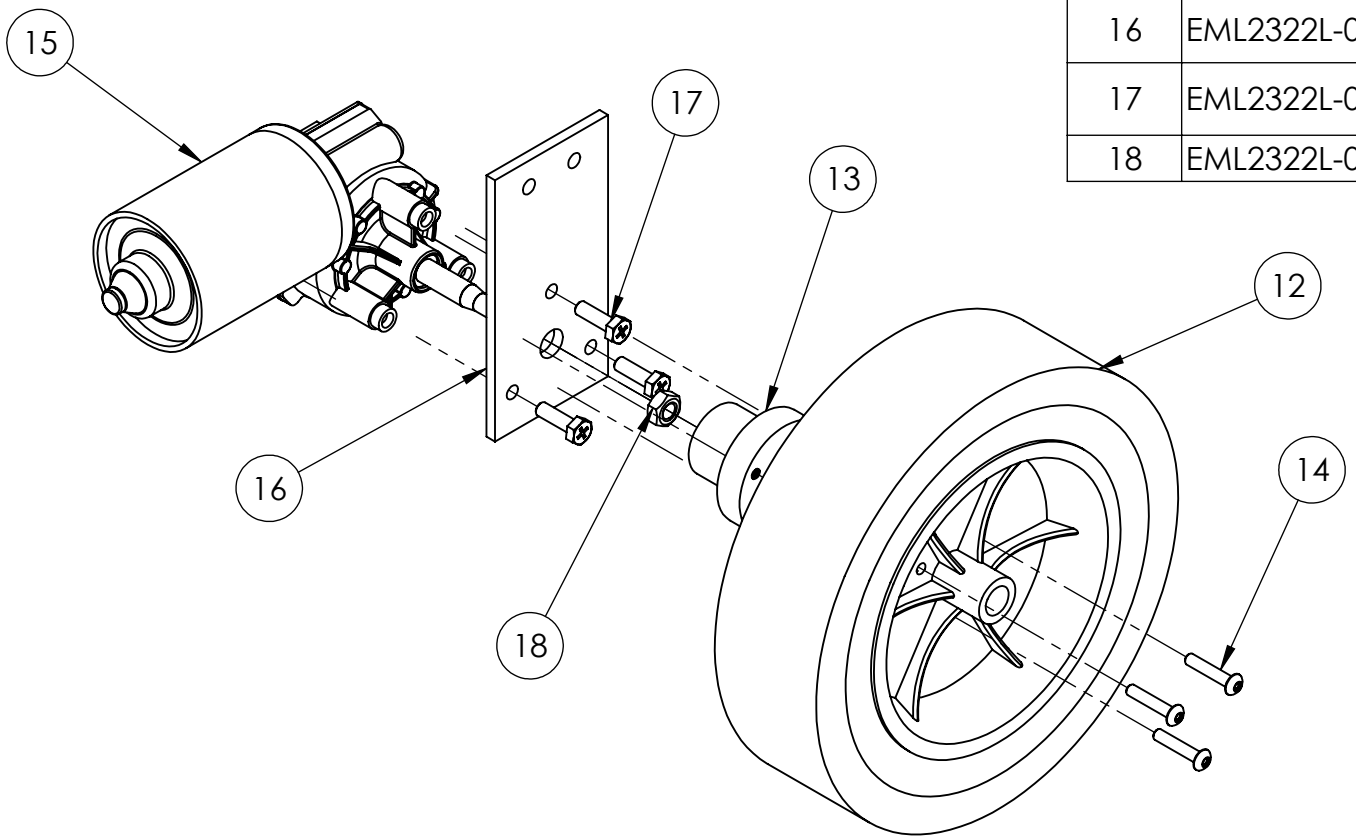


NOTES:
1. ALL DIMS IN INCHES
2. QTY: 2

TITLE: Drive Assembly					
DRAWN COLTON MAYS					
TOLERANCE UNLESS NOTED	DESIGNED CYRIL MORAN				
DIMENSION TYPE	PLACES IN DIMENSION			SIZE	DWG. NO.	REV
	0.0	0.00	0.000	A	EML2322L-A-002	A
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 1 OF 3

5 4 3 2 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
12	EML2322L-OTS22	8" Wheel Type 1	1
13	EML2322L-013	Entstort Wheel Hub	1
14	EML2322L-014	10-24 1" Button Head Screw	3
15	EML2322L-OTS31	44 RPM Entstort Right Angle Gear Motor	1
16	EML2322L-016	Entstort Motor Mount	1
17	EML2322L-017	M6-20mm Hex Head Screw	3
18	EML2322L-018	M8 x 1.25 Hex Nut	1



NOTES:
1. ALL DIMS IN INCHES
2. QTY 2

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: Drive Assembly

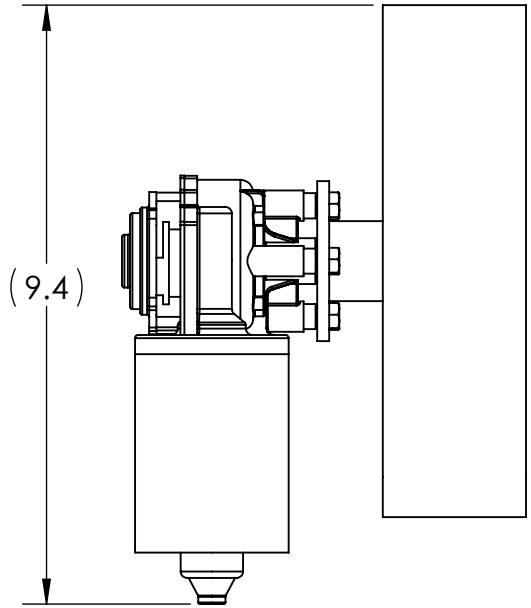
DRAWN COLTON MAYS

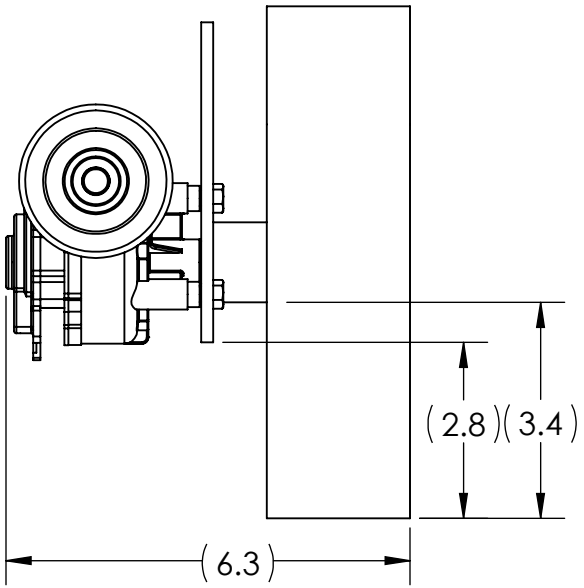
DESIGNED CYRIL MORAN

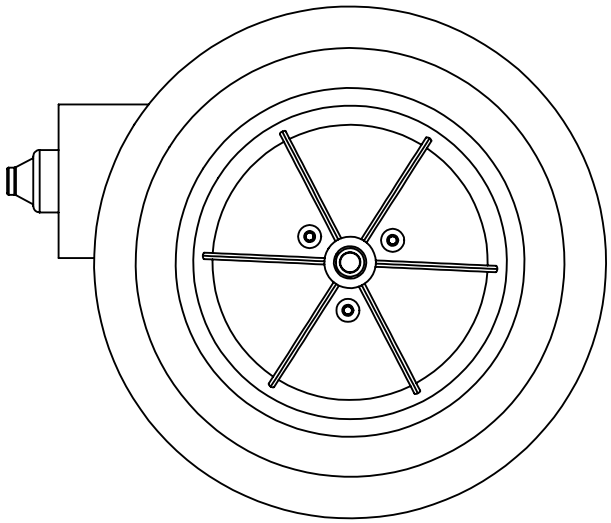
SIZE	DWG. NO.	REV
A	EML2322L-A-002	B

SCALE: 1:3 SHEET 2 OF 3

5 4 3 2 1





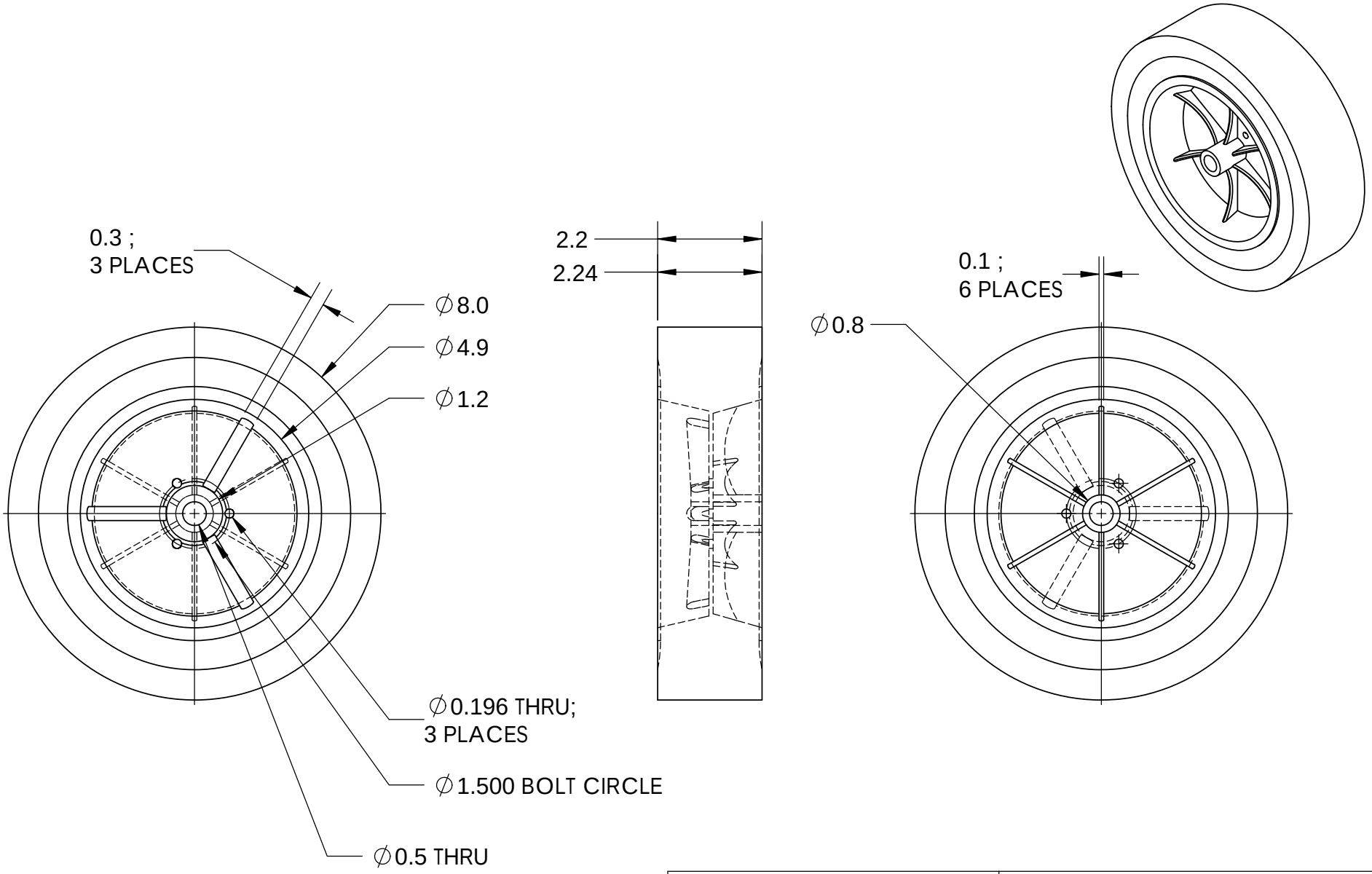


NOTES:
1. ALL DIMS IN INCHES
2. QTY: 2

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

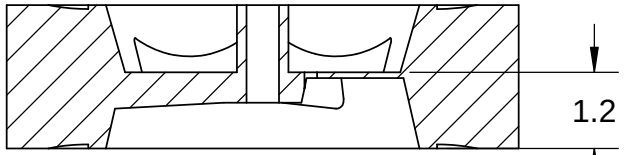
TITLE:	Drive Assembly
DRAWN	COLTON MAYS
DESIGNED	CYRIL MORAN
SIZE	A
DWG. NO.	EML2322L-A-002
REV	A
SCALE:	1:3
SHEET	3 OF 3

5 4 3 2 1

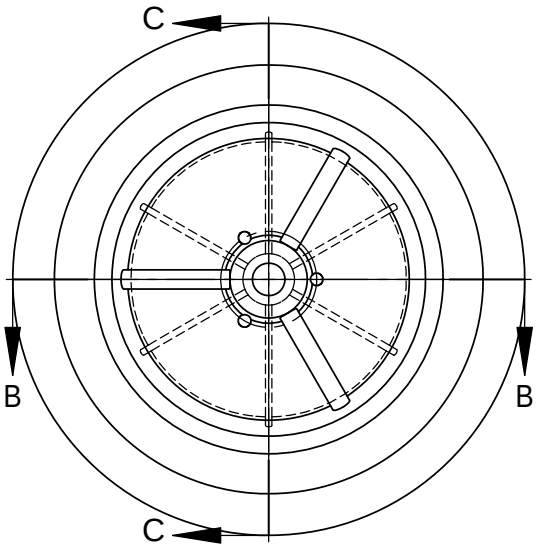


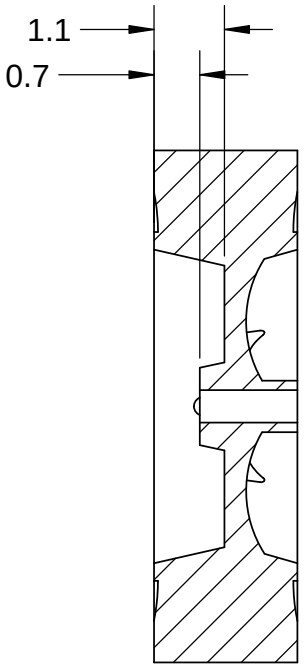
NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIMS AND MAT'L SPECIFIED BY MANUFACTURER

TOLERANCE UNLESS NOTED				TITLE: 8 Inch Wheel Type 1		
MEASURING INSTRUMENT	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN J. DERSCH		
CALIPERS			±0.005	DESIGNED ARNOLD		
PRECISION RULER		±0.015		SIZE A	DWG. NO. EML2322L-OTS22	REV A
TAPE MEASURE	±0.030					
PROTRACTOR	±10	±5	±2	SCALE: 1:3		SHEET 1 OF 2



SECTION B-B

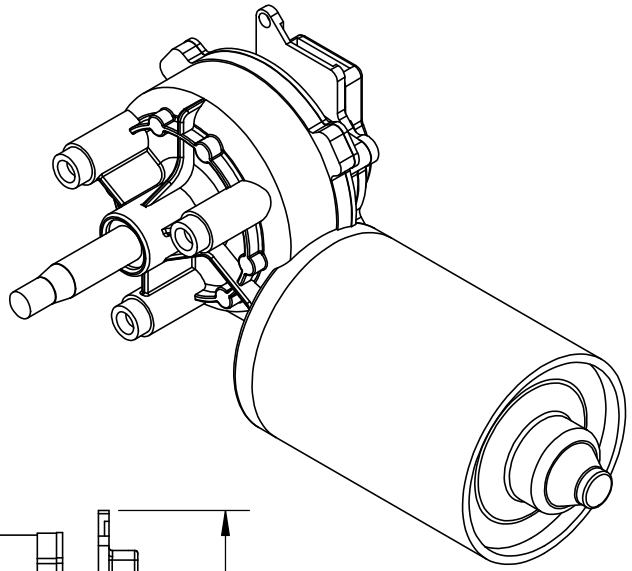


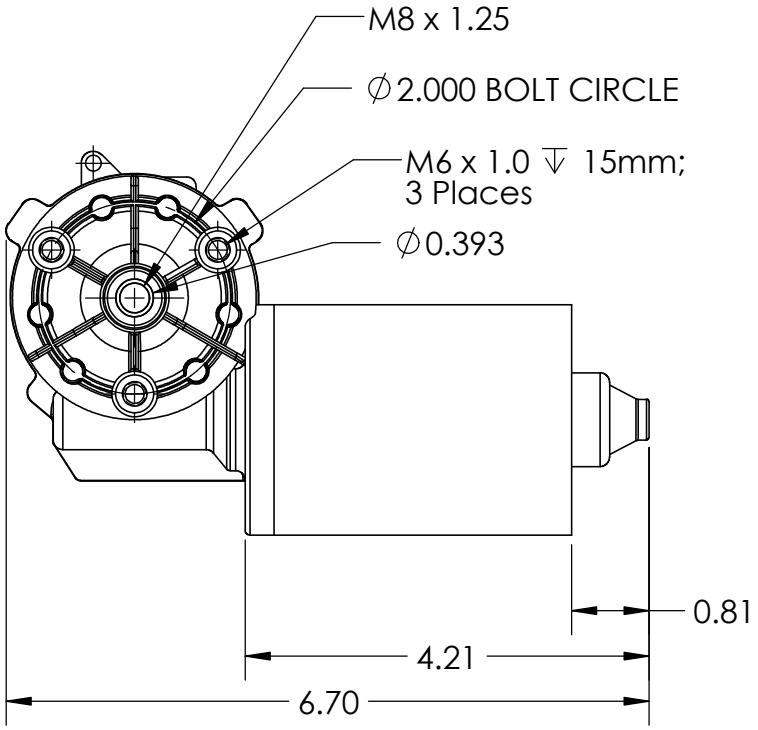


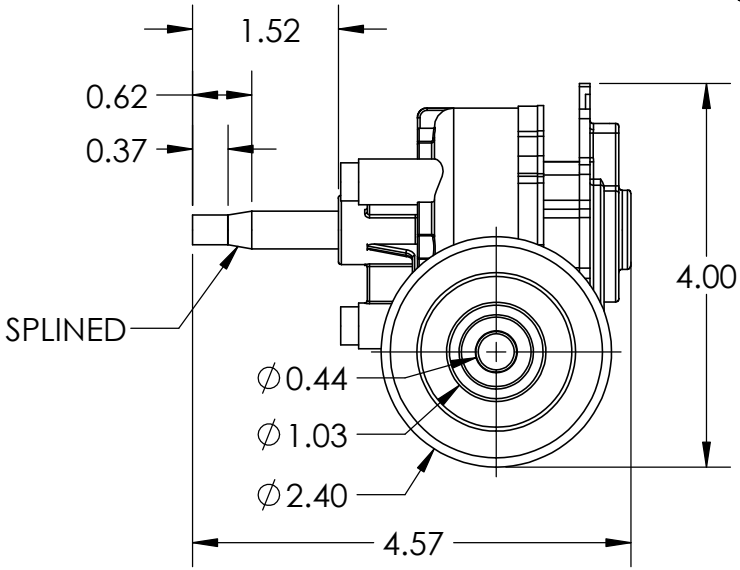
SECTION C-C

NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIMS AND MAT'L SPECIFIED BY MANUFACTURER

TOLERANCE UNLESS NOTED				TITLE: 8 Inch Wheel Type 1		
MEASURING INSTRUMENT	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN J. DERSCH		
CALIPERS			±0.005	DESIGNED ARNOLD		
PRECISION RULER		±0.015		SIZE A	DWG. NO. EML2322L-OTS22	REV A
TAPE MEASURE	±0.030					
PROTRACTOR	±10	±5	±2	SCALE: 1:3		SHEET 2 OF 2

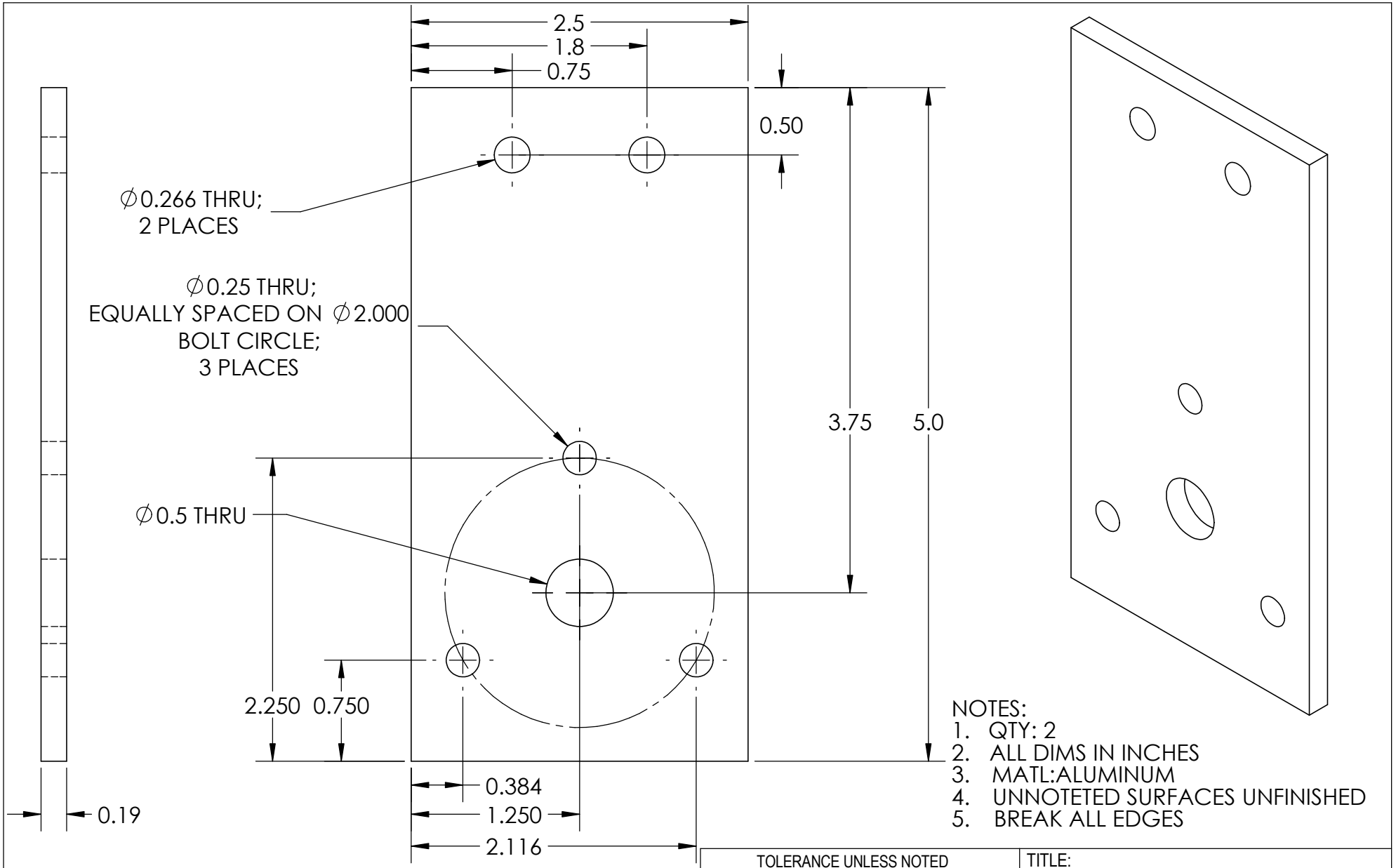






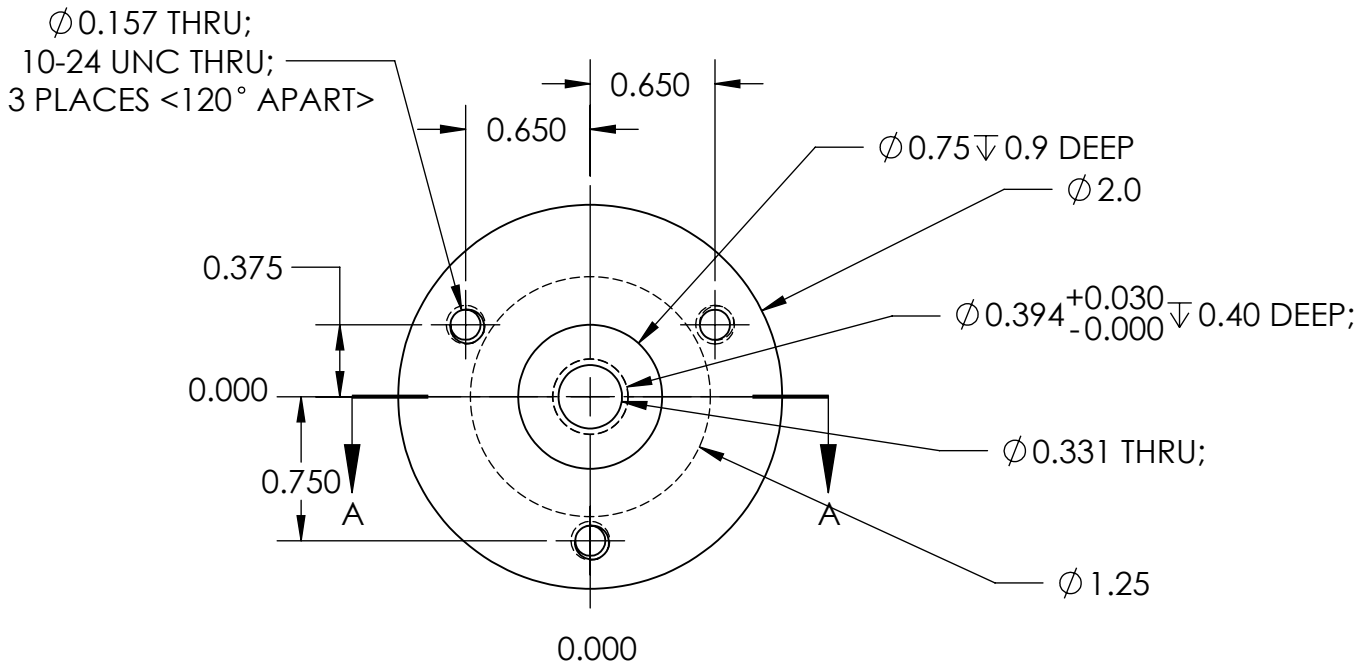
NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIMS AND MAT'L SPECIFIED BY MANUFACTURER

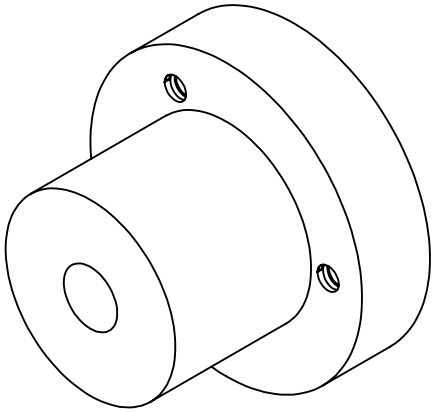
TOLERANCE UNLESS NOTED				TITLE: 44 RPM Entstort Right Angle Gear Motor		
MEASURING INSTRUMENT	PLACES IN DIMENSION			DRAWN J. DERSCH		
	0.0	0.00	0.000			
CALIPERS			±0.005	DESIGNED ENTSTORT		
PRECISION RULER		±0.015		SIZE A	DWG. NO. EML2322L-OTS31	REV A
TAPE MEASURE	±0.030					
PROTRACTOR	±10	±5	±2	SCALE: 1:2		SHEET 1 OF 1

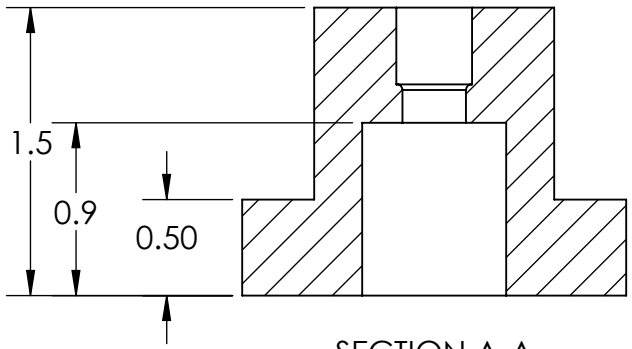


NOTES:
1. QTY: 2
2. ALL DIMS IN INCHES
3. MATL:ALUMINUM
4. UNNOTETED SURFACES UNFINISHED
5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE: Entstort Motor Mount		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	COLTON MAYS	
MACHINING	±0.050	±0.020	±0.005	DESIGNED	COLTON MAYS	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-016	REV C
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 1 OF 1





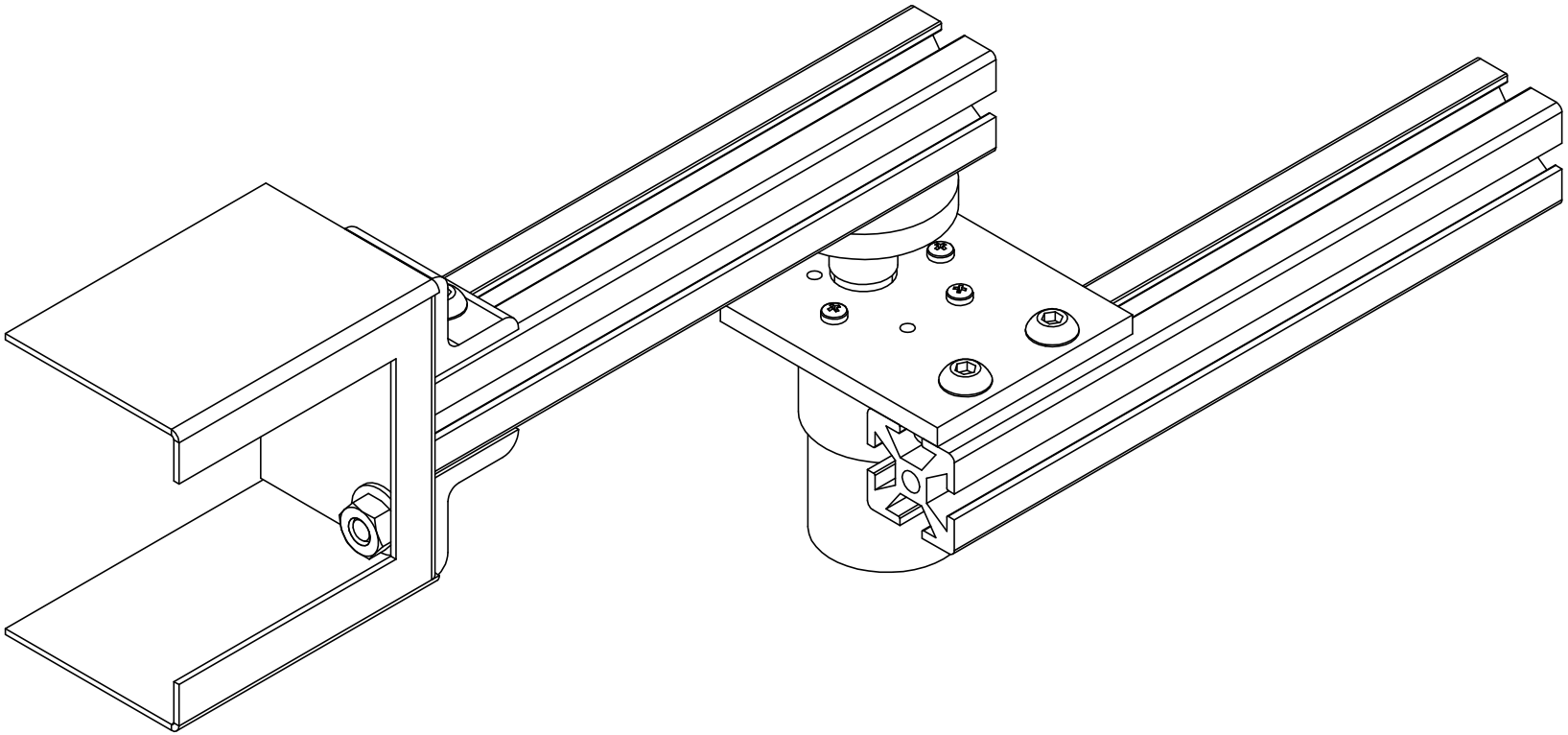


SECTION A-A

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

TOLERANCE UNLESS NOTED				TITLE: Entstort Wheel Hub		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-013	REV C
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 1 OF 1

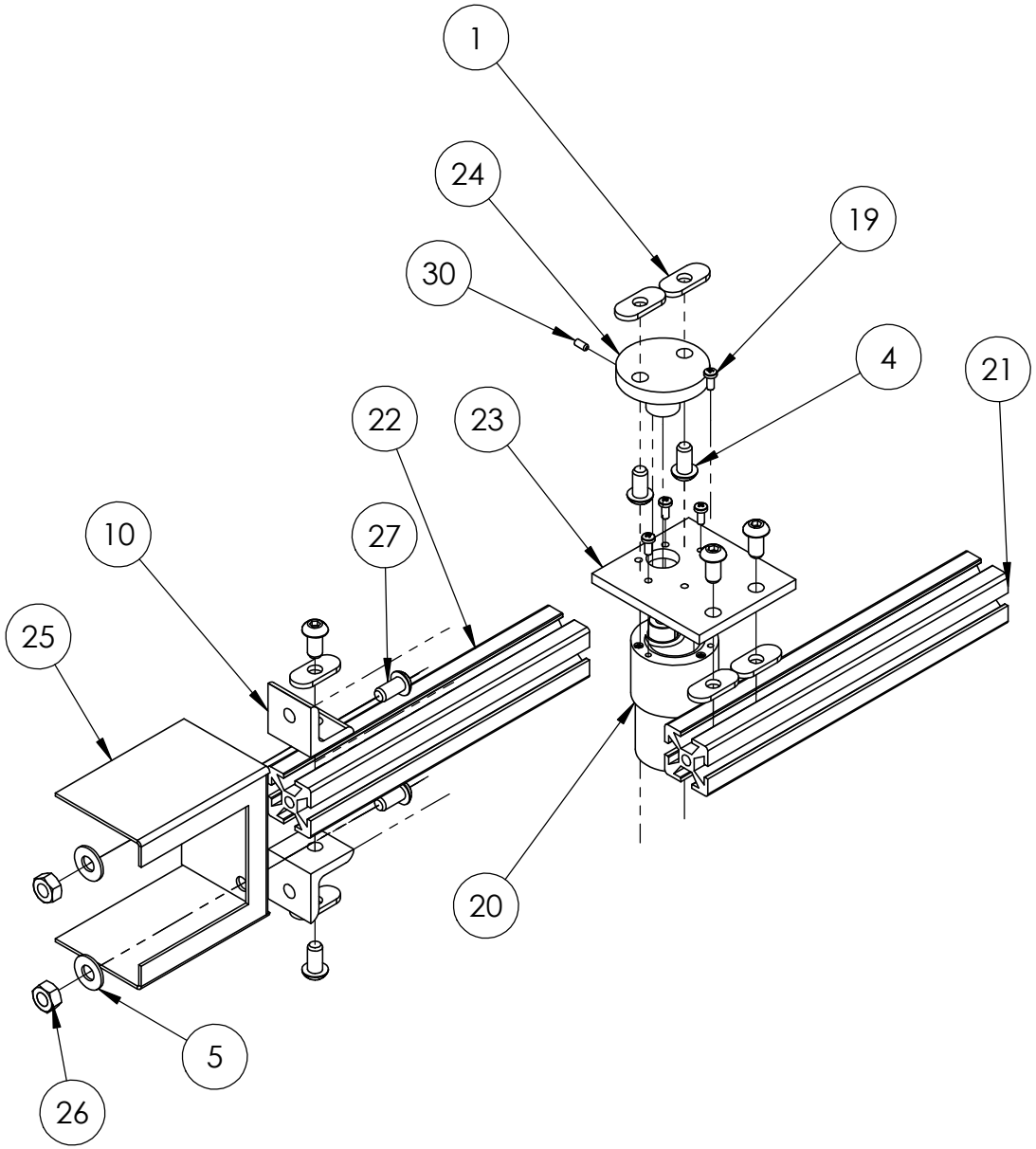
5 4 3 2 1



NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TITLE: Lever Arm					
DRAWN: COLTON MAYS					
TOLERANCE UNLESS NOTED	DESIGNED: COLTON MAYS				
DIMENSION TYPE	PLACES IN DIMENSION			SIZE	DWG. NO.	REV
	0.0	0.00	0.000	A	EML2322L-A-005	A
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 1 OF 3

5 4 3 2 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	6
4	EML2322L-OTS7	1/4-20 x1/2" BHCS	6
5	EML2322L-005	1/4" Washer	2
10	EML2322L-OTS12	80/20 90 Degree Angle Bracket	2
19	EML2322L-019	M3 X 10mm Screw	4
20	EML2322L-OTS29	15 RPM SEI Gear Motor	1
21	EML2322L-021	80-20 Extrusion. 7.0"	1
22	EML2322L-022	80-20 Extrusion, 6.5"	1
23	EML2322L-023	15RPM SEI Gear Motor Mount	1
24	EML2322L-024	15 RPM SEI Gear Wheel Hub Lever Arm	1
25	EML2322L-025	Ball Grabber	1
26	EML2322L-026	1/4-20 Hex Nut	2
27	EML2322L-027	1/4-20 X 3/8" BHCS	2
30	EML2322L-030	4-40 1/4" Set Screw	1

NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

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

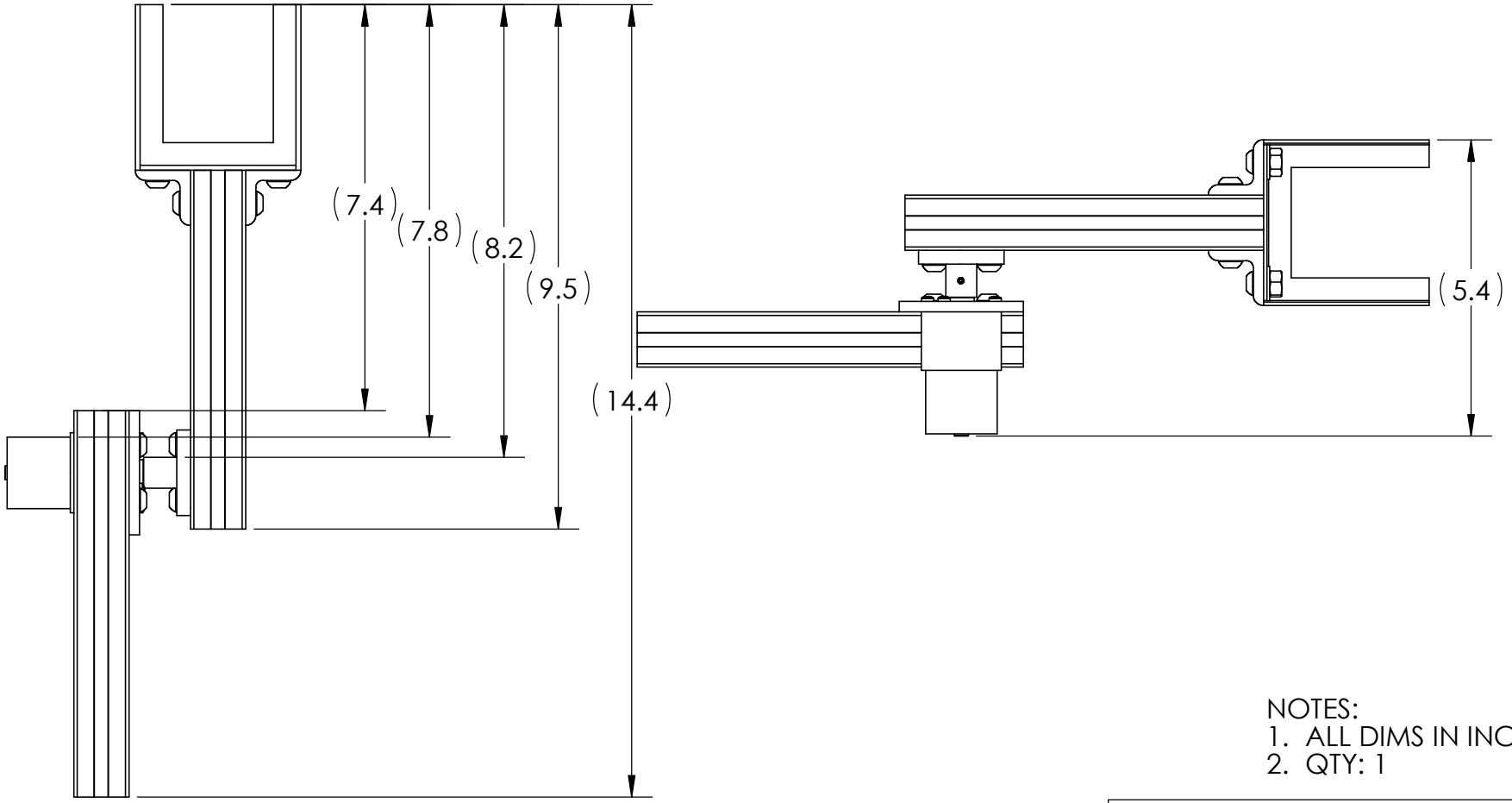
TITLE: Lever Arm

DRAWN COLTON MAYS

DESIGNED COLTON MAYS

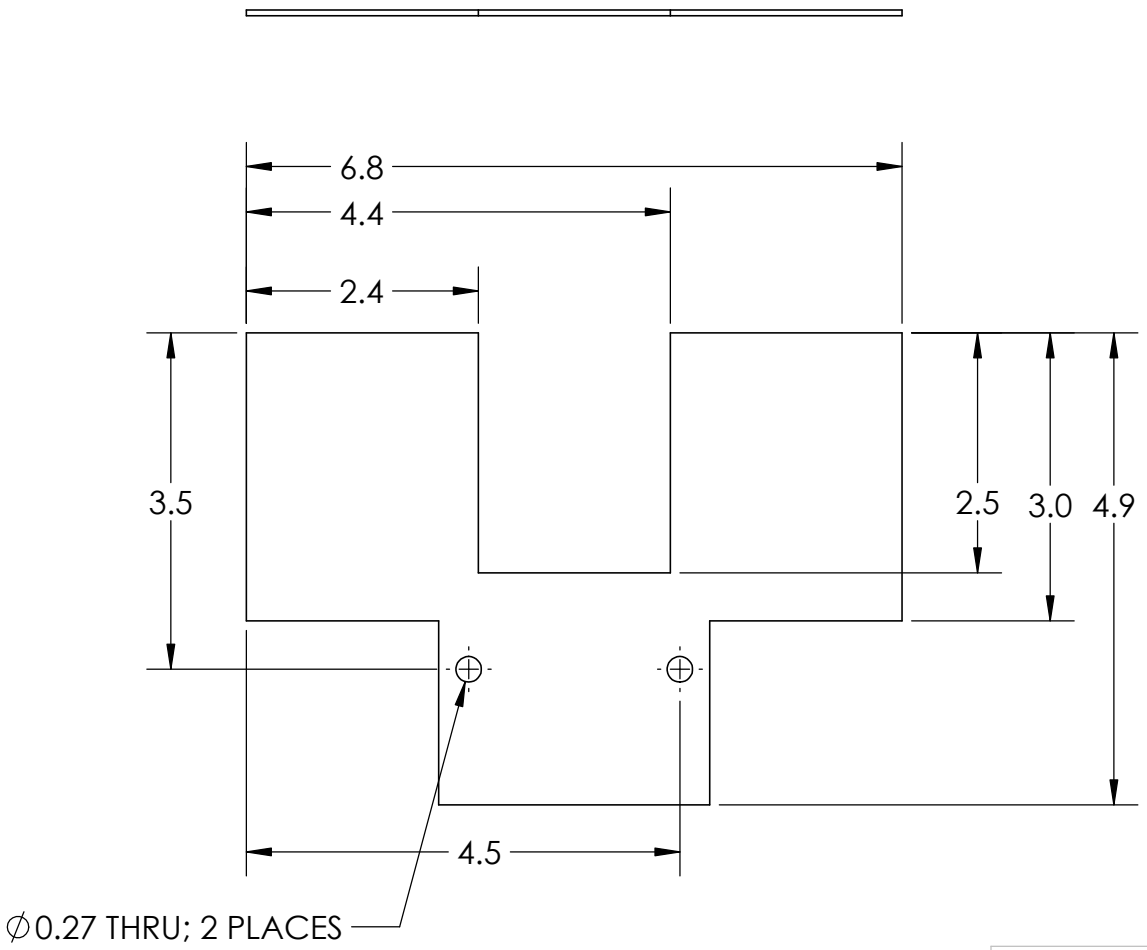
SIZE	DWG. NO.	REV
A	EML2322L-A-005	B

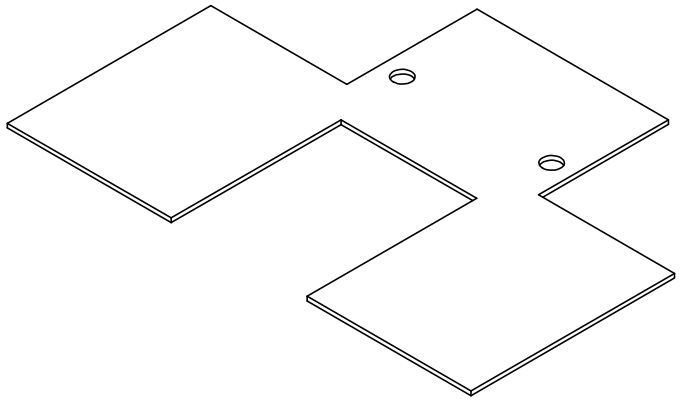
SCALE: 1:3 SHEET 2 OF 3



NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TITLE: Lever Arm					
DRAWN COLTON MAYS					
DESIGNED COLTON MAYS					
TOLERANCE UNLESS NOTED				SIZE	DWG. NO. / REV
DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000	A	EML2322L-A-005 / B
LOCATIONAL	±0.050	±0.020	±0.005		
ANGULAR	±5	±2	±0.5	SCALE: 1:3	SHEET 3 OF 3

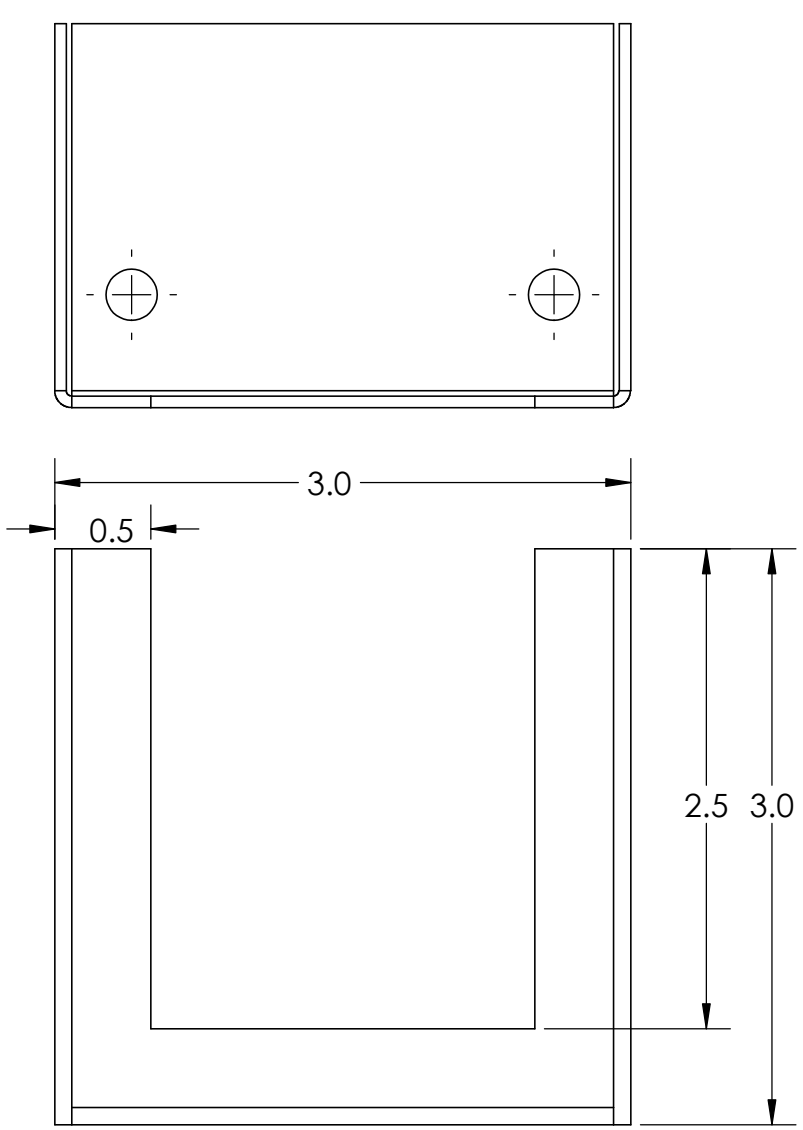


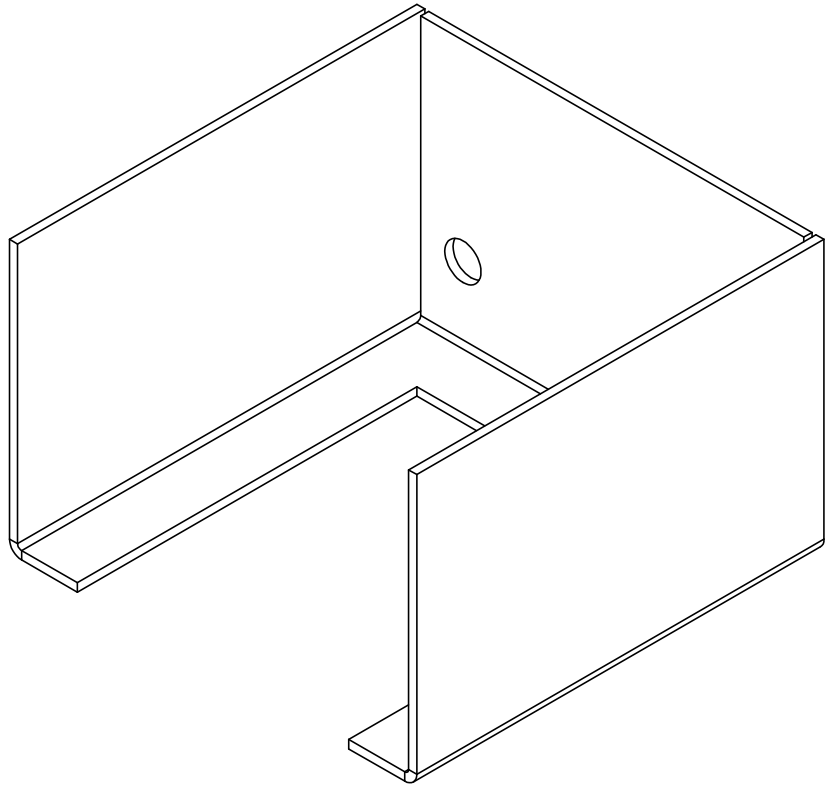


UNFOLDED VIEW
(IF APPLICABLE)

NOTES:
1. DIMS IN INCHES
2. QTY: 1
3. FINISH NOTED SURFACES
4. MAT'L: 16 GAUGE STEEL SHEET METAL
5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE: Ball Grabber Part	
OPERATION	PLACES IN DIMENSION				
	0.0	0.00	0.000	DRAWN COLTON MAYS	
MACHINING				DESIGNED COLTON MAYS	
SHEETMETAL (SHEAR, BEND)	±0.1	±0.060	±0.030	SIZE A	DWG. NO. EML2322L-025 REV B
WELDING	±0.1	±0.060			
ANGULAR DIMS	±5	±2		SCALE: 1:2	SHEET 1 OF 2

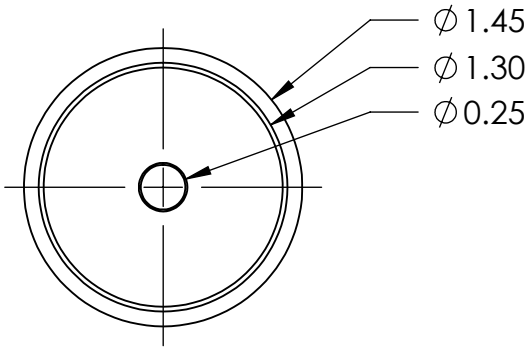


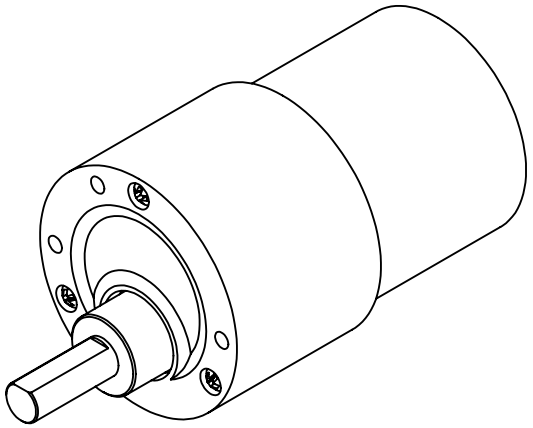


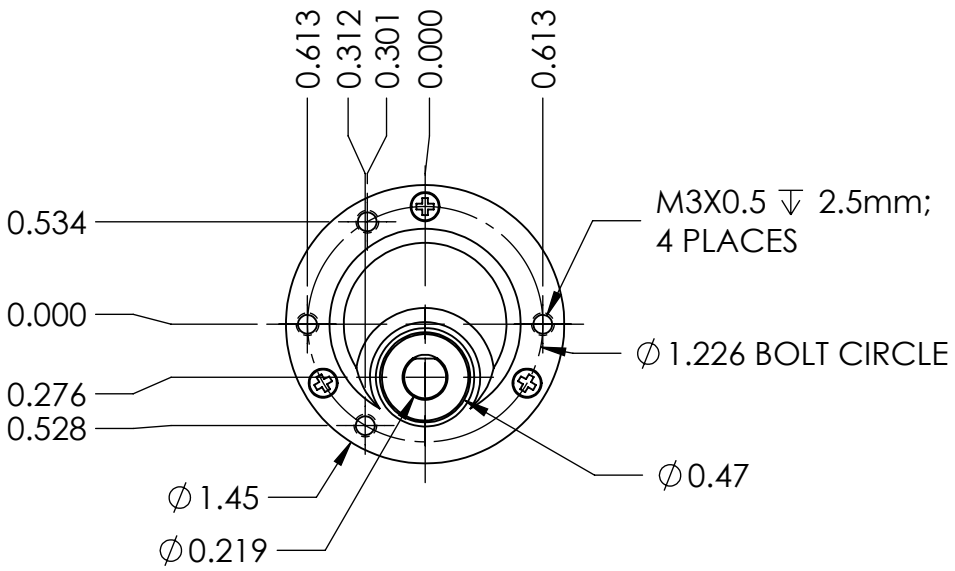
FOLDED VIEW
(IF APPLICABLE)

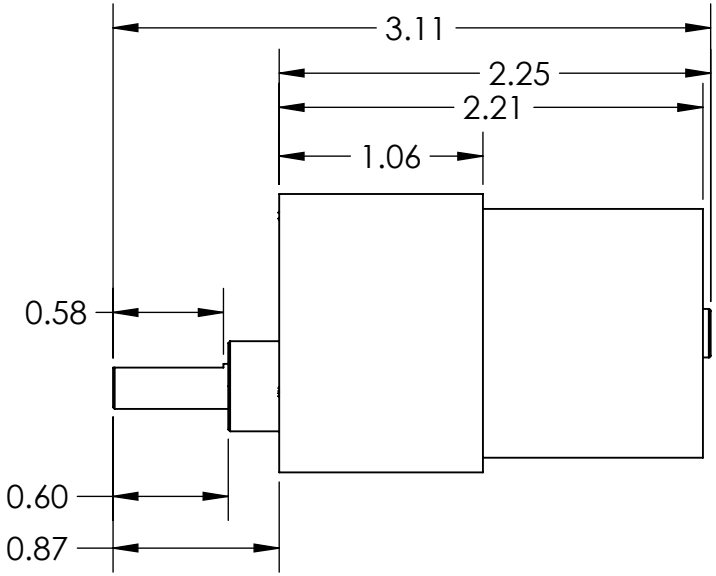
NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1
3. FINISH NOTED SURFACES
4. MAT'L 16 GAUGE SHEET METAL
5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE: Ball Grabber Part	
OPERATION	PLACES IN DIMENSION				
	0.0	0.00	0.000	DRAWN CYRIL MORAN	
MACHINING				DESIGNED CYRIL MORAN	
SHEETMETAL (SHEAR, BEND)	±0.1	±0.060	±0.030	SIZE A	DWG. NO. EML2322L-025 REV B
WELDING	±0.1	±0.060			
ANGULAR DIMS	±5	±2		SCALE: 1:1	SHEET 2 OF 2





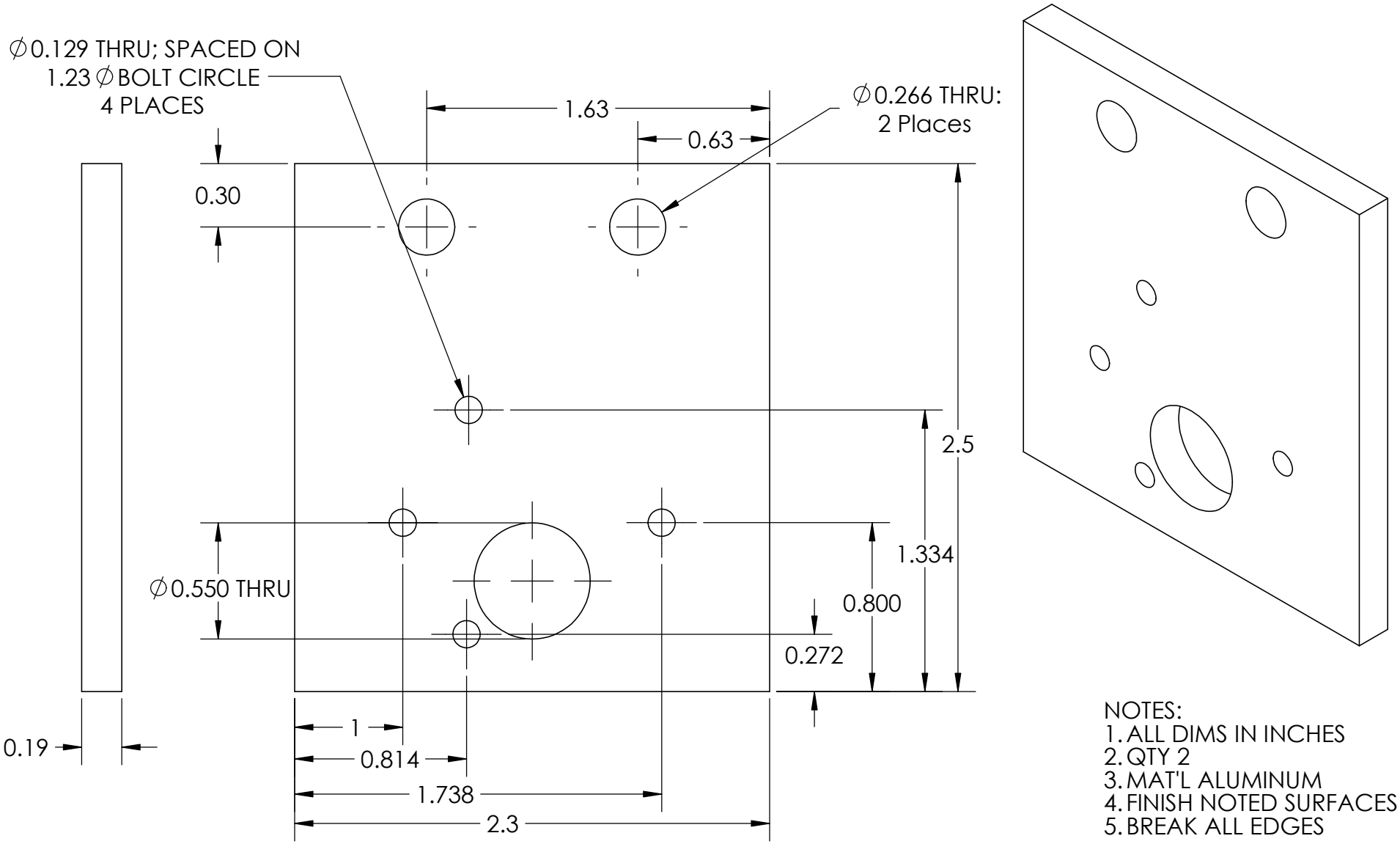




NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIMS AND MAT'L SPECIFIED BY MANUFACTURER

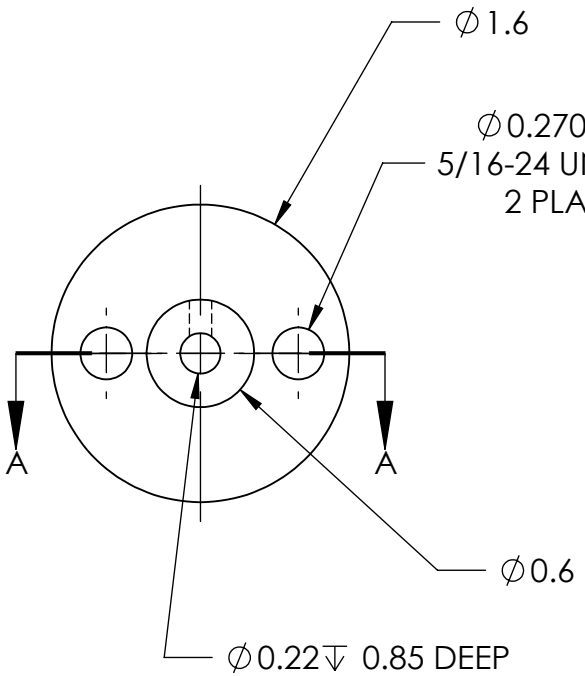
TOLERANCE UNLESS NOTED				TITLE: 15 RPM SEI Gear Motor		
MEASURING INSTRUMENT	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN A. LEWIS		
CALIPERS			±0.005	DESIGNED SEI		
PRECISION RULER		±0.015		SIZE A	DWG. NO. EML2322L-OTS29	REV A
TAPE MEASURE	±0.030					
PROTRACTOR	±10	±5	±2	SCALE: 1:1		SHEET 1 OF 1

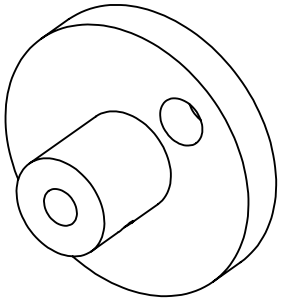
5 4 3 2 1

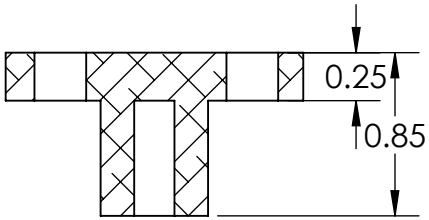


NOTES:
1. ALL DIMS IN INCHES
2. QTY 2
3. MAT'L ALUMINUM
4. FINISH NOTED SURFACES
5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE: 15 RPM SEI Gear Motor Mount	
OPERATION	PLACES IN DIMENSION				
	0.0	0.00	0.000	DRAWN COLTON MAYS	
MACHINING	±0.050	±0.020	±0.005	DESIGNED COLTON MAYS	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-023 REV B
WELDING	±0.1	±0.060			
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1.5:1	SHEET 1 OF 1





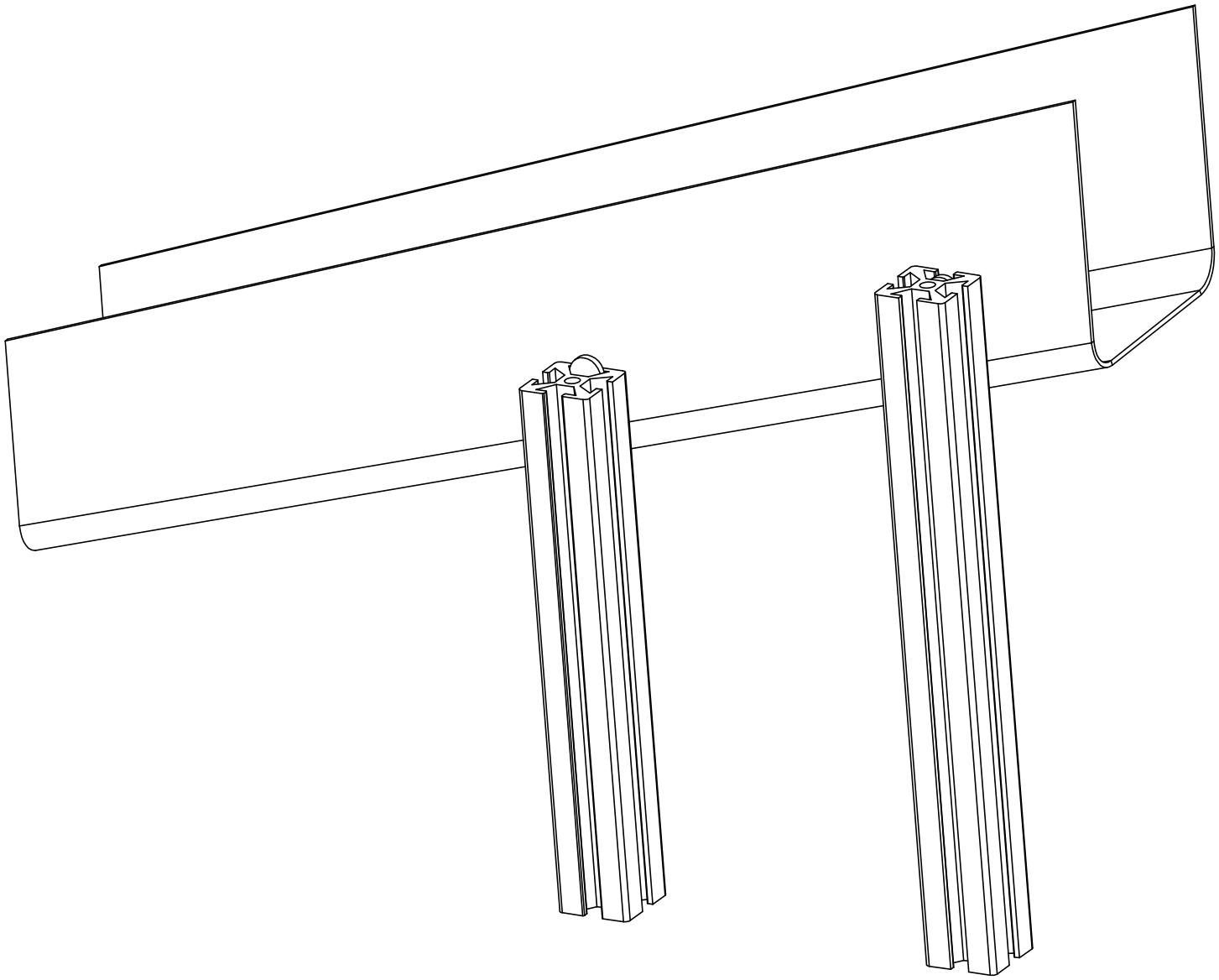


SECTION A-A

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

TOLERANCE UNLESS NOTED				TITLE: 15 RPM SEI Gear Motor Hub Lever Arm		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	CYRIL MORAN	
MACHINING	±0.050	±0.020	±0.005	DESIGNED	CYRIL MORAN	
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-024	B
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 1 OF 1

5 4 3 2 1

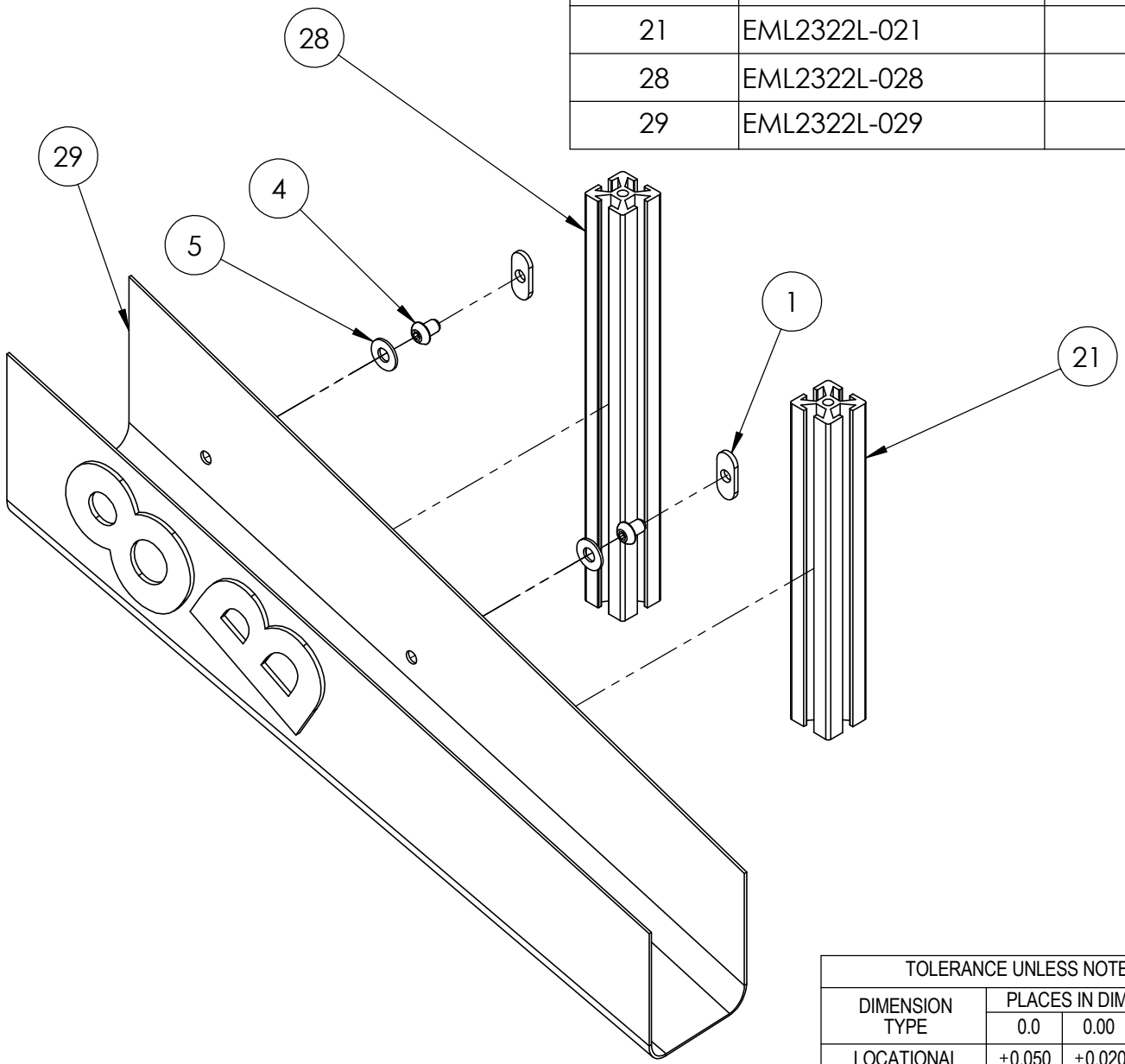


NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TITLE: Ball Hopper					
DRAWN COLTON MAYS					
TOLERANCE UNLESS NOTED	DESIGNED WYNN FUREY				
DIMENSION TYPE	PLACES IN DIMENSION			SIZE	DWG. NO.	REV
	0.0	0.00	0.000	A	EML2322L-A-006	A
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 1:2		SHEET 1 OF 3

5 4 3 2 1

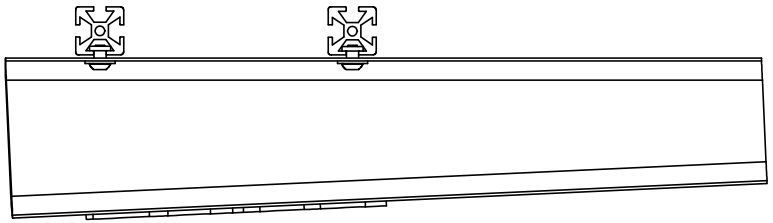
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-OTS6	1/4-20 T-Nut	2
4	EML2322L-OTS7	1/4-20 X 1/2 inch BHCS	2
5	EML2322L-005	1/4" Washer	2
21	EML2322L-021	80-20 Extrusion, 7.0"	1
28	EML2322L-028	80-20 Extrusion, 9.0"	1
29	EML2322L-029	Ball Hopper Part	1

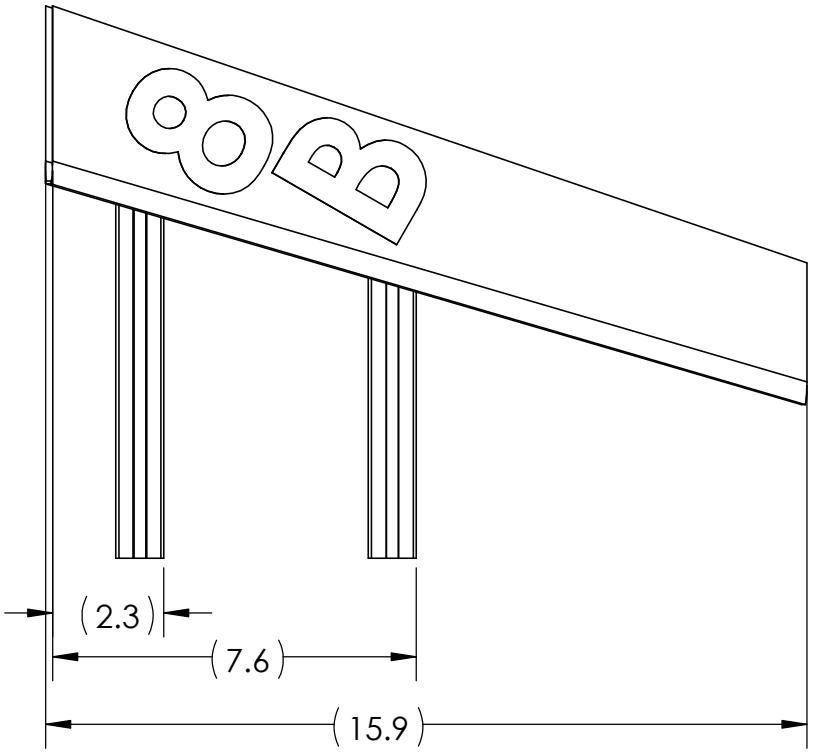


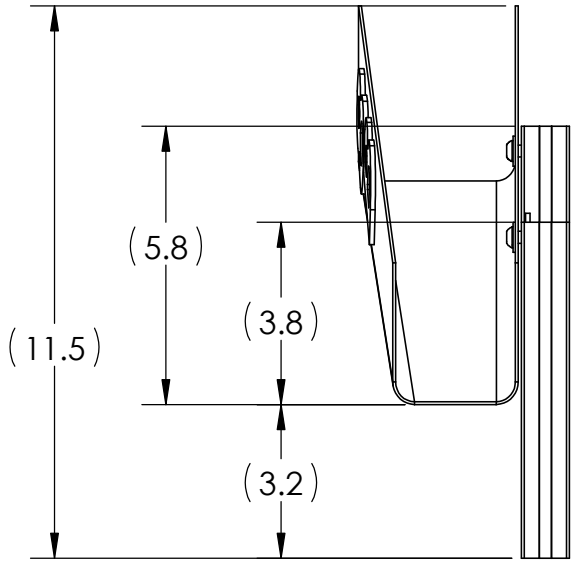
NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TITLE: Ball Hopper			
DRAWN COLTON MAYS			
DESIGNED WYNN FUREY			
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-A-006		REV A
SCALE: 1:3			SHEET 2 OF 3

5 4 3 2 1



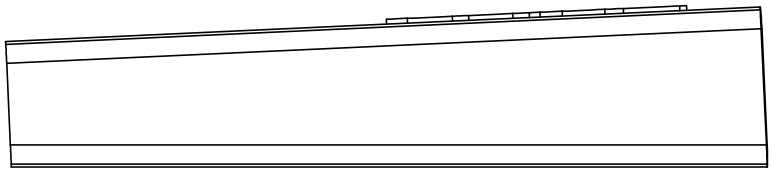


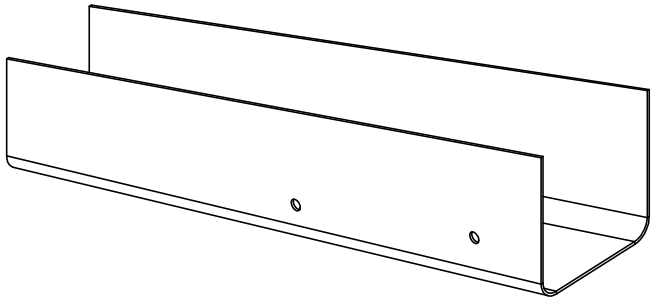


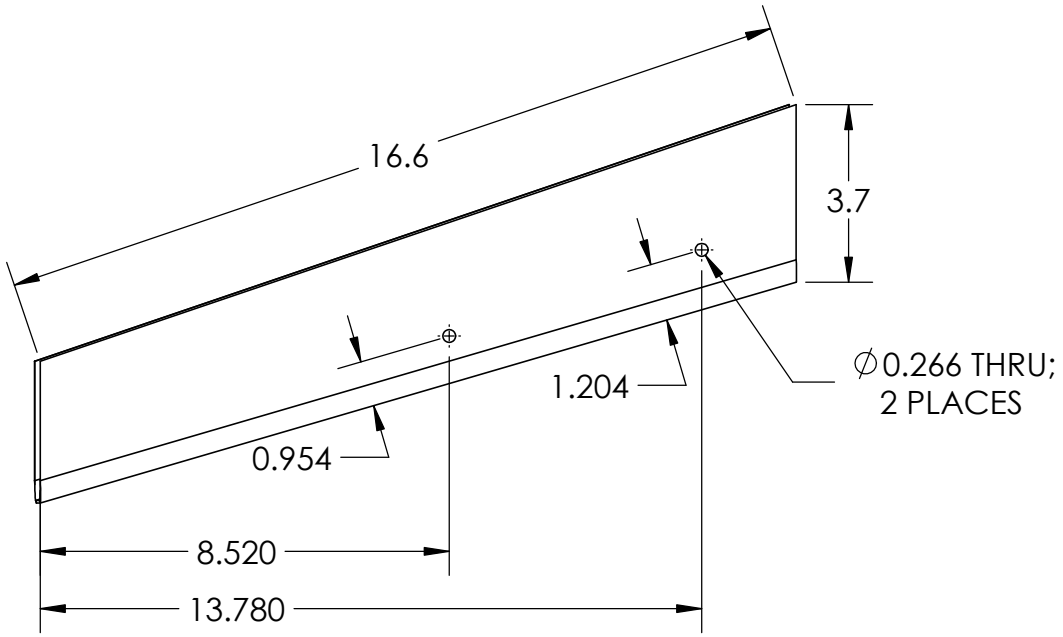
NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TITLE: Ball Hopper					
DRAWN COLTON MAYS					
TOLERANCE UNLESS NOTED	DESIGNED WYNN FUREY				
DIMENSION TYPE	PLACES IN DIMENSION			SIZE	DWG. NO.	REV
	0.0	0.00	0.000	A	EML2322L-A-006	A
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 1:4		SHEET 3 OF 3

5 4 3 2 1



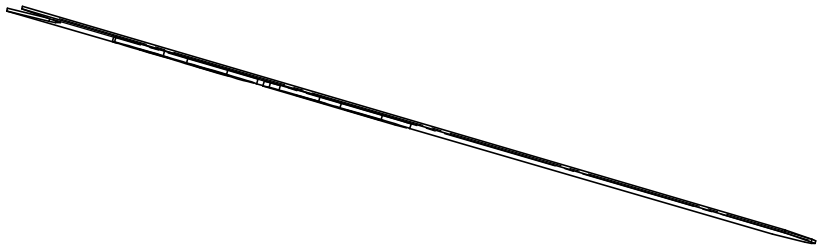


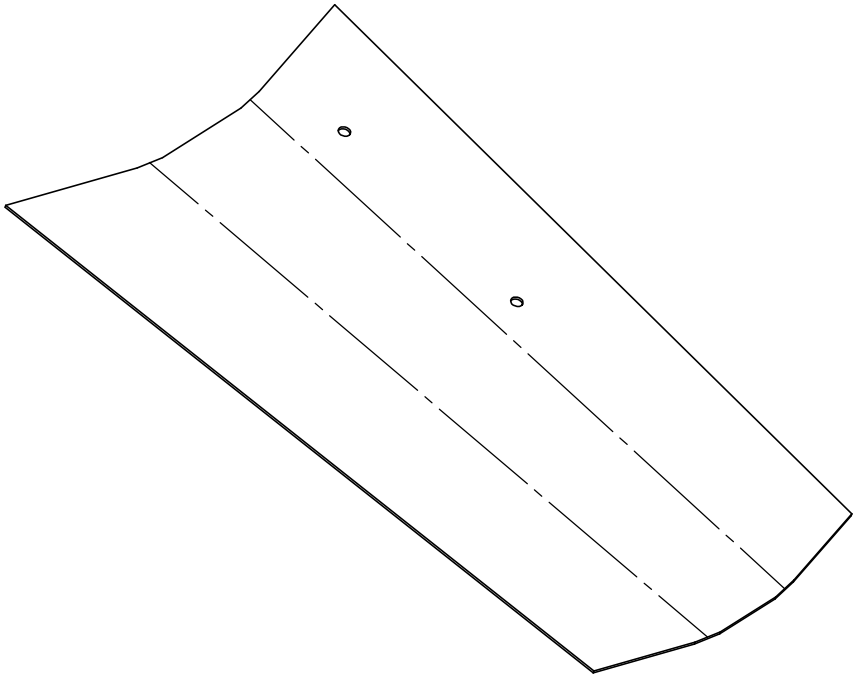


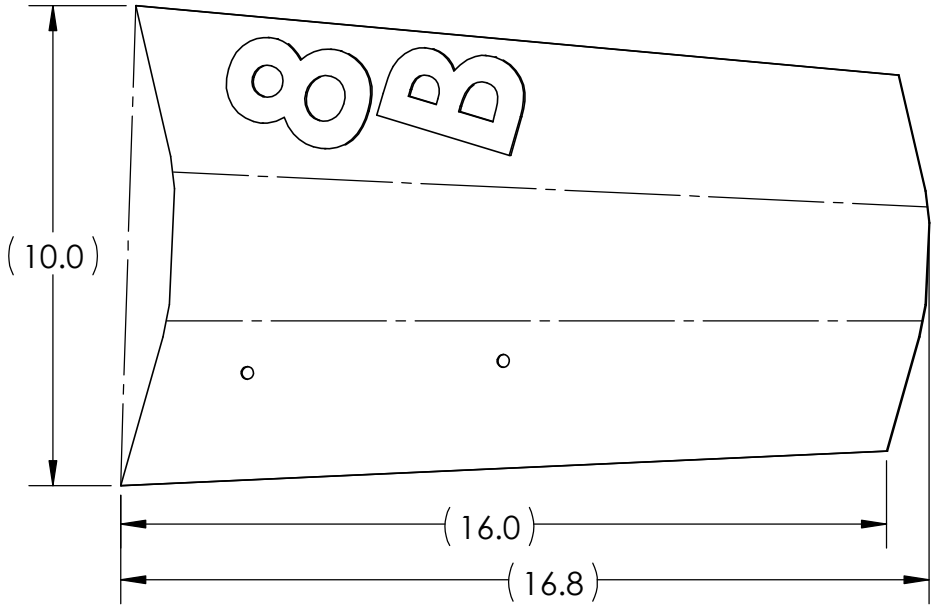
NOTES:
1. DIMS IN INCHES
2. QTY: 1
3. MAT'L 18 GAUGE SHEET METAL
4. BREAK ALL EDGES
5. FINISH NOTED SURFACES

FOLDED VIEW
(IF APPLICABLE)

TOLERANCE UNLESS NOTED				TITLE: Ball Hopper Part		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN	COLTON MAYS	
MACHINING				DESIGNED	WYNN FUREY	
SHEETMETAL (SHEAR, BEND)	±0.1	±0.060	±0.030	SIZE	DWG. NO.	REV
WELDING	±0.1	±0.060		A	EML2322L-029	B
ANGULAR DIMS	±5	±2		SCALE: 1:4		SHEET 1 OF 2



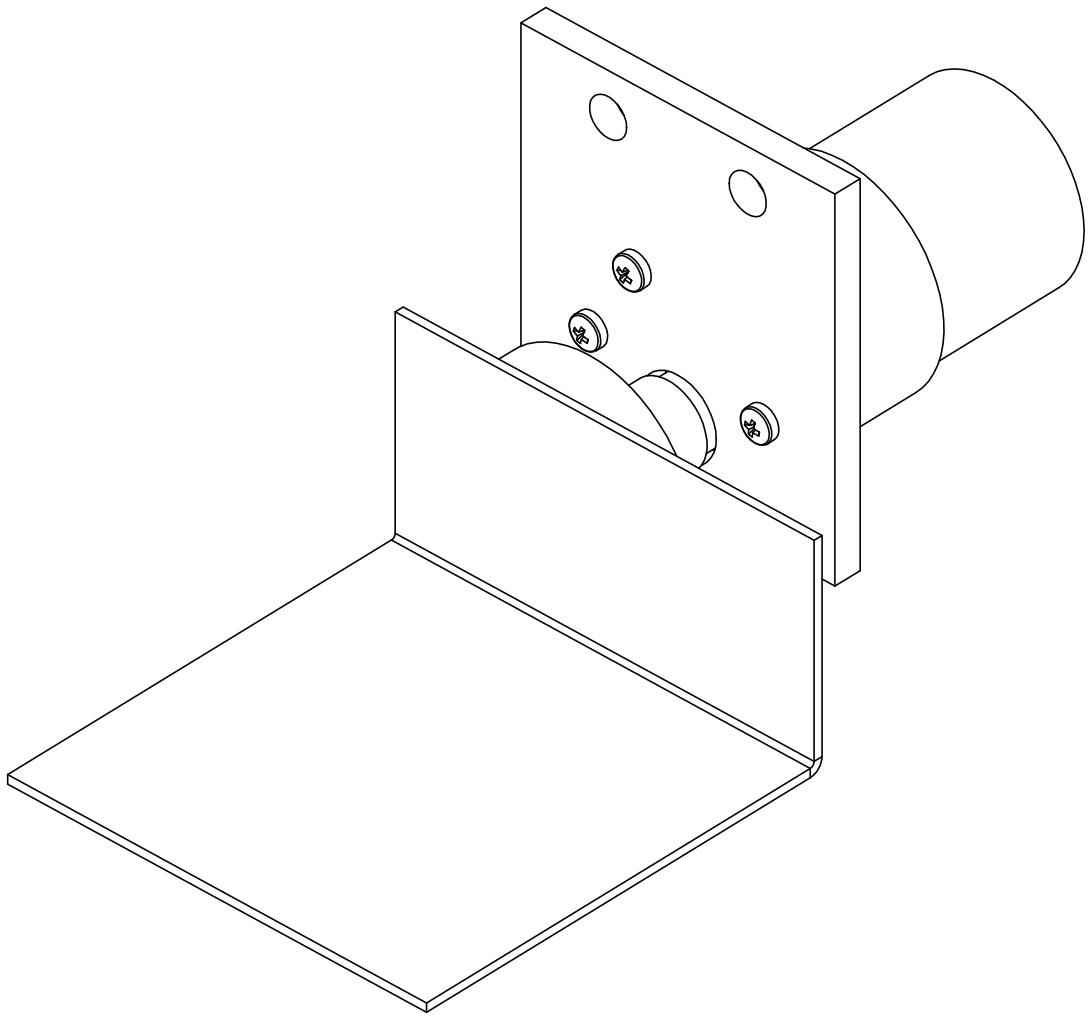




UNFOLDED VIEW
(IF APPLICABLE)

NOTES:
1. DIMS IN INCHES
2. QTY: 1
3. MTL: 16 GA SHEET METAL
4. FINISH NOTED SURFACES
5. BREAK ALL EDGES

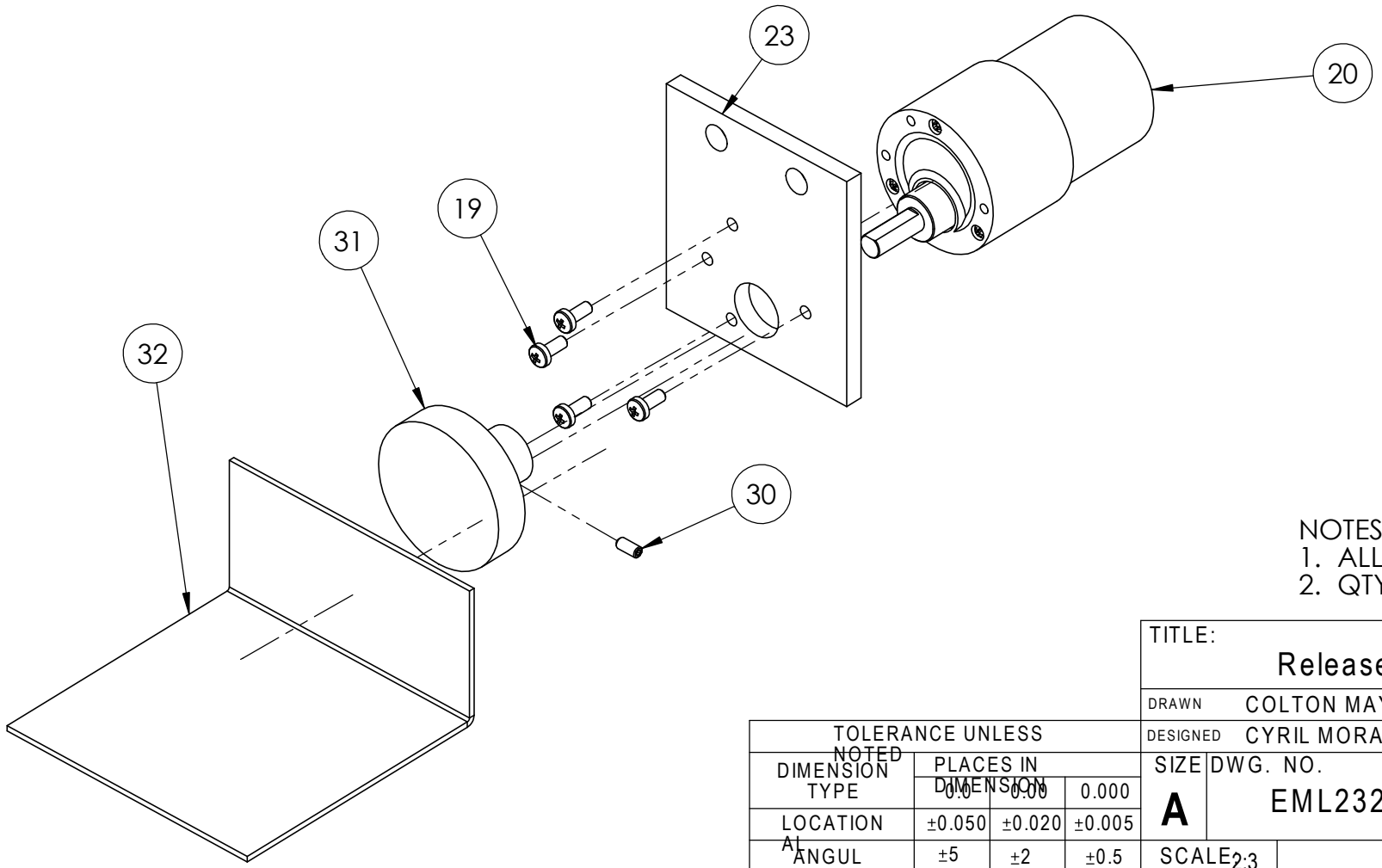
TOLERANCE UNLESS NOTED				TITLE: Ball Hopper Part		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN COLTON MAYS		
MACHINING				DESIGNED WYNN FUREY		
SHEETMETAL (SHEAR, BEND)	±0.1	±0.060	±0.030	SIZE A	DWG. NO. EML2322L-029	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2		SCALE: 1:4		SHEET 2 OF 2



NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

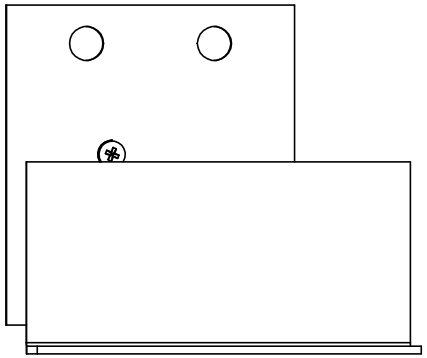
TITLE: Release Gate					
DRAWN COLTON MAYS					
DESIGNED COLTON MAYS					
TOLERANCE UNLESS NOTED				SIZE	DWG. NO. / REV
DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000	A	EML2322L-A-004 / B
LOCATION	±0.050	±0.020	±0.005		
ANGULAR	±5	±2	±0.5	SCALE 1:1	SHEET 1 OF 3

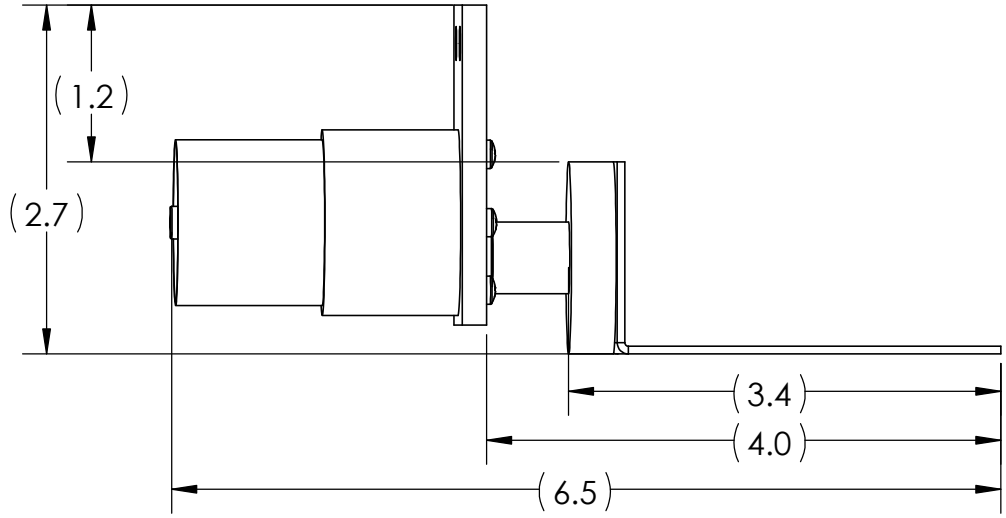
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
19	EML2322L-019	M3 X 10mm Screw	4
20	EML2322L-OTS29	15 RPM SEI Gear Motor	1
23	EML2322-023	15 RPM SEI Gear Motor Mount	1
30	EML2322-030	Alloy Steel Cup-Point Set Screw	1
31	EML2322L-031	15 RPMSEI Gear Motor Hub Release Gate	1
32	EML2322L-032	Release Gate Part	1

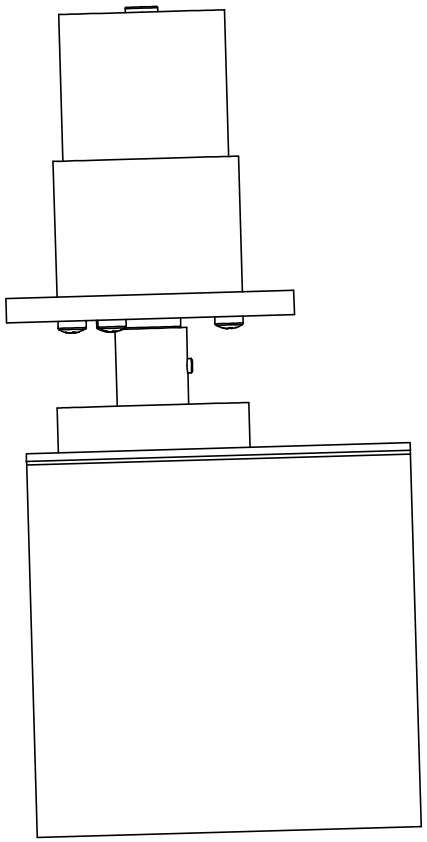


NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TITLE: Release Gate			
DRAWN COLTON MAYS			
DESIGNED CYRIL MORAN			
TOLERANCE UNLESS NOTED			
DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000
LOCATION	±0.050	±0.020	±0.005
ANGULAR	±5	±2	±0.5
SIZE A	DWG. NO. EML2322L-A-004		REV B
SCALE 2:3			SHEET 2 OF 3

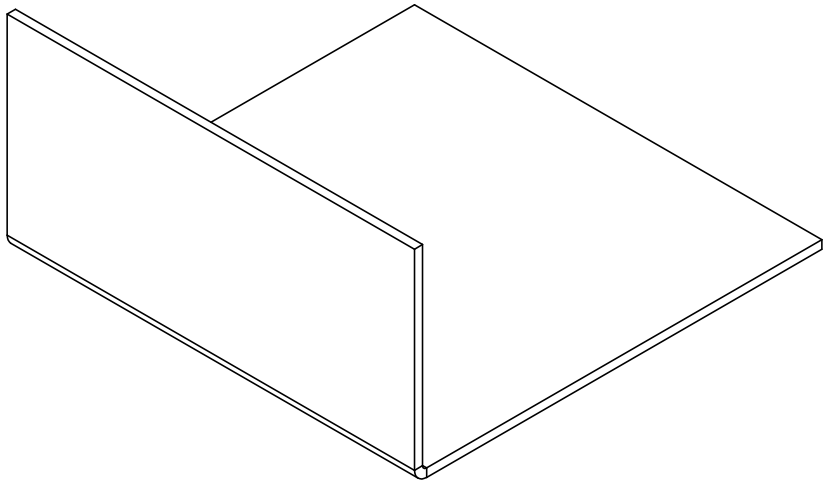


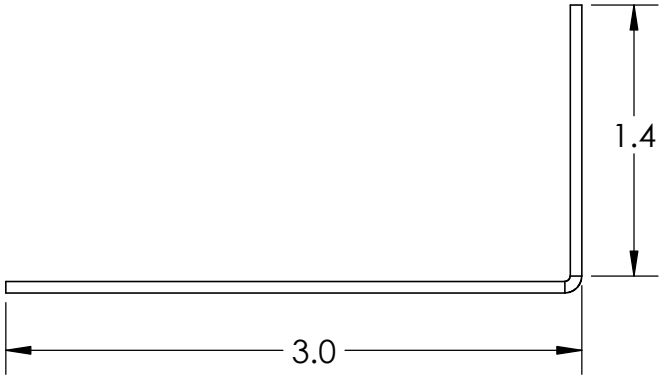


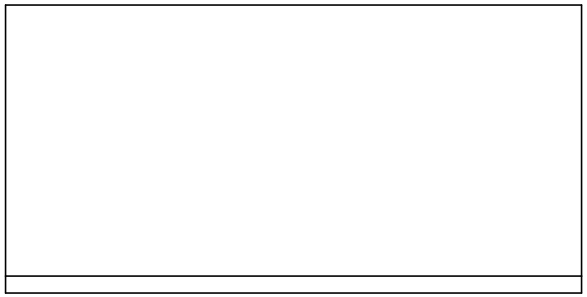


NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1

TITLE: Release Gate					
DRAWN COLTON MAYS					
DESIGNED COLTON MAYS					
TOLERANCE UNLESS NOTED			SIZE	DWG. NO.	REV
DIMENSION TYPE	PLACES IN DIMENSION			A	EML2322L-A-004	B
	0.0	0.00	0.000			
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 2:3		SHEET 3 OF 3





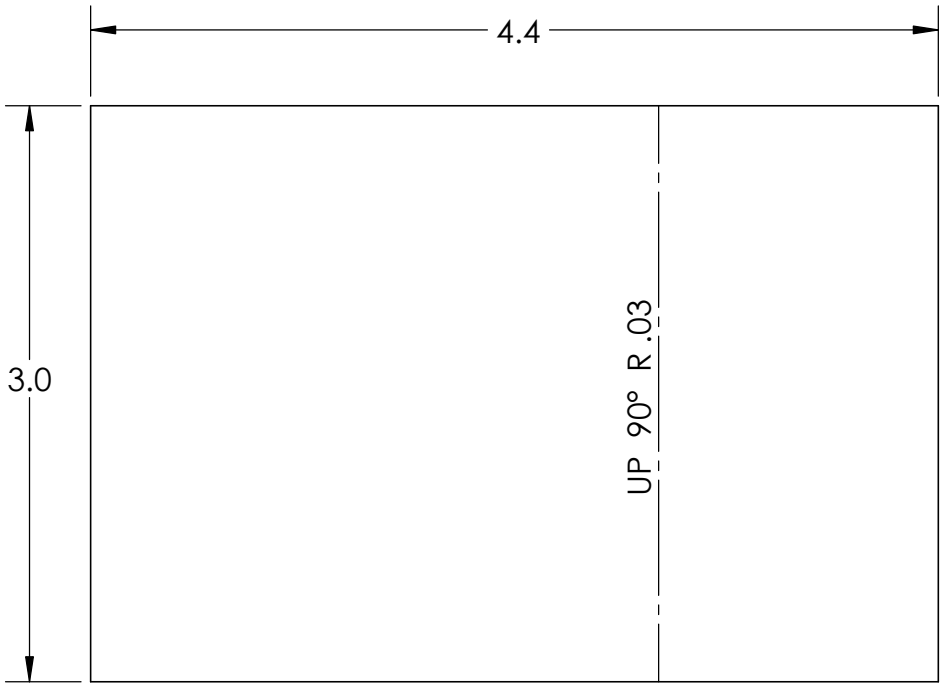


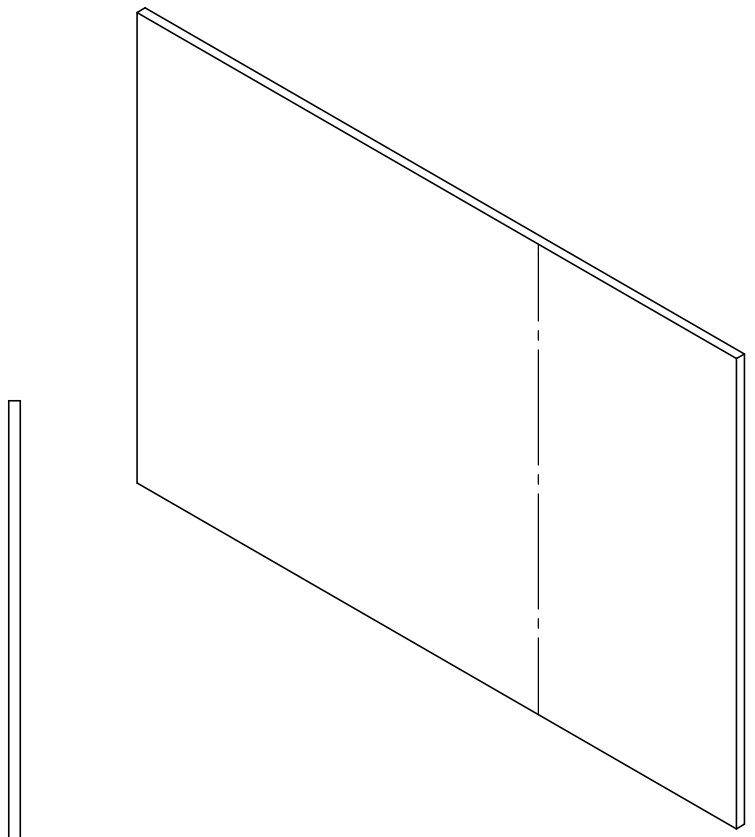
NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1
3. FINISH NOTED SURFACES
4. MAT'L 16 GAUGE SHEET METAL
5. BREAK ALL EDGES

FOLDED VIEW
(IF APPLICABLE)

TOLERANCE UNLESS NOTED				TITLE: Release Gate Part		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN COLTON MAYS		
MACHINING				DESIGNED COLTON MAYS		
SHEETMETAL (SHEAR, BEND)	±0.1	±0.060	±0.030	SIZE A	DWG. NO. EML2322L-032	REV A
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2		SCALE: 1:1		SHEET 1 OF 2

5 4 3 2 1

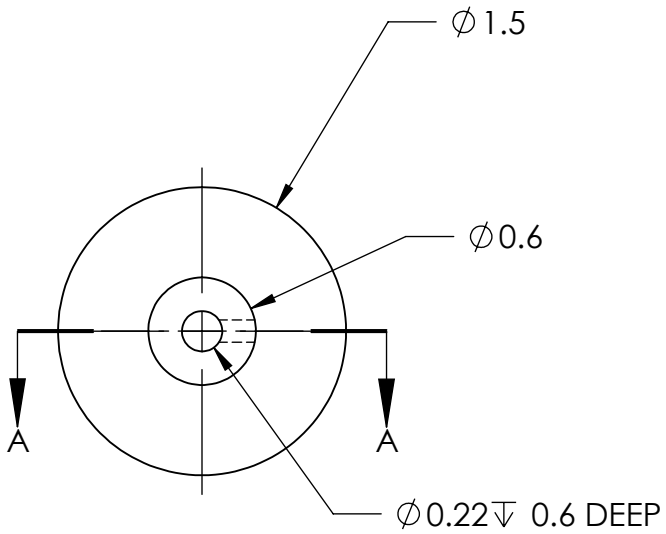


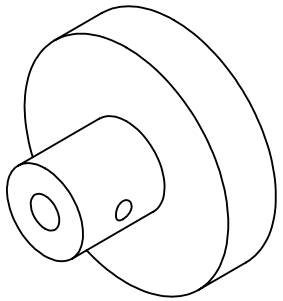


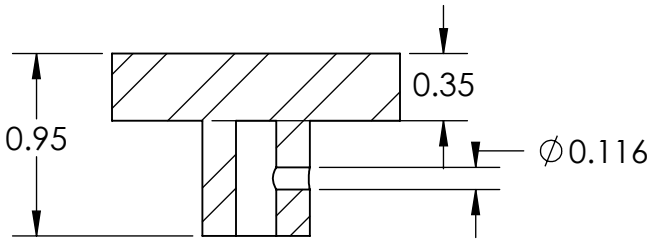
NOTES:
1. ALL DIMS IN INCHES
2. QTY: 1
3. FINISH NOTED SURFACES
4. MAT'L 16 GAUGE SHEET METAL
5. BREAK ALL EDGES

UNFOLDED VIEW
(IF APPLICABLE)

TOLERANCE UNLESS NOTED				TITLE: Release Gate Part		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN COLTON MAYS		
MACHINING				DESIGNED COLTON MAYS		
SHEETMETAL (SHEAR, BEND)	±0.1	±0.060	±0.030	SIZE A	DWG. NO. EML2322L-032	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2		SCALE: 1:1		SHEET 2 OF 2







SECTION A-A

NOTES:
1. QTY: 1
2. ALL DIMS IN INCHES
3. MAT'L STEEL
4. FINISHED NOTES SURFACES
5. BREAK ALL EDGES

TOLERANCE UNLESS NOTED				TITLE: SEI Motor Hub Release Gate		
OPERATION	PLACES IN DIMENSION					
	0.0	0.00	0.000	DRAWN CYRIL MORAN		
MACHINING	±0.050	±0.020	±0.005	DESIGNED CYRIL MORAN		
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060		SIZE A	DWG. NO. EML2322L-031	REV B
WELDING	±0.1	±0.060				
ANGULAR DIMS	±5	±2	±0.5	SCALE: 1:1		SHEET 1 OF 1

5 4 3 2 1

Appendix D: Estimated Project Budget

Project Budget for Team 8B

Item Description	Vendor	Qty	Unit	Unit Price	Subtotal
Ø 2.0" AL round bar stock (wheel hubs)	LAB	0.33	ft	$20.00	$6.60
3/16" x 2.50" AL rect. bar stock (motor mounts)	LAB	1.25	ft	$3.75	$4.69
16 gauge steel sheetmetal (release mechanism, hopper, ball manipulator)	LAB	2	ft^2	$4.00	$8.00
80/20 1" x 1" aluminum extrusion (*)	LAB	5.8	ft	$3.00	$17.40
Ø 1.5" steel round bar stock (release gate wheel hub)	LAB	1	in.	$10.00	$10.00
Entstort 44 RPM right angle gear motor	LAB	2	each	N/C	N/C
Ø 8" Type 1 Wheel	LAB	2	each	N/C	N/C
Ø 5" Swivel Caster Wheel	LAB	1	each	N/C	N/C
15 RPM SEI Gear Motor	LAB	2	each	N/C	N/C
1/4 - 20 Hex Nut	LAB	2	each	N/C	N/C
80/20 1" x 1" aluminum extrusion	LAB	6	ft	N/C	N/C
80/20 aluminum right angle brackets	LAB	17	each	N/C	N/C
1/4-20 T-Nut	LAB	70	each	N/C	N/C
1/4-20 x 1/2" button head fastener (80/20)	LAB	86	each	N/C	N/C
10-24 x 1" button head screw (wheel hubs)	LAB	6	each	N/C	N/C
M8 x 1.25 nut (wheel hubs)	LAB	2	each	N/C	N/C
80/20 aluminum straight bracket	LAB	17	each	N/C	N/C
M3 x 0.5 10 mm screw	LAB	8	each	N/C	N/C
1/4 in. washer	LAB	6	each	N/C	N/C
M6 x 1.0 20 mm hex head screw	LAB	6	each	N/C	N/C
1/4-20 X 3/8" BHCS	LAB	4	each	N/C	N/C
4-40 1/4" set screw	LAB	2	each	N/C	N/C

TOTAL $46.69

NOTES:

(*) denotes this is in addition to the 12' provided in the project description
(**) denotes this was provided by the team and not paid for from the project budget