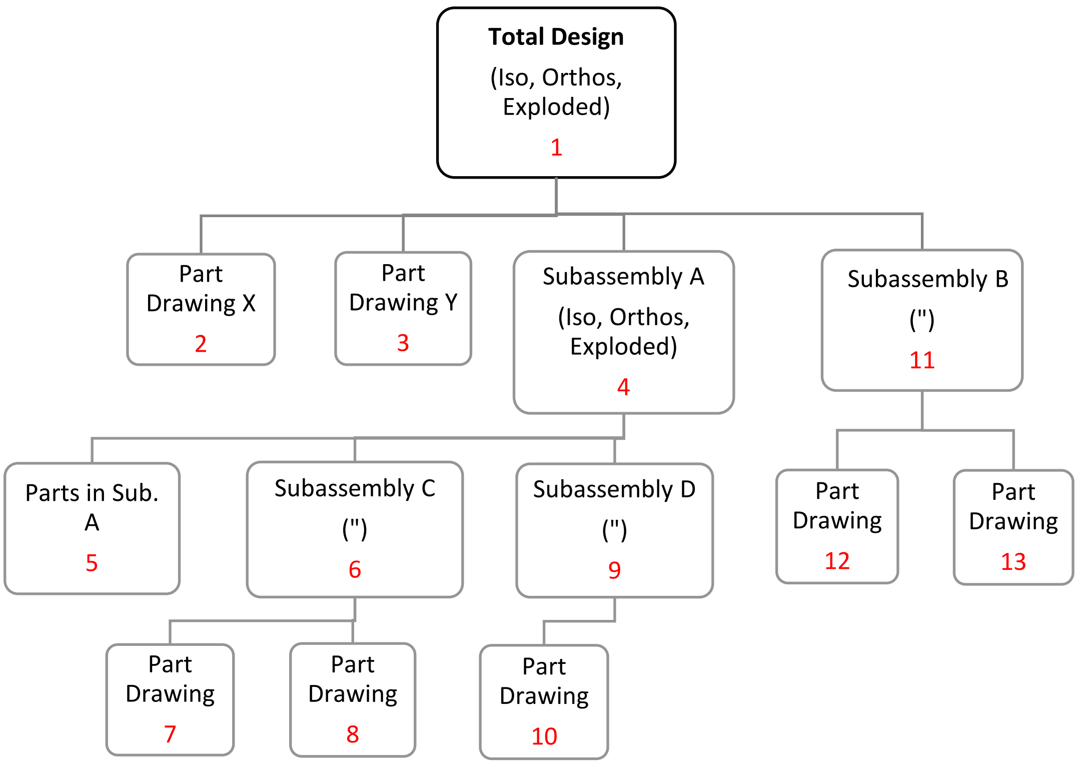
Assembly Drawing Organization and Dimensioning

This document explains the proper process for organizing and dimensioning the assembly drawings created for DR3.

<u>Report Organization</u>

The following graphic illustrates the correct way drawings should be ordered.



If a design is comprised of subassemblies A and B, and components X and Y *(which are not part of another subassembly (like a control box, for example)).* First, the assembly drawings *(iso, orthos, exploded views, BOM)* for the entire design should be shown with proper dims between individual components / assemblies. Next, individual part drawings for parts X and Y should be shown. After all individual parts have been shown, assembly drawings for subassembly A are shown. The same sequence outlined above is repeated for this assembly. All parts not in other assemblies are listed first, followed by their constituent subassemblies *(where the same* *ordering procedure is maintained)*. Notice how each subassembly is broken down immediately after it is shown before moving on to assemblies on the same level. Once everything under the tree in subassembly A has been shown, move on to subassembly B. If a part is an element of multiple subassemblies *(for example if part 5 and part 12 are the same),* it only needs to be shown once, in its earliest location. But, be sure to keep its item number / part name consistent in the BOM and exploded views.

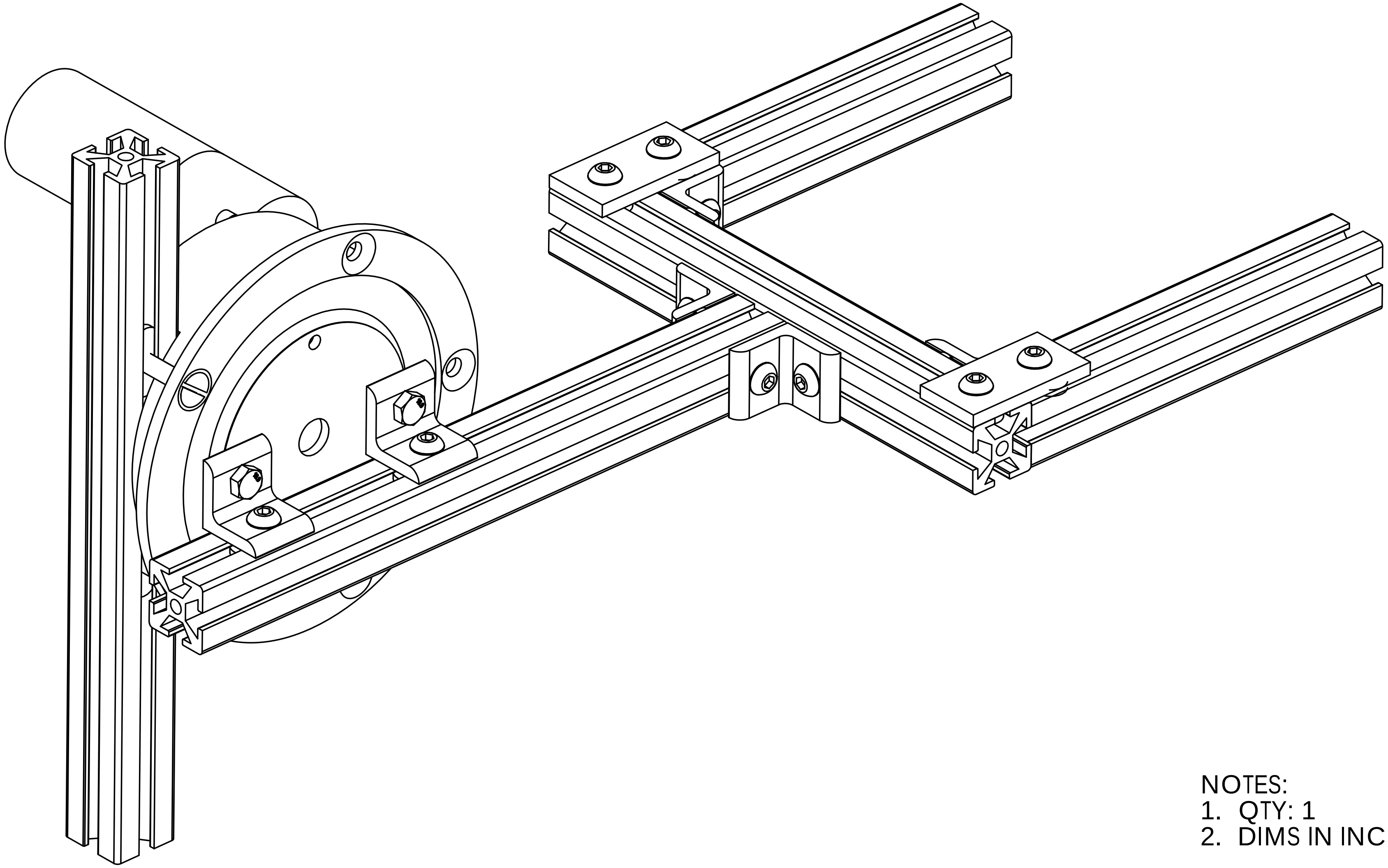
Assembly Dimensioning Guidelines

When creating ortho drawings for assemblies, the only dims needed are those that locate individual components with respect to each other. Constituent subassemblies should be treated as if they have already been constructed. So, dimensions pertinent to the smaller assemblies do not need to be included in the larger assembly drawings. Instead, dims between that subassembly and other assemblies/components that it mates to need to be included.

Likewise, dims that are solely driven by the geometry of components, rather than their mating locations, are also unnecessary since they do not provide relevant information regarding the fabrication of the assembly. The overall length of the Gripper Assembly in the attached example is a good illustration of this concept. The total length is independent of how the parts fit together. The value could also easily be derived by referencing the exploded view of the assembly to determine the parts, and subsequently the respective part files (and then adding the pertinent dims). The components can't be assembled in a way consistent with the exploded view that results in a dimension of anything other than 17.0 inches. So, it isn't a requisite dimension in the orthographic views. But, the overall length of the assembly could be a useful dimension to have for a variety of reasons; therefore, it is included as a reference dimension *(designated by parentheses around the dimension)*. Reference dims could be described by the line of thought *"I don't use this value to put the assembly together, but this is just how it turns out to be when the rest of the dimensions are followed"*. Reference dims are used to clarify dims that provide useful information or benefit to the assembler in some way where an actual dim would over-define the drawing. Things like overall length or height are common examples of reference dims.

To improve ease of assembly, it is beneficial to provide locational dims between component features that actually mate to each other. For example, if dimensioning the mounting location for a Globe motor along the length of a piece of 80/20, it would be best to dimension from one end of the 80/20 to one of the mounting holes on the motor, not to an arbitrary feature on the motor. There are, of course, exceptions to this idea, such as if you were instead mounting an Entstort drive assembly that already has a motor mount attached to the bolt pattern of the motor. If the main concern during assembly is that the edge of the mounting bracket is flush with the edge of the mobile platform, it is safe to assume so. Every situation or exception cannot be listed in a document, so it will be necessary for you to develop your own intuition as far as determining what the proper feature(s) to dimension to are.

The following pages are to serve as an example for the proper way to order and dimension assembly drawings for your third design report (except for, of course, the drawings labeled as "incorrect")



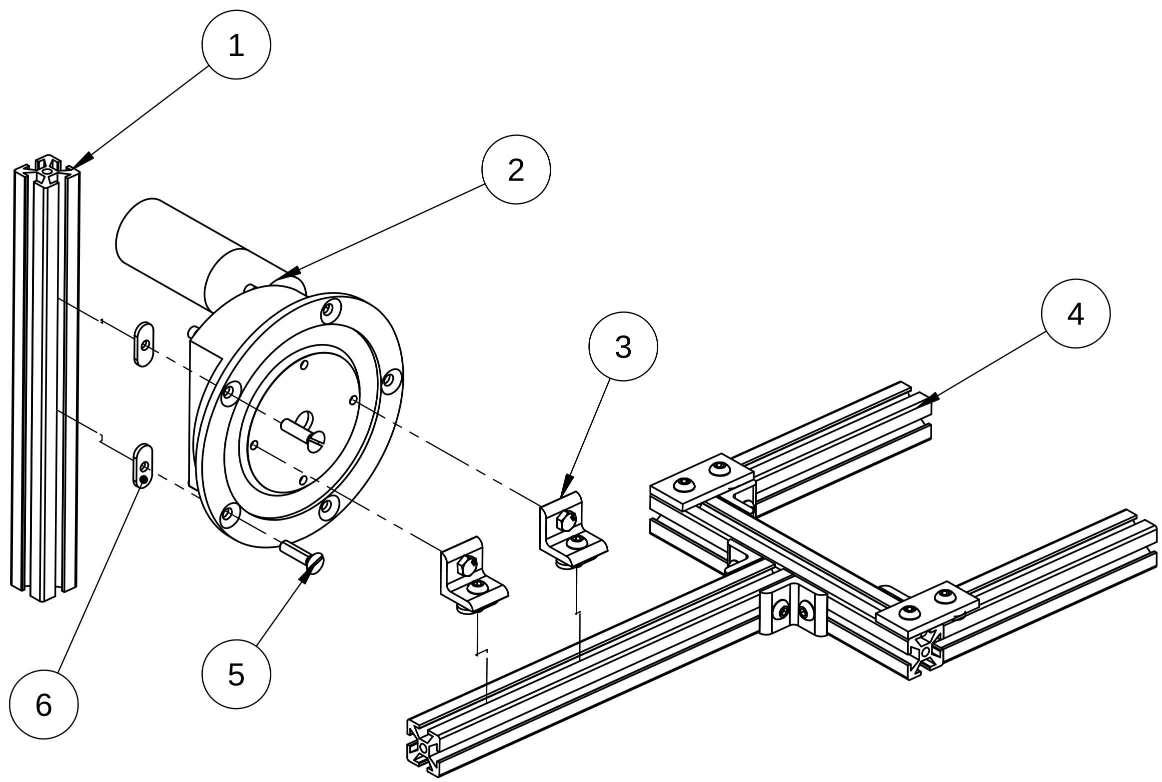
NOTES:
1. QTY: 1
2. DIMS IN INCHES

TITLE: Full Assembly			
DRAWN	H. HOPKINS		
DESIGNED	H. HOPKINS		
SIZE A	DWG. NO. EML2322L-A-001		REV 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

5 4 3 2 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-001	80-20 Extrusion - 10.0 inch	1
2	EML2322L-OTS1	4.5 RPM Globe Motor	1
3	EML2322L-A-002	90 Bracket Assembly for Globe	2
4	EML2322L-A-003	Gripper Assembly	1
5	EML2322L-OTS2	1/4-20 x 1 Flat Head Screw	2
6	EML2322L-OTS3	1/4-20 T-Nut	2



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

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: Full Assembly

DRAWN H. HOPKINS

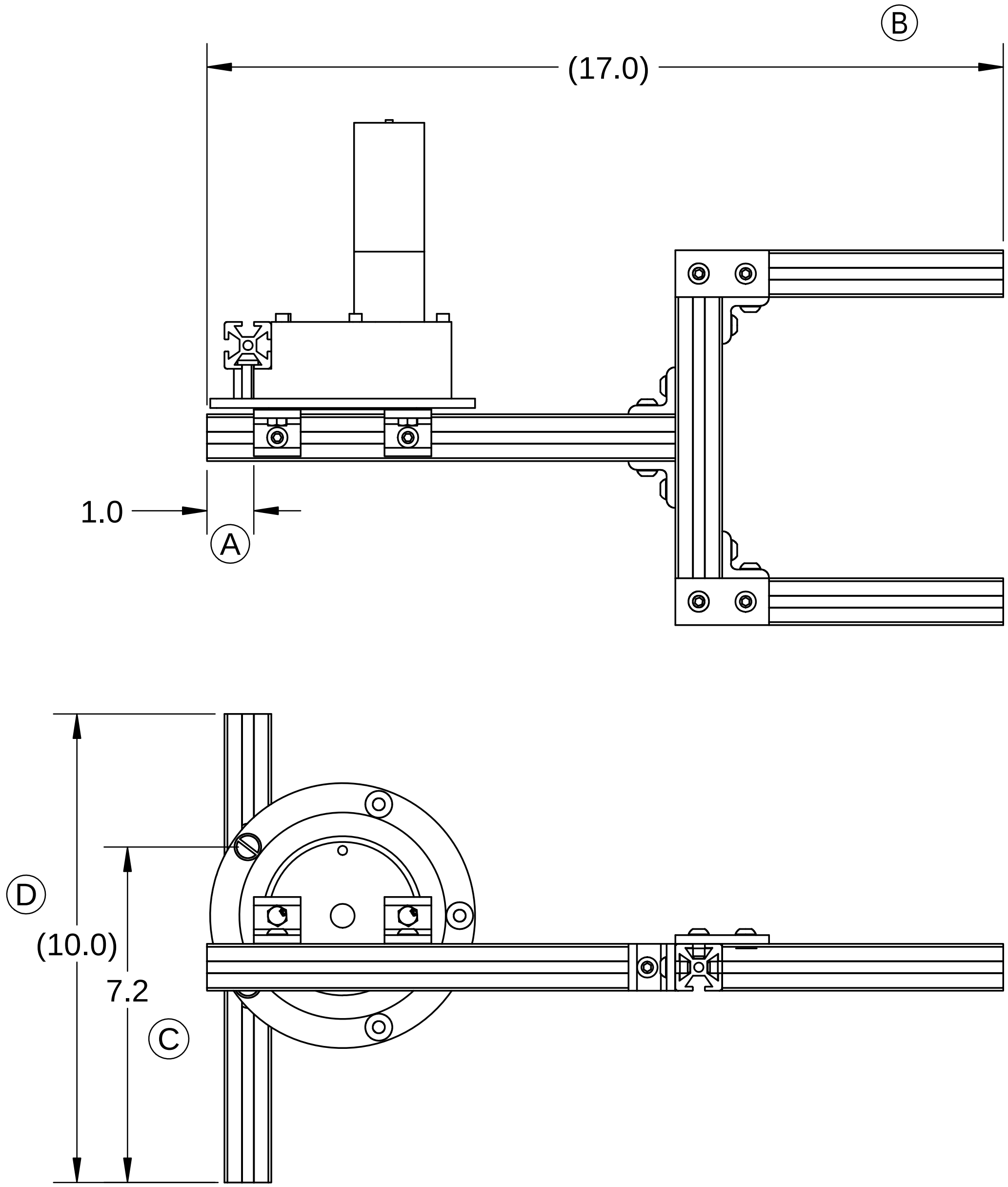
DESIGNED H. HOPKINS

SIZE A | DWG. NO. EML2322L-A-001 | REV A

SCALE: 1:2 | SHEET 2 OF 4

5 4 3 2 1

CORRECT



(A) -- A dimension that indicates where on the 80/20 piece it mounts to the globe motor is required. Only one dimension that defines this distance is needed. If other dimensions were included as well (such as a dimension from the end of the 80/20 to the second bracket), the assembly would be overdefined, since those additional dimensions could be derived from the geometry of the individual part files, and are therefore driven by the first dimension. Note that the dimension is given to the part of the globe motor that mates to the 80/20, making it easier to assemble.

(B)-- This dimension states the overall length of the assembly. However, the dimension is not needed to assemble it properly, since the value can be derived from the individual part files for 80/20 and the Gripper Assembly. But, since the overall length of the total assembly is useful information to have, it is included as a reference dimension.

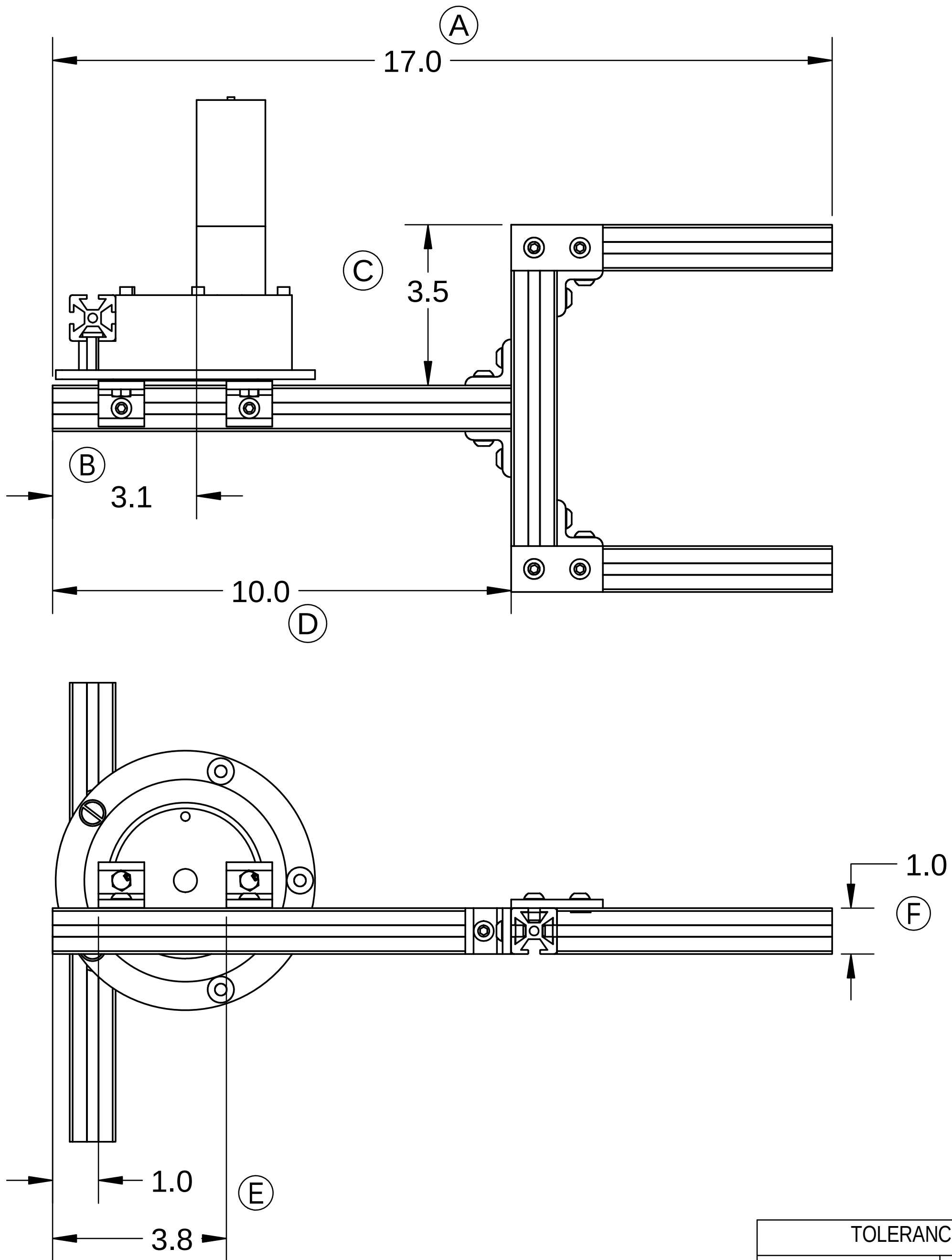
(C)-- One dimension that indicates the distance between the globe motor and the end of the vertical 80/20 that it mounts on is given. Again note that the dimension is given to a mating component, not an arbitraty feature on the motor.

(D) -- Once again, this dimension does not need to be included, because it is simply the length of that piece of 80/20. That value could be found in the part file for that piece. But, since it is useful information for the entire assembly, it is included as a reference dimension.

NOTES:
1. 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:	Full Assembly
DRAWN	HHOPKINS
DESIGNED	HHOPKINS
SIZE	A
DWG. NO.	EML2322L-A-001
REV	A
SCALE: 1:2	SHEET 3 OF 4



INCORRECT

(A) -- This dimension is not needed to assemble the bucket manipulator, since this component should already be constructed. Dimensions to mating components are all that is needed. If included to clarify the overall length of the assembly, it should be done as a reference dimension.

(B) -- Dimension should be given to the mating part of the component, not an arbitratry feature when possible.

(C) -- Dimension should come from the drawings for the Gripper Assembly. It has no value in this drawing, since the assembly of the gripper should be complete before starting to assemble this component.

(D) -- Dimension does not influence how system is assembled. Can be found in part drawing file of 80/20.

(E) -- These dimensions are referencing the same component along the same axis. Only one is needed, since the second is driven by the first. Listing both therefore overdefines the drawing. If for some reason it would be beneficial to have multiple values, all but one should be a reference dimension.

(F) -- Dimension has no influence on how the assembly is put together. Also could be found in individual part drawing.

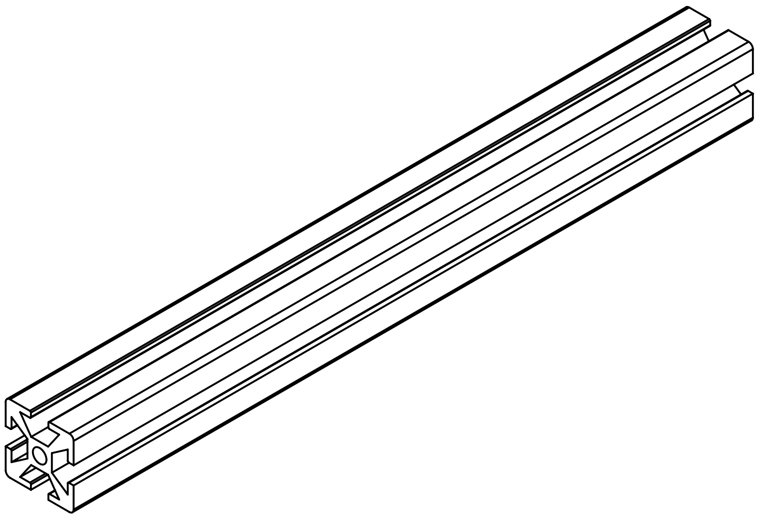
NOTES:
1. DIMS IN INCHES
2. QTY:1

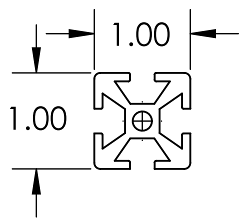
TOLERANCE UNLESS NOTED			
DIMENSION TYPE	PLACES IN DIMENSION		
	0.0	0.00	0.000
LOCATIONAL	±0.050	±0.020	±0.005
ANGULAR	±5	±2	±0.5

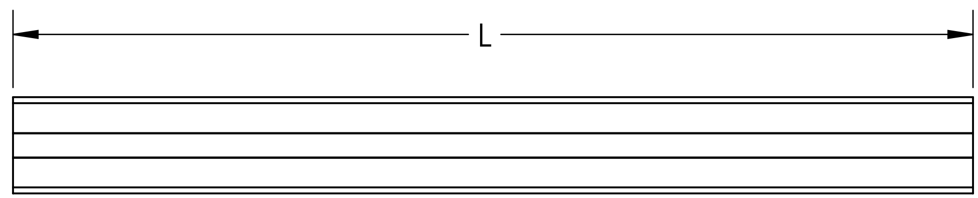
TITLE:	Full Assembly
DRAWN	HHOPKINS
DESIGNED	HHOPKINS
SIZE	A
DWG. NO.	EML2322L-A-001
REV	A
SCALE: 1:2	SHEET 4 OF 4

3 2 1

Part Number	Length	Quantity
EML2322L-001	10.0	2
EML2322L-002	8.0	1
EML2322L-003	6.0	2





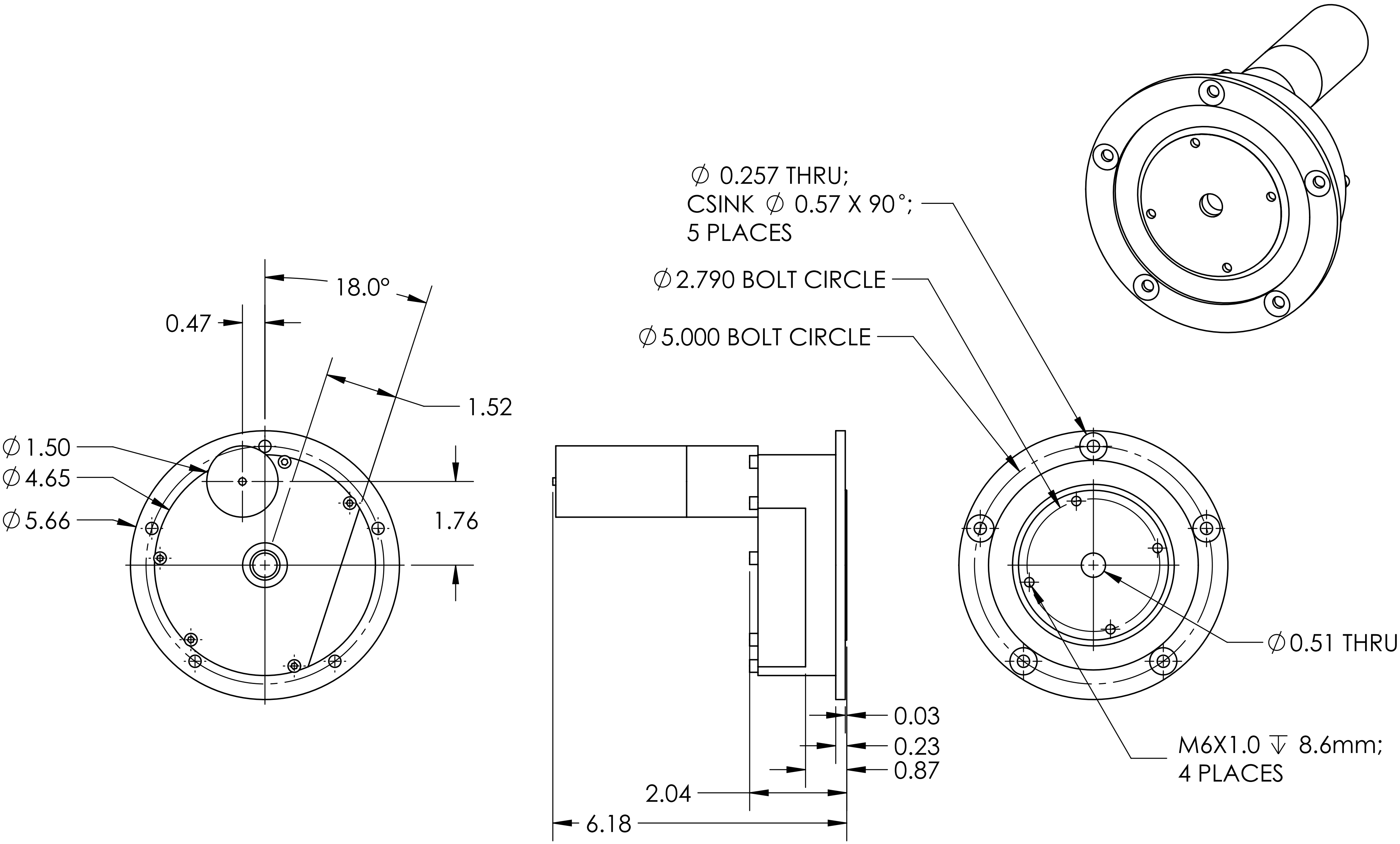


NOTES:
1. DIMS IN INCHES
2. MATL: 80/20 AL EXTRUSION
3. BREAK CUT ENDS
4. FINISH NO SURFACES
5. QTY SPECIFIED IN TABLE

TOLERANCE UNLESS NOTED			
OPERATION	PLACES IN DIMENSION		
	0.0	0.00	0.000
MACHINING	±0.050	±0.020	±0.005
CUT OFF (SAW, BURN, SHEAR)	±0.1	±0.060	
WELDING	±0.1	±0.060	
ANGULAR DIMS	±5	±2	±0.5

TITLE: 80-20 Extrusion 10 inch (simplified)		
DRAWN HHOPKINS		
DESIGNED HHOPKINS		
SIZE A	DWG. NO. EML2322L-XXX	REV A
SCALE: 1:4		SHEET 1 OF 1

5 4 3 2 1



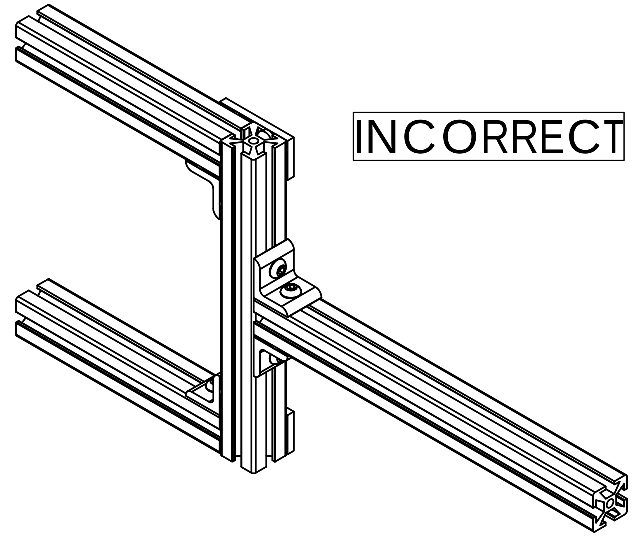
NOTES:
1. DIMS IN INCHES
2. QTY SPECIFIED IN BOM
3. DIMS AND MAT'L SPECIFIED BY MANUFACTURER

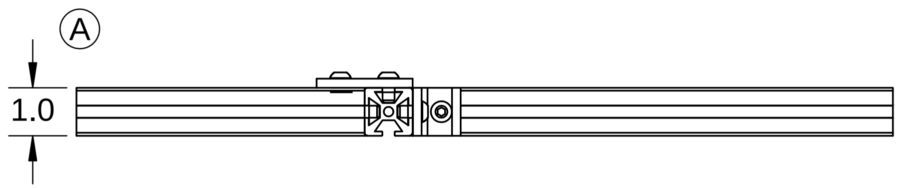
TOLERANCE UNLESS NOTED			
MEASURING INSTRUMENT	PLACES IN DIMENSION		
	0.0	0.00	0.000
CALIPERS			±0.005
PRECISION RULER		±0.015	
TAPE MEASURE	±0.030		
PROTRACTOR	±10	±5	±2

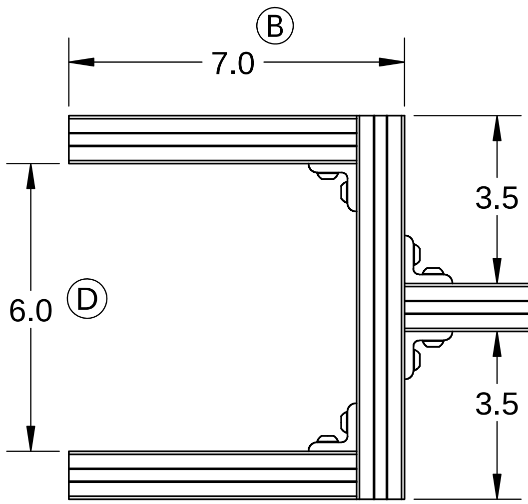
TITLE: 4.5 RPM Globe Gear Motor		
DRAWN	J. DERSCH	
DESIGNED	GLOBE	
SIZE A	DWG. NO. EML2322L-OTS30	REV A
SCALE: 1:3		SHEET 1 OF 1

5 4 3 2 1

NOTE: Drawings/Parts for "90 Bracket Assembly for Globe" (Item 3) should go before this drawing. They are not included in this document because they should be relatively straighforward.







A -- Dimension is unrelated to assembly process. Can be found in part file(s) if needed.

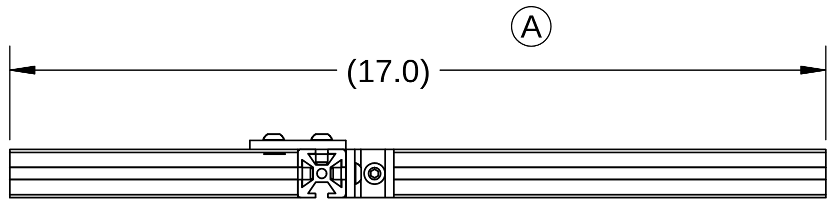
B -- Same problem as A

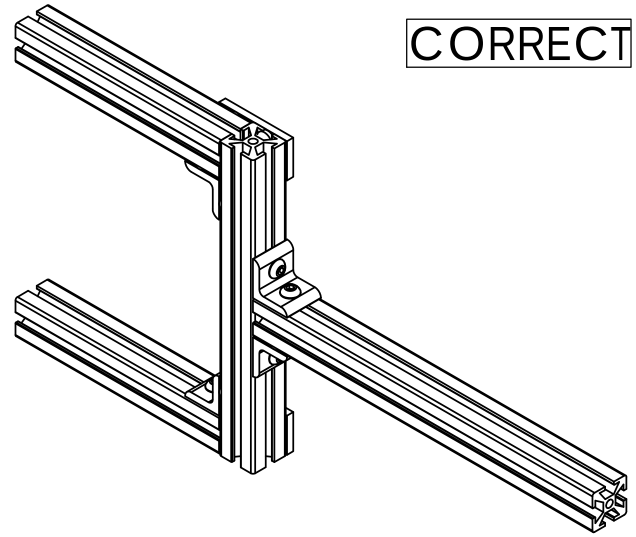
C -- A dimension that shows where the horizontal piece attatches along the vertical piece is needed. But, including 2 dimensions overdefines the assembly. Either take one out or change one to a reference dimension.

D -- Dimensions should be given between parts that mate to eachother. This dimension does not completely clarify to whoever assembles the gripper where the two horizontal pieces mount on the vertical piece. A dimension like this could still be used as long as there is a dimension to where one of them mounts on the vertical piece.

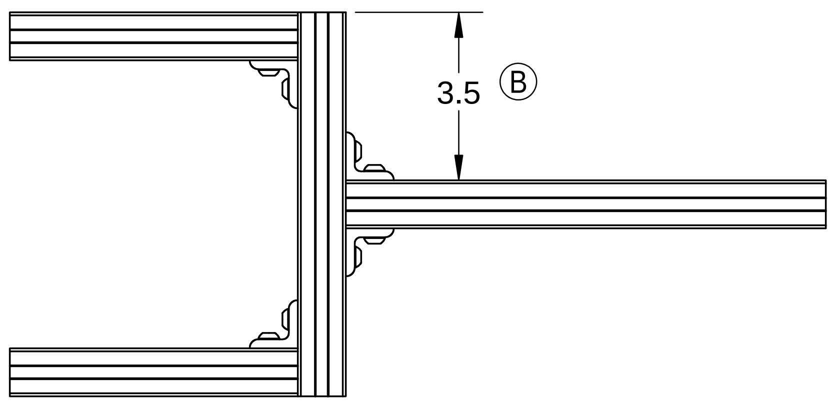
NOTES:
1. DIMS IN INCHES
2. QTY:1

				TITLE: Gripper Assembly		
				DRAWN	HHOPKINS	
TOLERANCE UNLESS NOTED				DESIGNED	HHOPKINS	
DIMENSION TYPE	PLACES IN DIMENSION			SIZE	DWG. NO.	REV
	0.0	0.00	0.000	A	EML2322L-A-003	A
LOCATIONAL	±0.050	±0.020	±0.005			
ANGULAR	±5	±2	±0.5	SCALE: 1:4		SHEET 1 OF 3





CORRECT



A -- The overall length of the assembly is not a dimension that is required to assemble it properly. The value is governed by the lengths of the individual 80/20 pieces, which can be found in their respective part files. But, their lengths are independant of how/where they are attatched, so the dimension isn't essential here. However, the overall length could be useful information, so it is included as a reference dimension (not having a dimension here at all would still be correct).

B -- This dimension clarifys where 2 individual parts in the assembly mate to each other. Whoever assembles the component should not have to assume that the part is centered.

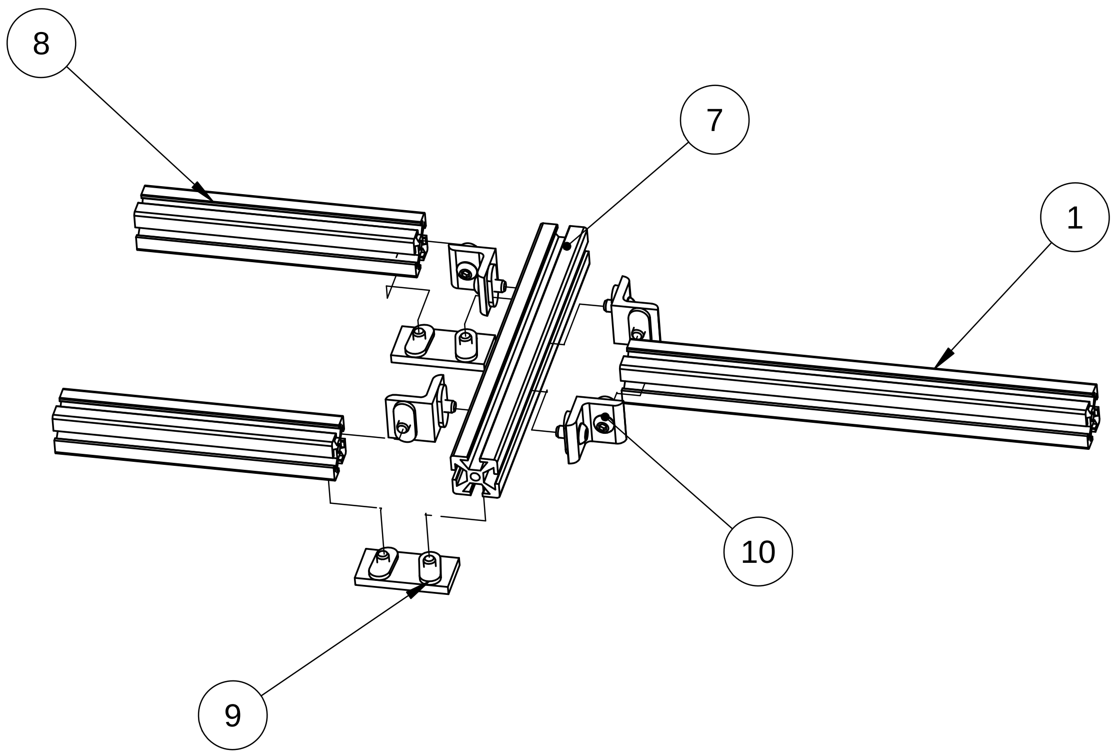
NOTES:
1. DIMS IN INCHES
2. QTY: 1

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:	Gripper Assembly
DRAWN	HHOPKINS
DESIGNED	HHOPKINS
SIZE	A
DWG. NO.	EML2322L-A-003
REV	A
SCALE: 1:4	SHEET 2 OF 3

3 2 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	EML2322L-001	80-20 Extrusion - 10.0 inch	1
7	EML2322L-002	80-20 Extrusion - 8.0 inch	1
8	EML2322L-003	80-20 Extrusion - 6.0 inch	2
9	EML2322L-A-004	80-20 Straight Degree Bracket Assy	2
10	EML2322L-A-005	80-20 90 Degree Bracket Assy	4



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

The correct order for drawings after this assembly is as follows:
1. Straight Bracket Assembly Drawings
2. Straight Bracket Part Drawing
3. 90 Degree Bracket Assembly Drawings
4. 90 Degree Part Drawing

The drawing for the 80/20 pieces is not needed, because it has been shown earlier in the report.

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:	Gripper Assembly
DRAWN	HHOPKINS
DESIGNED	HHOPKINS
SIZE	A
DWG. NO.	EML2322L-A-003
REV	A
SCALE: 1:4	SHEET 3 OF 3