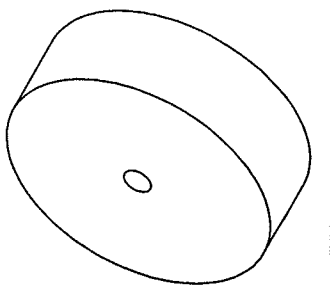
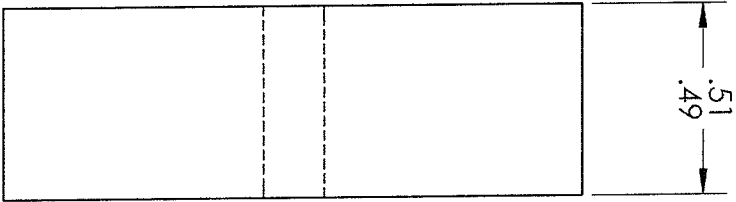


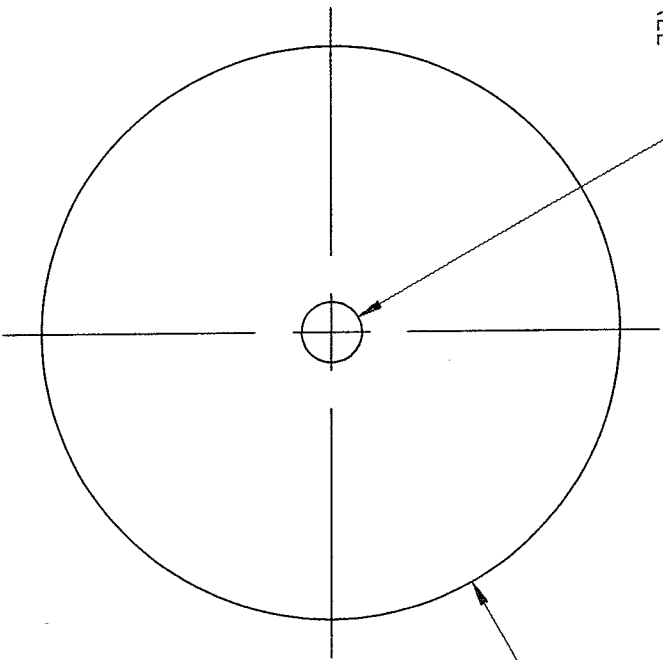
UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES			
TOLERANCES: TWO PLACE DECIMAL ± .01 THREE PLACE DECIMAL ± .005			
DRAWN	NAME	DATE	PART NAME:
CHECKED	BJO	2/16/12	MANIPULATOR RAIL GUIDE DRILL HOLES
	RWH	2/17/12	
MATERIAL		COMMENTS:	
STEEL			
SCALE: 2:1			



SCALE
1:1

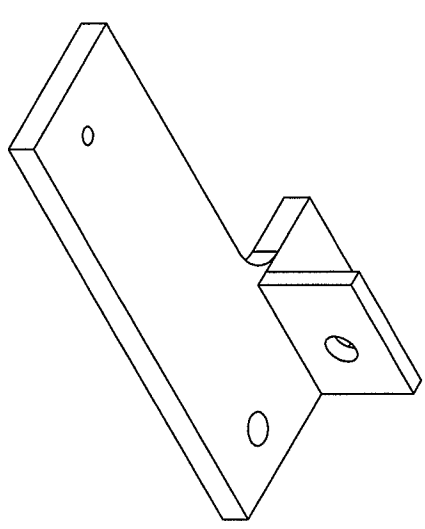
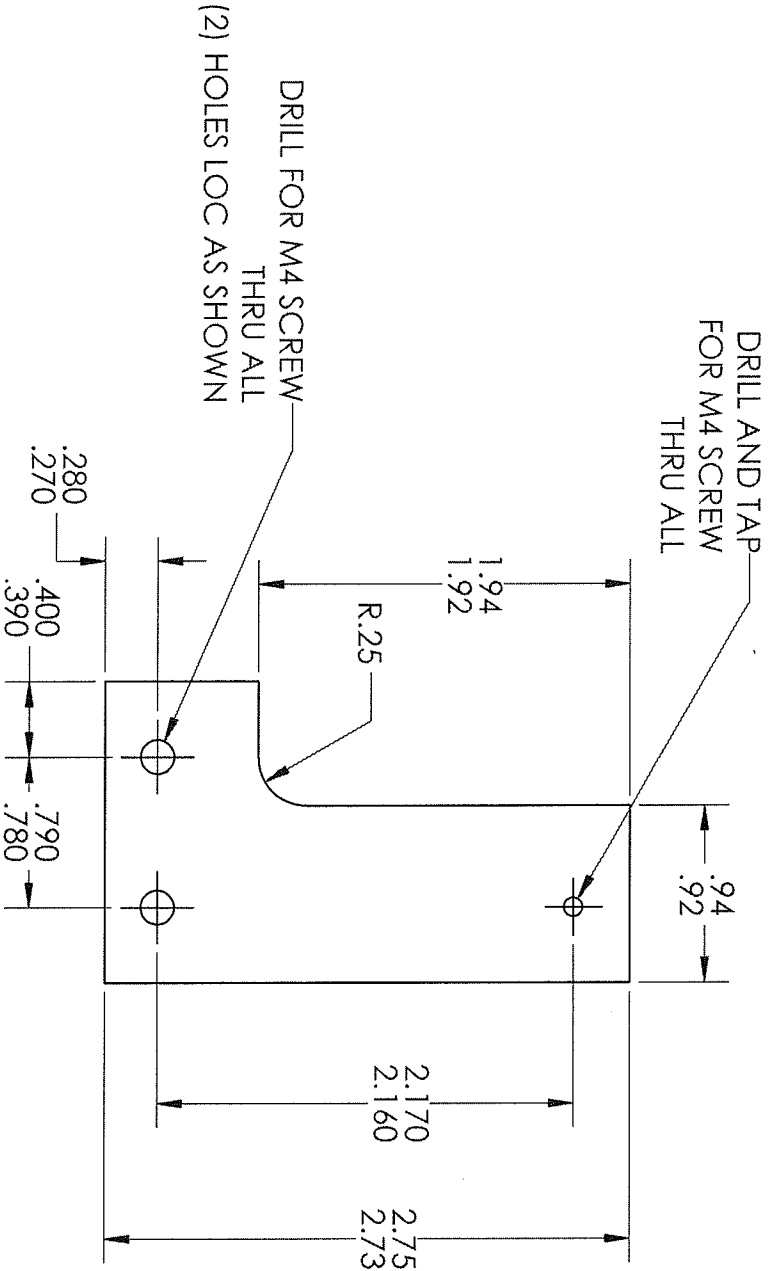
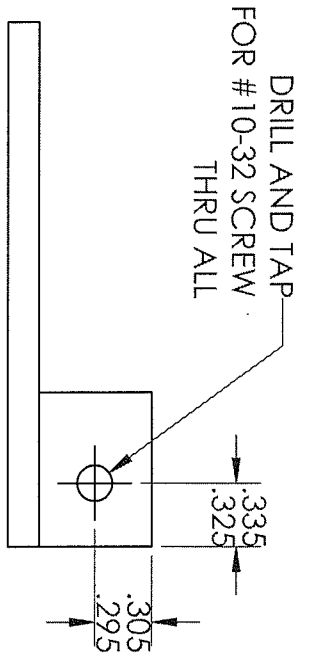
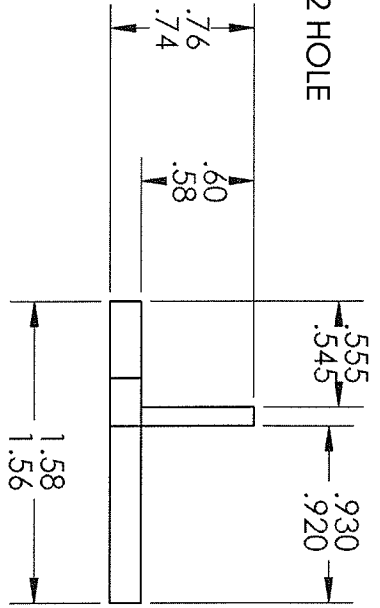


DRILL AND TAP
FOR M4 SCREW
THRU ALL

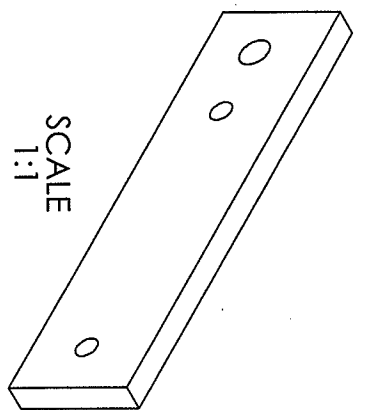


UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME	DATE	PART NAME: MANIPULATOR MOUNTING BLOCK	
TOLERANCES: TWO PLACE DECIMAL $\pm .01$ THREE PLACE DECIMAL $\pm .005$		DRAWN	BJO		2/18/12
MATERIAL $\phi 1.5"$ ALUMINUM STOCK		CHECKED	RWH		2/19/12
COMMENTS:		SCALE: 2:1			

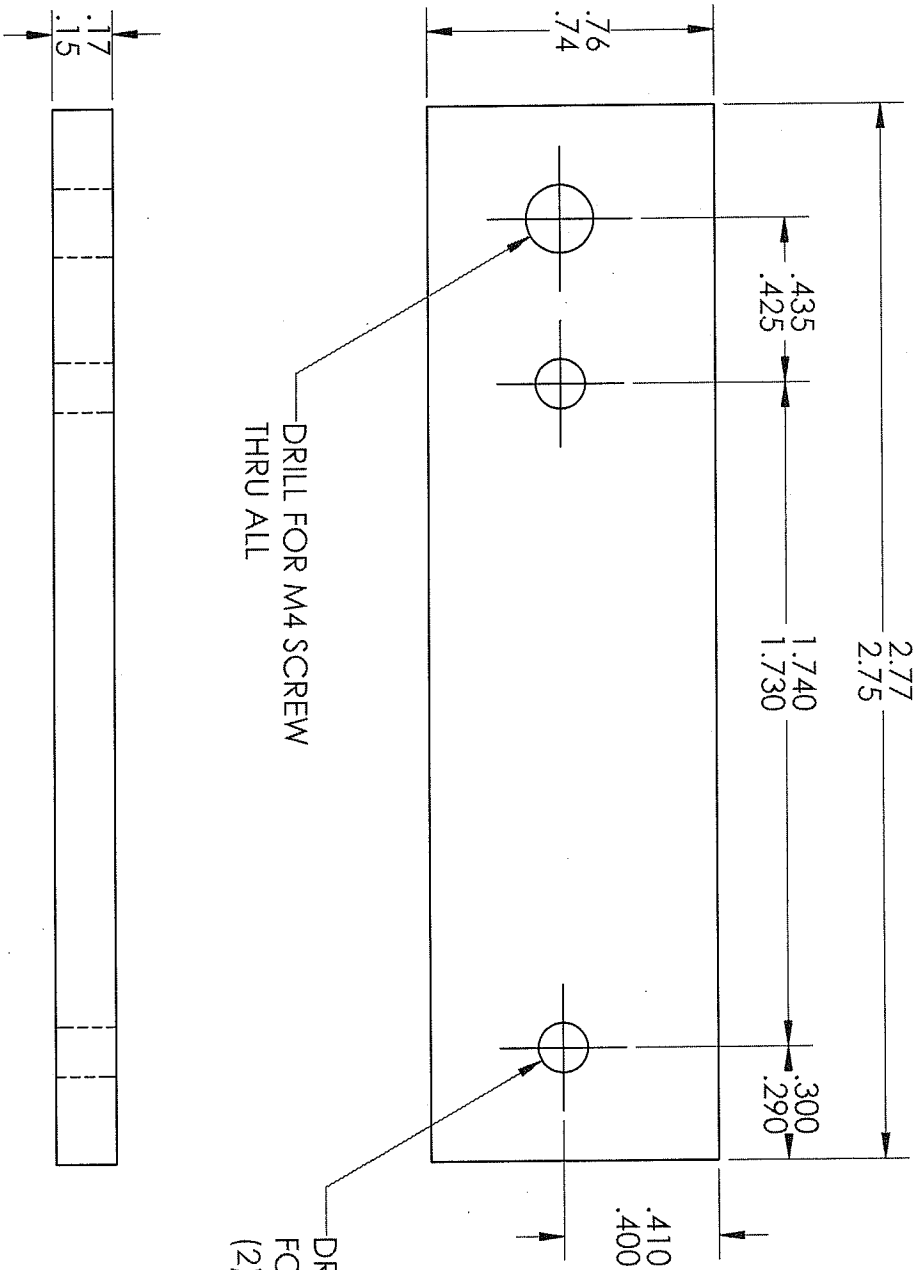
- NOTE:
1. MACHINE 2.74 X 1.57 X .75 BLOCK
 2. DRILL (3) M4 HOLES
 3. MACHINE DEPTH CUT
 4. DRILL AND TAP #10-32 HOLE



UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES TOLERANCES: TWO PLACE DECIMAL ± .01 THREE PLACE DECIMAL ± .005		DRAWN	BJO	2/24/12	PART NAME: Y-AXIS SUPPORT BAR
MATERIAL ALUMINUM		CHECKED	RWH	3/20/12	
COMMENTS:					
SCALE: 1:1					



SCALE
1:1

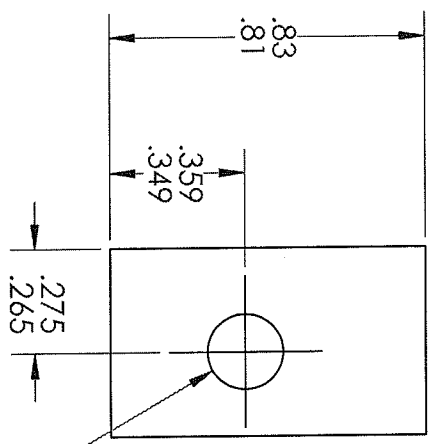


DRILL FOR M4 SCREW
THRU ALL

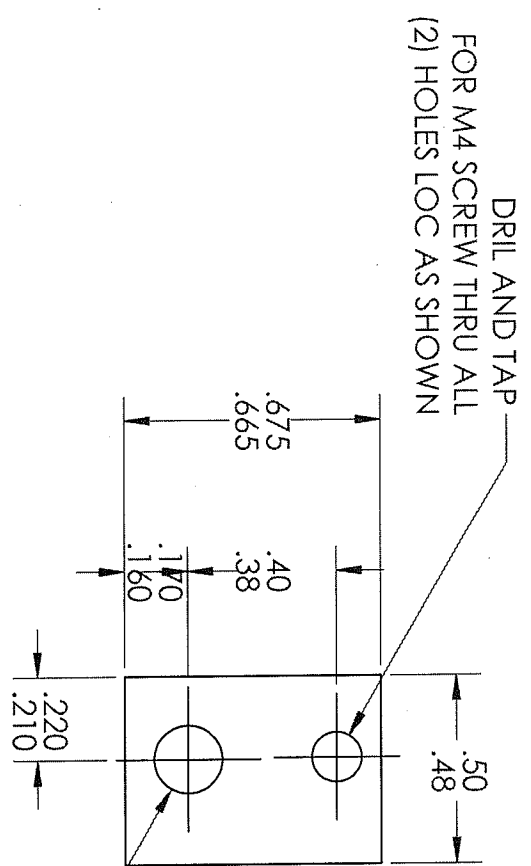
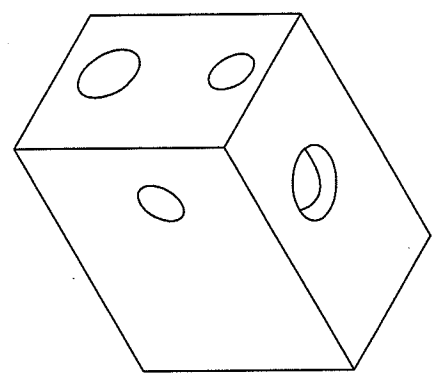
DRILL AND TAP
FOR M4 SCREW THRU ALL
(2) HOLES LOC AS SHOWN

UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME	DATE	PART NAME: Z-AXIS SUPPORT BAR
TOLERANCES: TWO PLACE DECIMAL ± .01 THREE PLACE DECIMAL ± .005		DRAWN BJO	2/28/11	
MATERIAL: ALUMINUM		CHECKED RWH	3/20/12	SCALE: 2:1
COMMENTS:				

- NOTE:**
1. MACHINE BLOCK
 2. DRILL AND TAP #10-32 SCREW HOLE
 3. DRILL AND TAP REMAINING HOLES

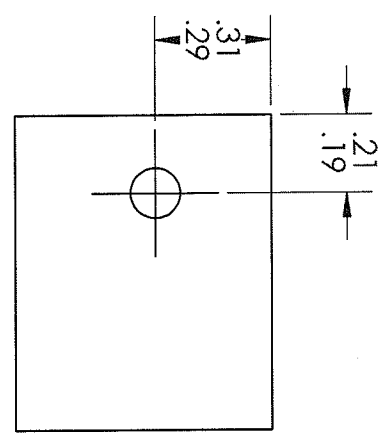


DRILL AND TAP FOR #10-32 SCREW THRU ALL



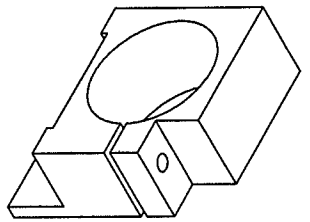
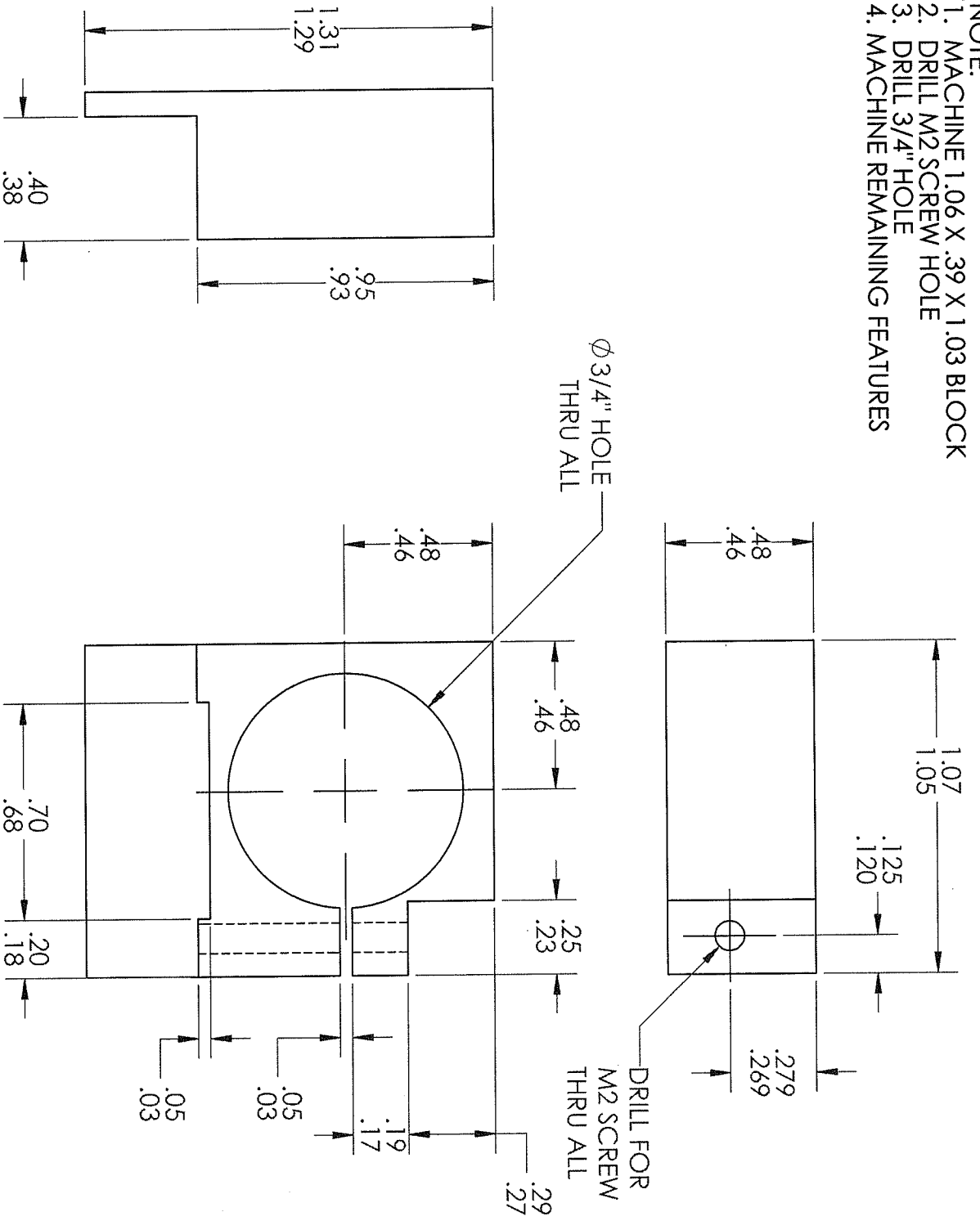
DRILL AND TAP FOR M4 SCREW THRU ALL (2) HOLES LOC AS SHOWN

DRILL AND TAP FOR M4 SCREW THRU ALL



UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME	DATE	PART NAME: MANIPULATOR PIPETTE MOUNT BLOCK	
TOLERANCES: TWO PLACE DECIMAL ± .01		DRAWN	BJO		2/28/11
THREE PLACE DECIMAL ± .005		CHECKED	RWH		3/20/12
MATERIAL: ALUMINUM	COMMENTS:			SCALE: 2:1	

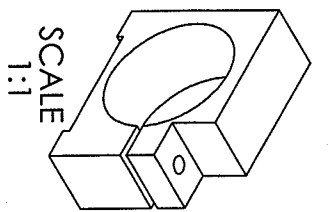
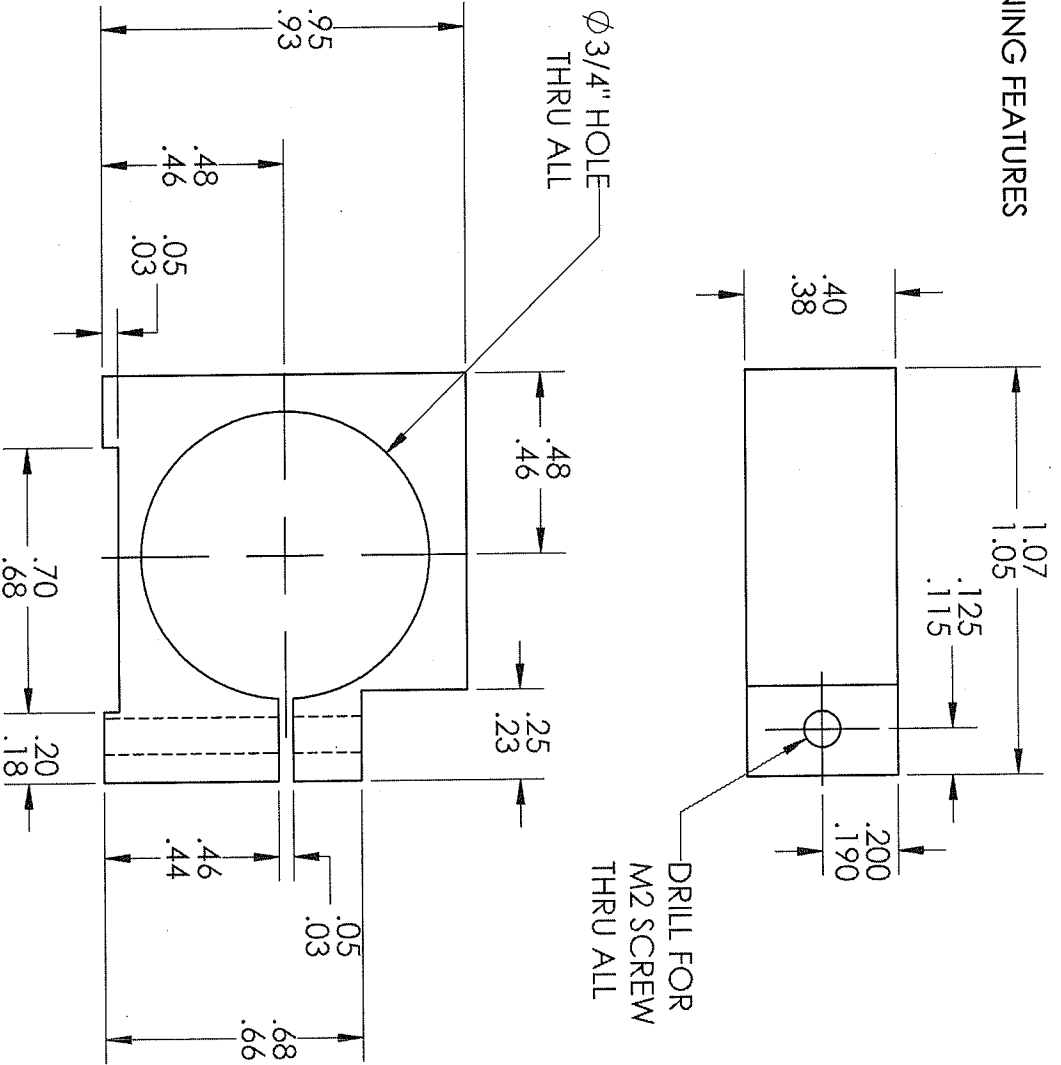
- NOTE:
1. MACHINE 1.06 X .39 X 1.03 BLOCK
 2. DRILL M2 SCREW HOLE
 3. DRILL 3/4" HOLE
 4. MACHINE REMAINING FEATURES



SCALE
1:1

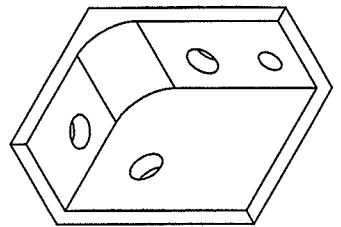
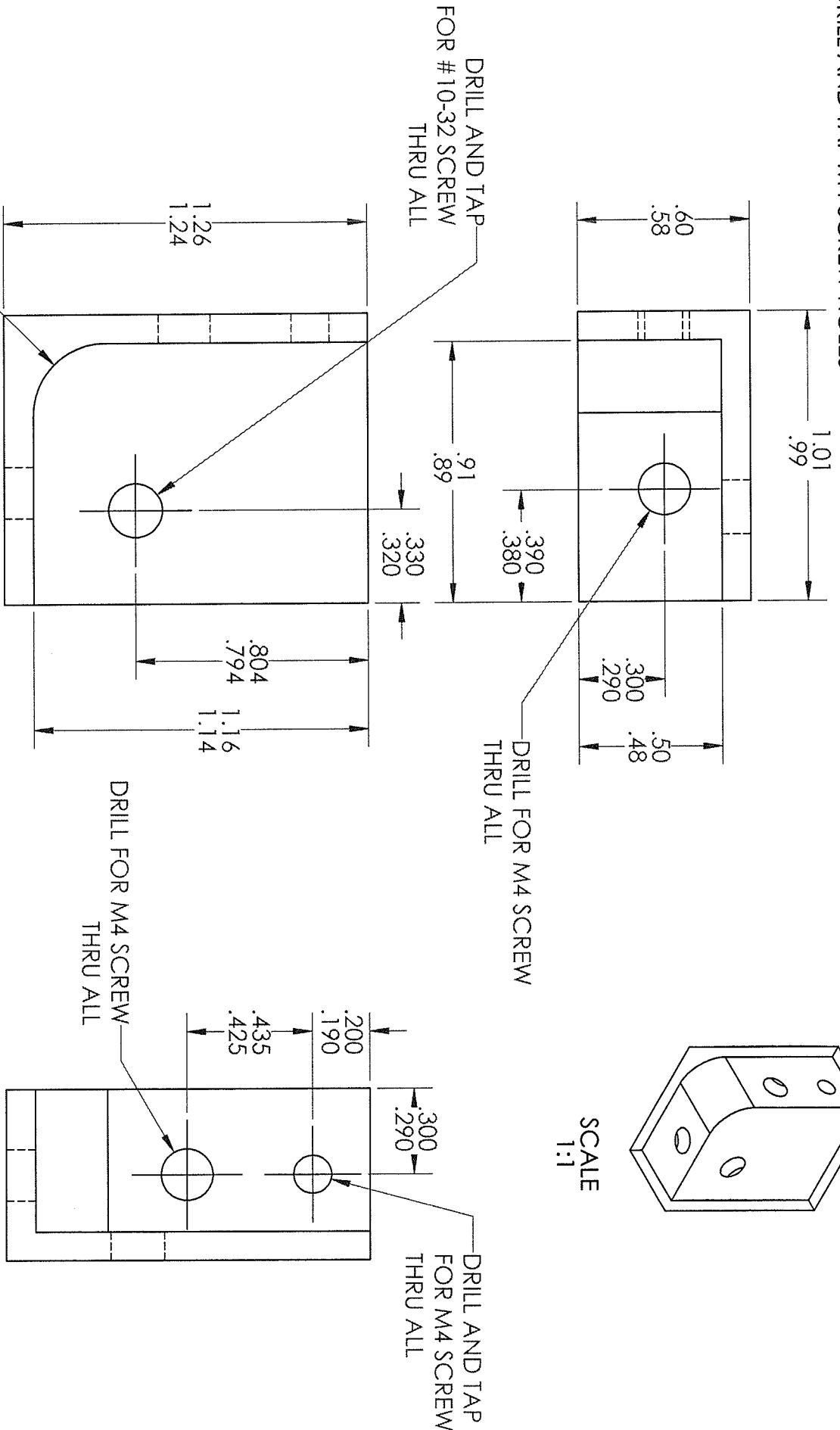
UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME	DATE	PART NAME: MANIPULATOR PISTON CYLINDER MOUNT
TOLERANCES: TWO PLACE DECIMAL ± .01		DRAWN	BJO	
THREE PLACE DECIMAL ± .005		CHECKED	RWH	
MATERIAL: ABS PLASTIC		COMMENTS:		SCALE: 2:1

- NOTE:
1. MACHINE 1.06 X .39 X .94 BLOCK
 2. DRILL M2 SCREW HOLE
 3. DRILL 3/4" HOLE
 4. MACHINE REMAINING FEATURES



UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME	DATE	PART NAME: MANIPULATOR Y-AXIS PISTON CYLINDER MOUNT	
TOLERANCES: TWO PLACE DECIMAL ± .01		DRAWN	BJO		2/2/12
THREE PLACE DECIMAL ± .005		CHECKED	RWH		3/20/12
MATERIAL ABS PLASTIC		COMMENTS:		SCALE: 2:1	

- NOTE:**
1. MACHINE .98 X .59 X 1.22 BLOCK
 2. MACHINE SLOT
 3. DRILL AND TAP M4 SCREW HOLES



SCALE
1:1

UNLESS OTHERWISE STATED
DIMENSIONS ARE IN INCHES

TOLERANCES:
TWO PLACE DECIMAL ± .01
THREE PLACE DECIMAL ± .005

MATERIAL

ALUMINUM

NAME

DATE

PART NAME:

MANIPULATOR ELBOW BRACKET

DRAWN

BJO

2/18/12

CHECKED

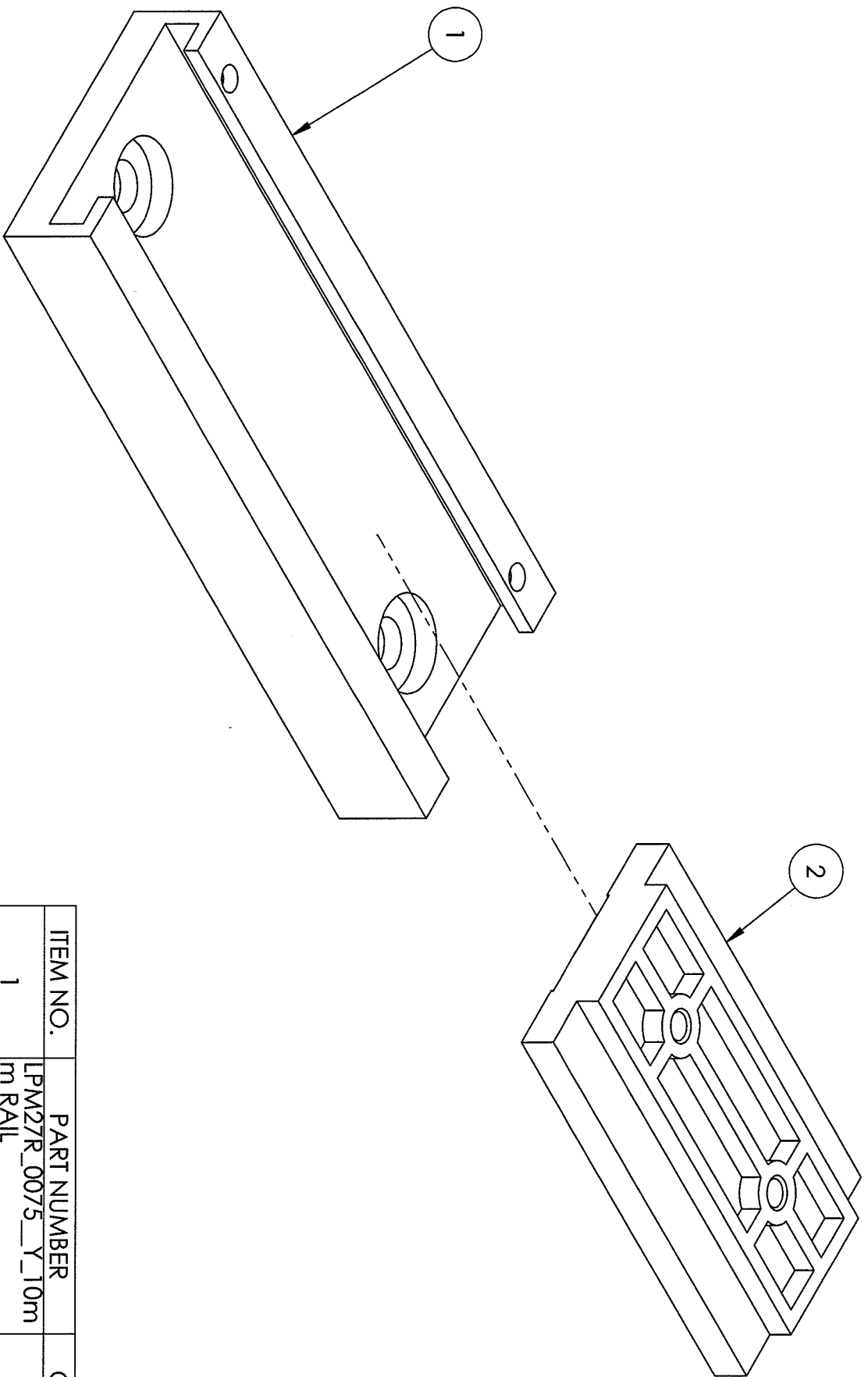
RWH

2/19/12

COMMENTS:

SCALE: 2:1

NOTE:
 1. SLIDE CARRIAGE INTO RAIL
 FOR EACH AXIS (X3)



ITEM NO.	PART NUMBER	QTY.
1	LPM27R_0075_Y_10m m RAIL MODIFIED.SLDASM	1
2	LPM27C CARRIAGE	1

ASSEMBLY NAME:

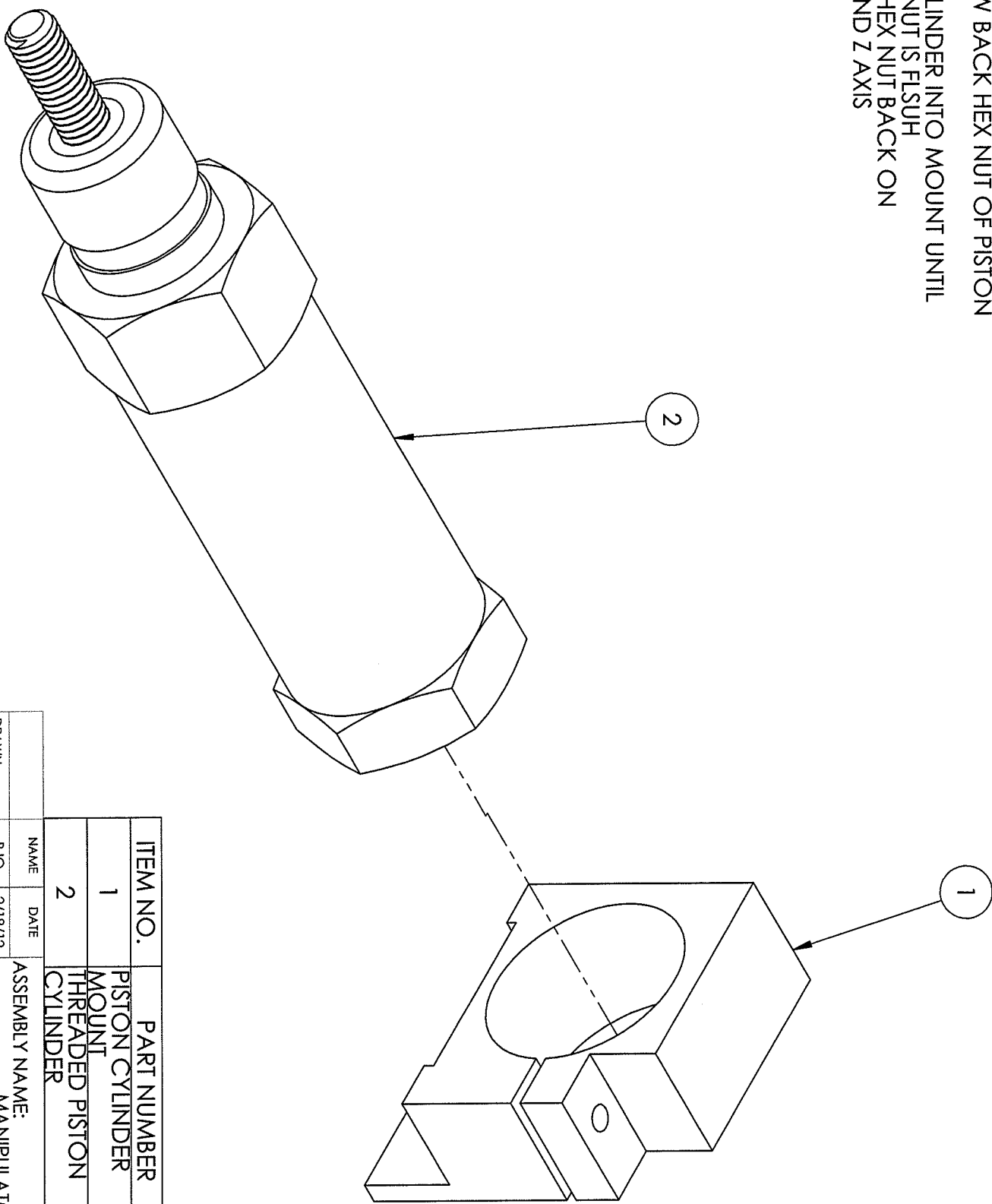
MANIPULATOR
 CARRIAGE INTO RAIL

NAME	DATE
BJO	2/18/12
RWH	2/19/12

DRAWN
 CHECKED
 COMMENTS:

SCALE: 2:1

- NOTE:
1. UNSCREW BACK HEX NUT OF PISTON CYLINER
 2. SLIDE CYLINDER INTO MOUNT UNTIL FRON HEX NUT IS FLUSH
 3. SCREW HEX NUT BACK ON
 4. FOR X AND Z AXIS



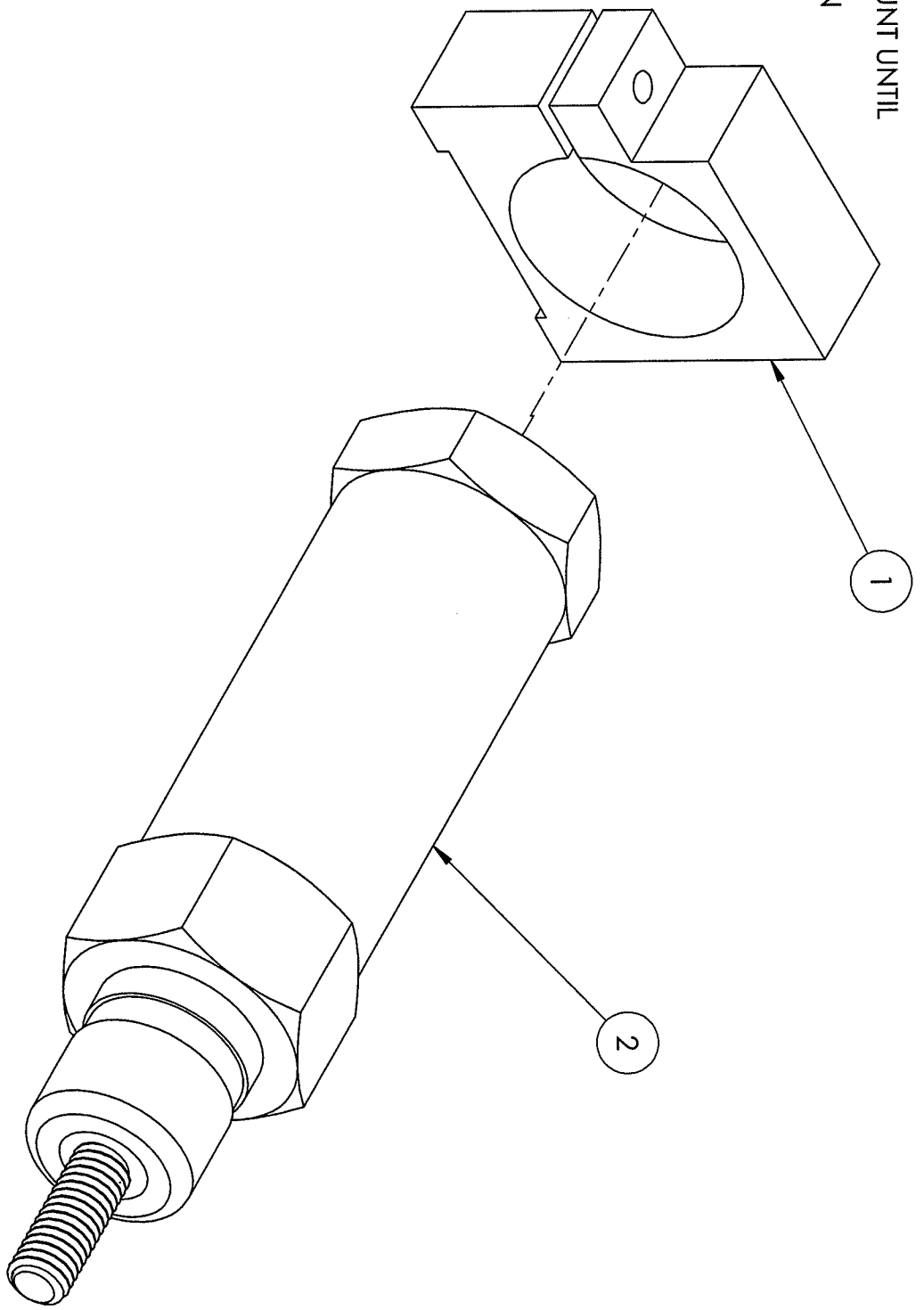
ITEM NO.	PART NUMBER	QTY.
1	PISTON CYLINDER MOUNT	1
2	THREADED PISTON CYLINDER	1

ASSEMBLY NAME:		MANIPULATOR PISTON CYLINDER INTO MOUNT	
DRAWN	BJO	DATE	2/18/12
CHECKED	RWH	DATE	2/19/12

COMMENTS:

SCALE: 2:1

- NOTE:**
1. UNSCREW BACK HEX NUT OF PISTON CYLINDER
 2. SLIDE CYLINDER INTO MOUNT UNTIL FRON HEX NUT IS FLUSH
 3. SCREW HEX NUT BACK ON
 4. FOR Y AXIS

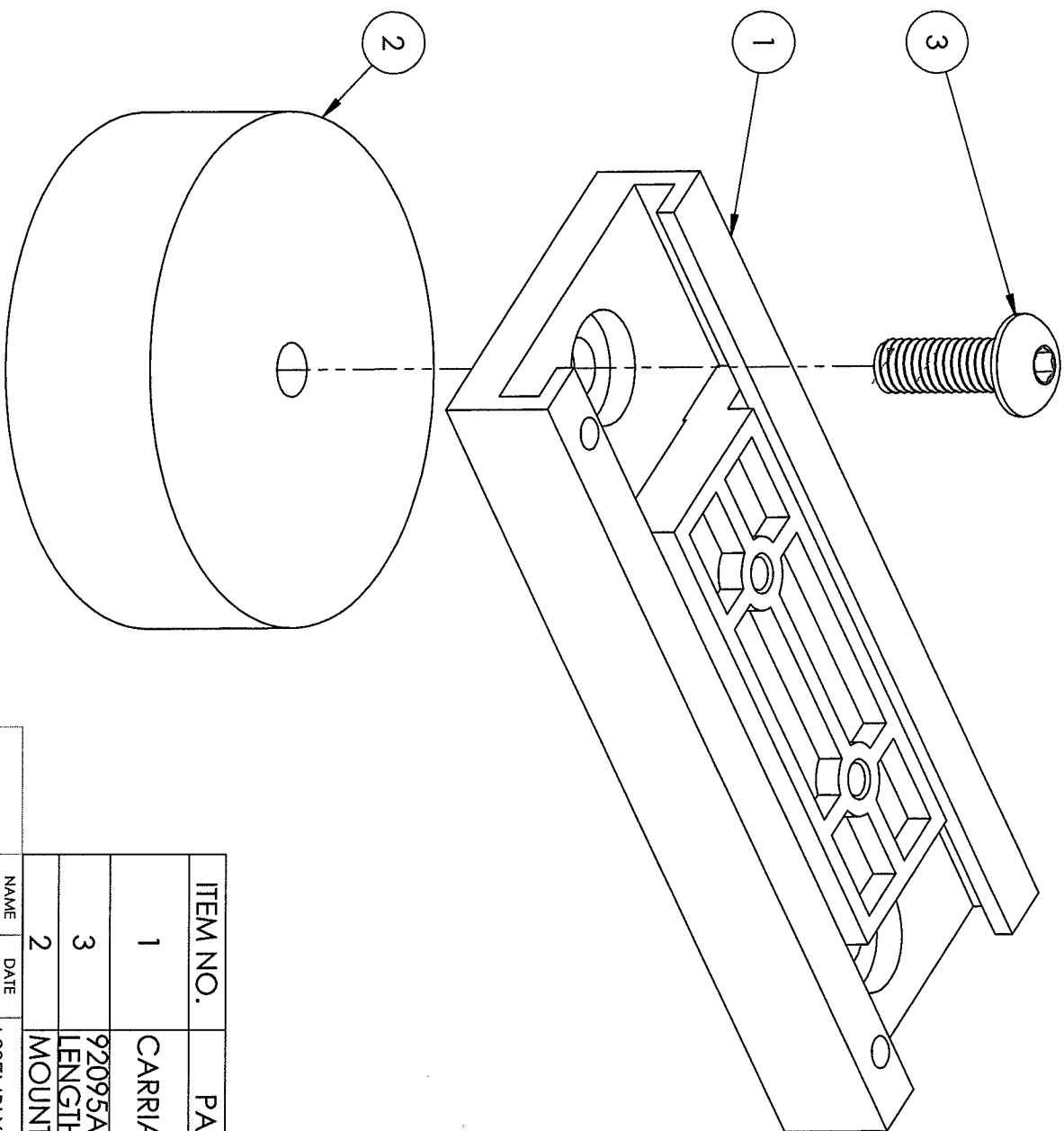


ITEM NO.	PART NUMBER	QTY.
1	Y-AXIS PISTON CYLINDER MOUNT	1
2	THREADED PISTON CYLINDER	1

NAME		DATE		ASSEMBLY NAME: MANIPULATOR	
DRAWN		3/16/12		Y-AXIS	
CHECKED		3/17/12		PISTON CYLINDER INTO MOUNT	

COMMENTS: SCALE: 2:1

NOTE:
1. FOR X AXIS

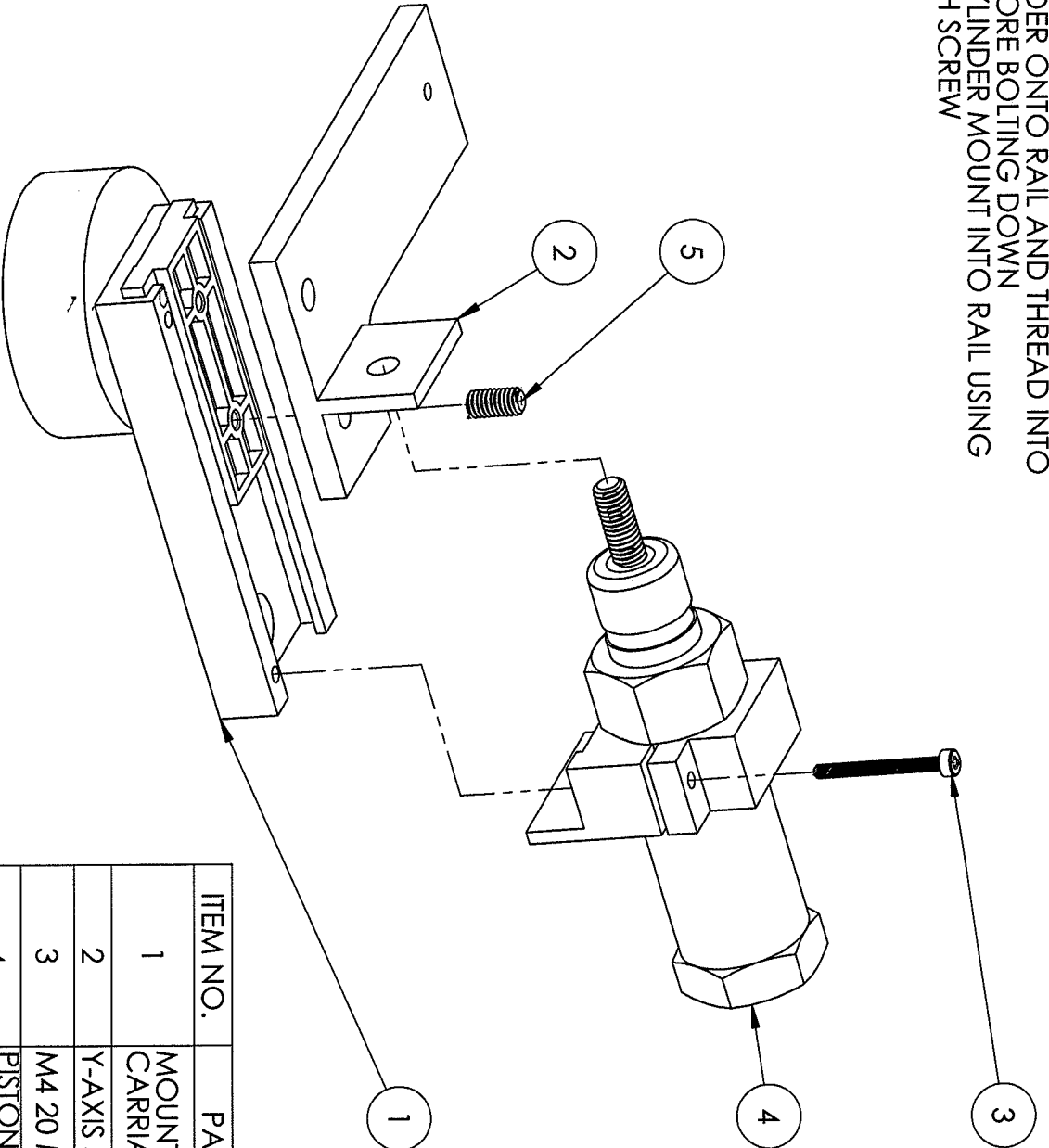


ITEM NO.	PART NUMBER	QTY.
1	CARRIAGE INTO RAIL	1
3	92095A192 M4 12 MM LENGTH	1
2	MOUNTING BLOCK	1

ASSEMBLY NAME:	
DRAWN	BJO
CHECKED	RWH
DATE	3/16/12
DATE	3/17/12

MANIPULATOR MOUNTING BLOCK TO CARRIAGE
SCALE: 2:1

- NOTE:**
1. SCREW Y-AXIS SUPPORT BAR INTO X-AXIS CARRIAGE
 2. SET PISTON CYLINDER ONTO RAIL AND THREAD INTO SUPPORT BAR BEFORE BOLTING DOWN
 3. SCREW PISTON CYLINDER MOUNT INTO RAIL USING M2 20 MM LENGTH SCREW

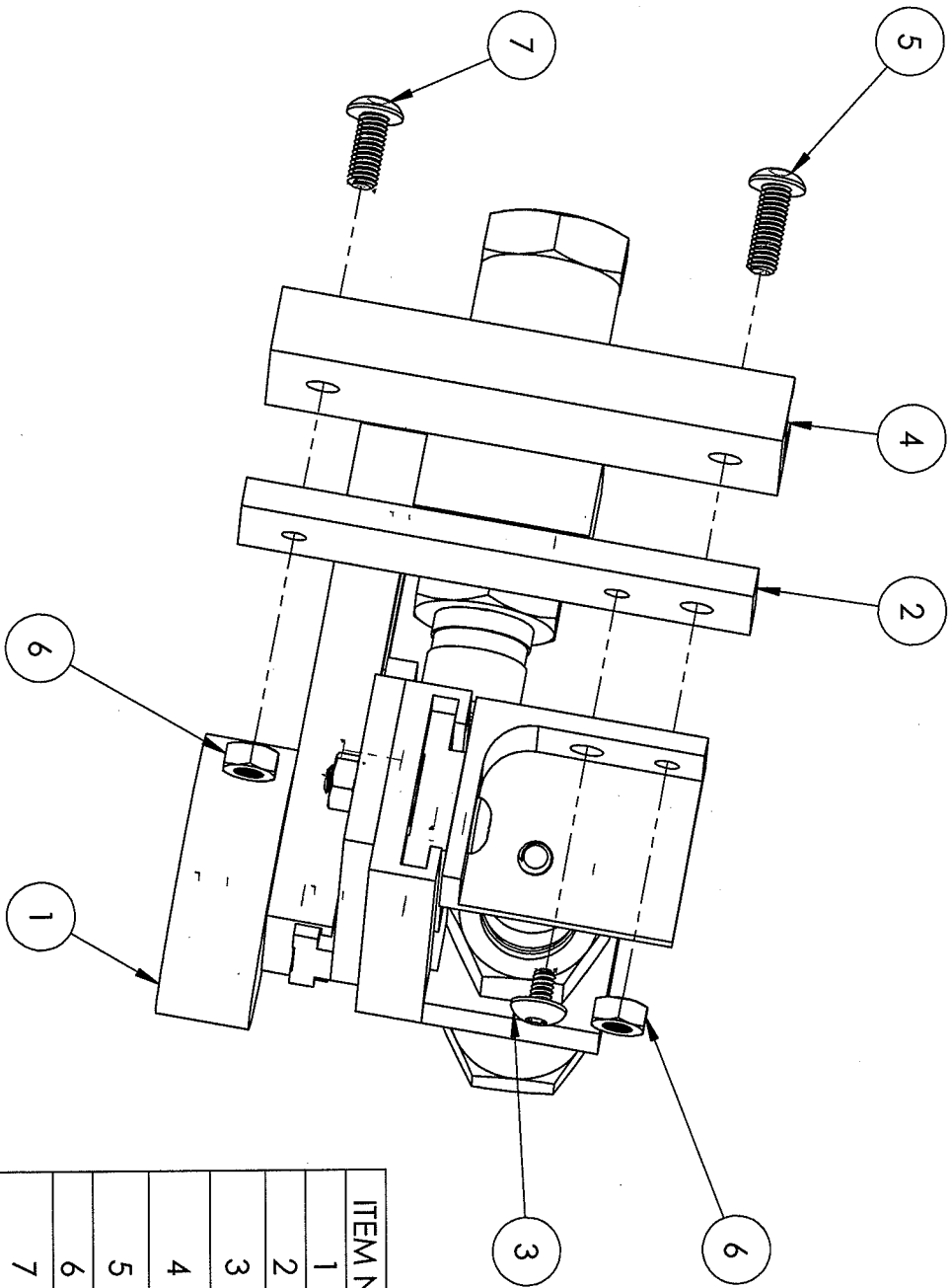


ITEM NO.	PART NUMBER	QTY.
1	MOUNTING BLOCK TO CARRIAGE	1
2	Y-AXIS SUPPORT BAR	1
3	M4 20 MM LENGTH	1
4	PISTON CYLINDER INTO MOUNT	1
5	92605ATT3 M4 SET SCREW 8 MM LENGTH	1

NAME	DATE	ASSEMBLY NAME:
BJO	3/16/12	MANIPULATOR X-AXIS
CHECKED	RWH	3/17/12

COMMENTS:

SCALE: 1:1



ITEM NO.	PART NUMBER	QTY.
1	Y-AXIS	1
2	Z-AXIS SUPPORT BAR	1
3	91239AT136 M4 5 MM LENGTH	1
4	CARRIAGE INTO RAIL	1
5	92095A1192 M4 12 MM LENGTH	1
6	92497A250 M4 NUT	2
7	92095A1190 M4 10 MM LENGTH	1
8	LPM27C CARRIAGE	1

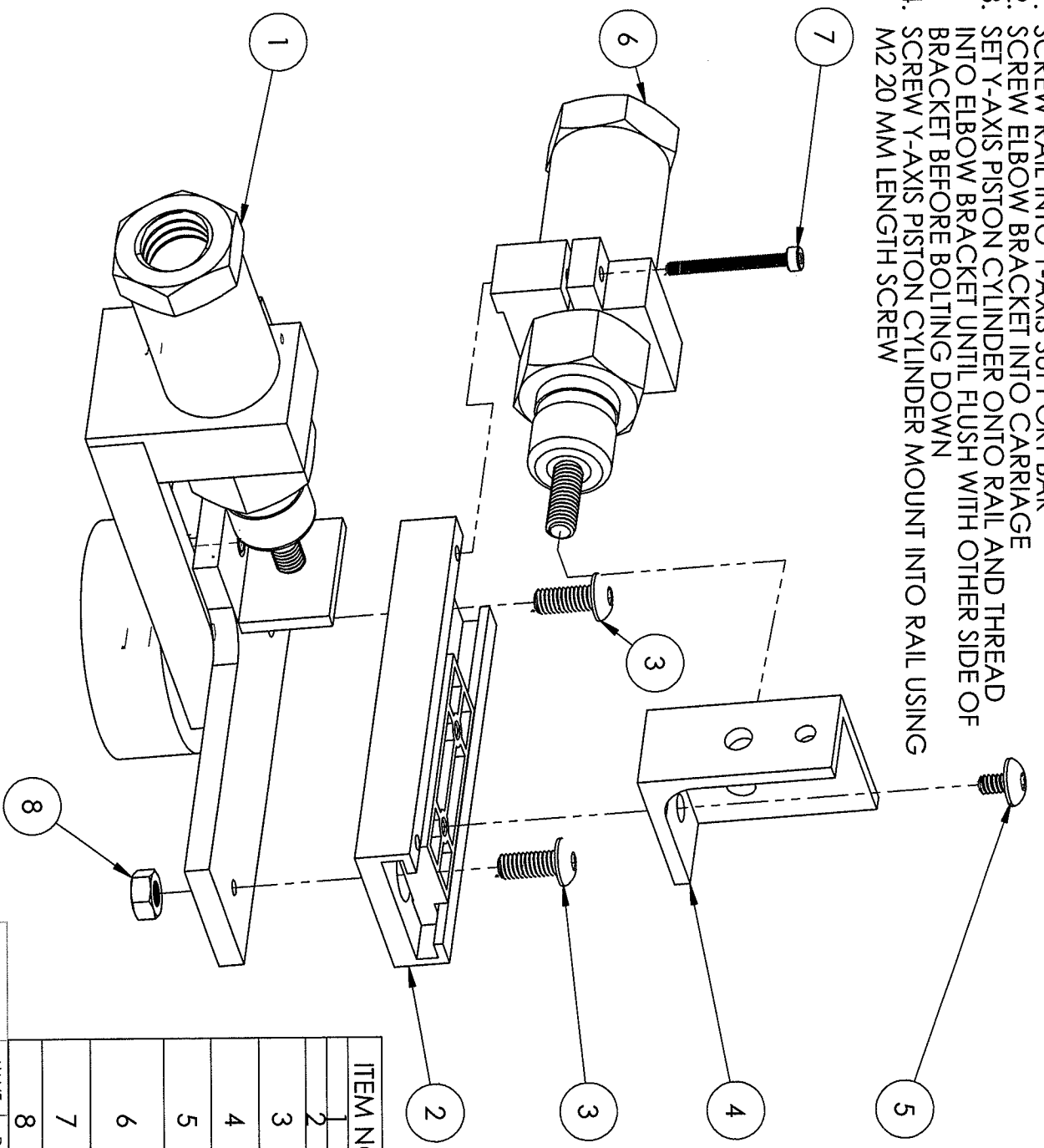
NAME	DATE	ASSEMBLY NAME:
BJO	3/19/12	MANIPULATOR Z-AXIS

DRAWN	BJO	3/19/12
CHECKED	RWH	3/20/12

COMMENTS:

SCALE: 1:1

- NOTE:
1. SCREW RAIL INTO Y-AXIS SUPPORT BAR
 2. SCREW ELBOW BRACKET INTO CARRIAGE
 3. SET Y-AXIS PISTON CYLINDER ONTO RAIL AND THREAD INTO ELBOW BRACKET UNTIL FLUSH WITH OTHER SIDE OF BRACKET BEFORE BOLTING DOWN
 4. SCREW Y-AXIS PISTON CYLINDER MOUNT INTO RAIL USING M2 20 MM LENGTH SCREW



ITEM NO.	PART NUMBER	QTY.
1	X-AXIS CARRIAGE INTO RAIL	1
2	92095A190 M4 10 MM LENGTH	2
3	LP M27 ELBOW BRACKET	1
4	91239A136 M4 5MM LENGTH	1
5	Y AXIS PISTON CYLINDER INTO MOUNT	1
6	M2 20 MM LENGTH	1
7	92497A250 M4 NUT	1
8		

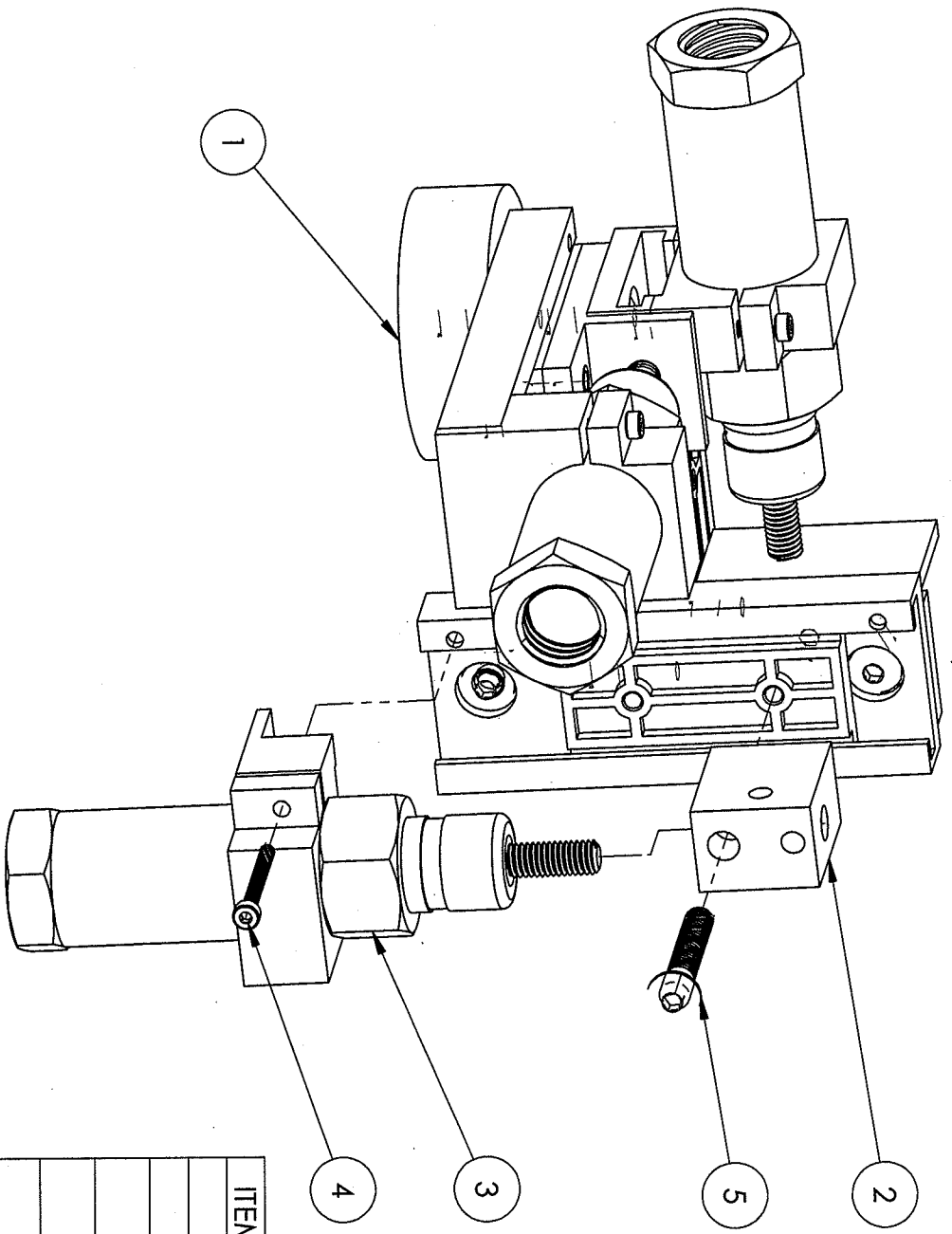
NAME	DATE
BJO	3/19/12
CHECKED	RWH
	3/20/12

ASSEMBLY NAME:
MANIPULATOR Y-AXIS

COMMENTS:

SCALE: 1:1

- NOTE:**
1. SCREW PIPETTE MOUNT BLOCK INTO CARRIAGE USING M4 25 MM LENGTH SCREW
 2. SET PISTON CYLINDER ONTO RAIL AND THREAD INTO PIPETTE MOUNT BLOCK BEFORE BOLTING DOWN
 3. SCREW PISTON CYLINDER MOUNT INTO RAIL USING M2 20 MM LENGTH SCREW



ITEM NO.	PART NUMBER	QTY.
1	Z-AXIS PIPETTE MOUNT BLOCK	1
2	PISTON CYLINDER INTO MOUNT	1
3	M2 20 MM LENGTH 92095A197 M4 25 MM LENGTH	1
4		1
5		1

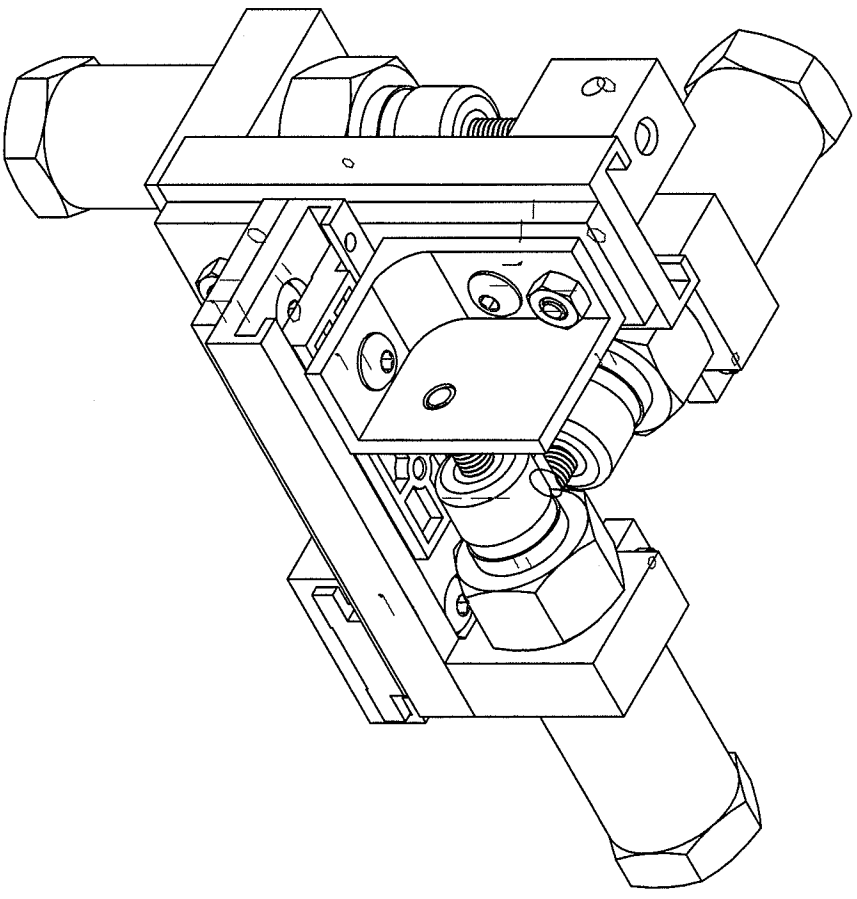
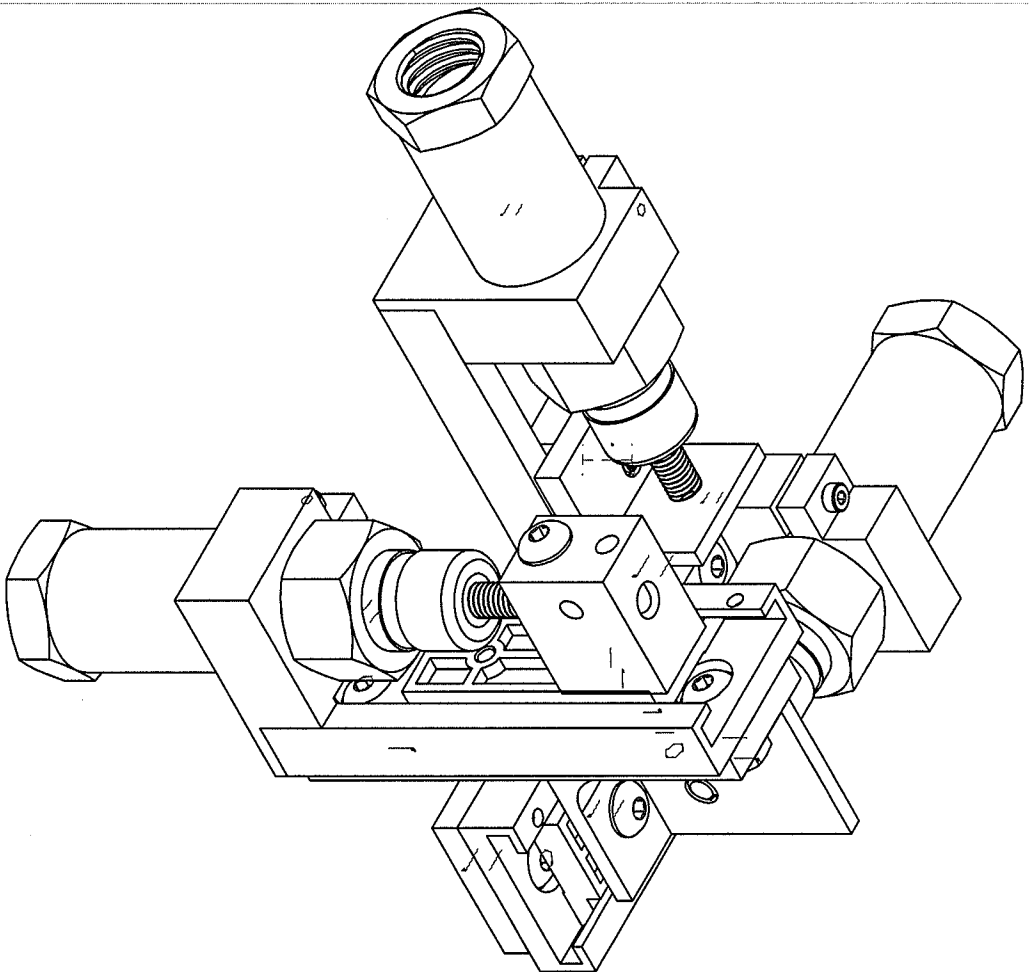
ASSEMBLY NAME:

MANIPULATOR PIPETTE MOUNT

NAME	DATE
BJO	3/19/12
CHECKED	RWH
	3/20/12

COMMENTS:

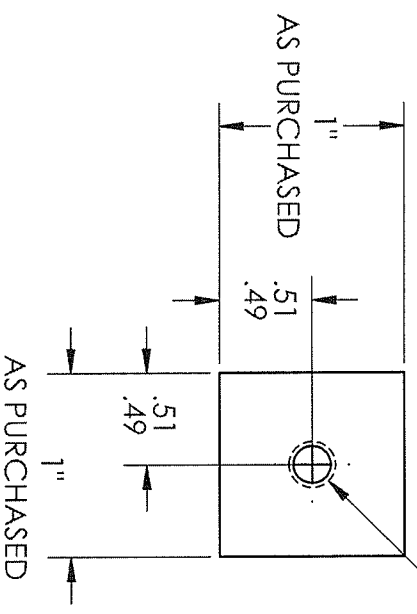
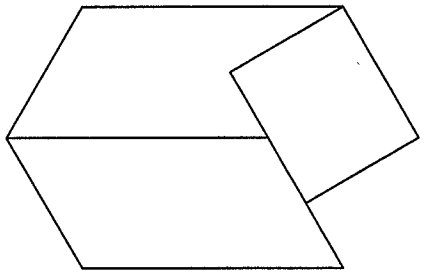
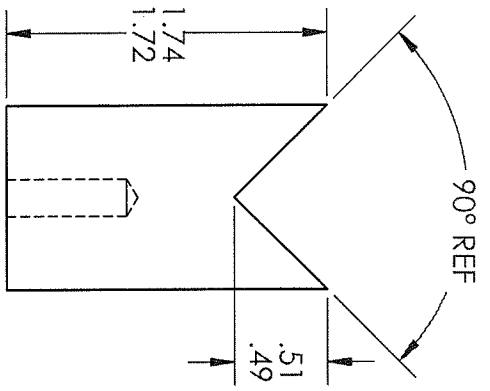
SCALE: 1:1



	NAME	DATE	ASSEMBLY NAME:
DRAWN	BJO	3/19/12	MANIPULATOR FULL ASSEMBLY
CHECKED	RWH	3/20/12	

COMMENTS:

SCALE: 1:1



#7 DRILL .65 DEEP
 1/4 20 UNC .5 DEEP
 (1) HOLES LOC AS SHOWN

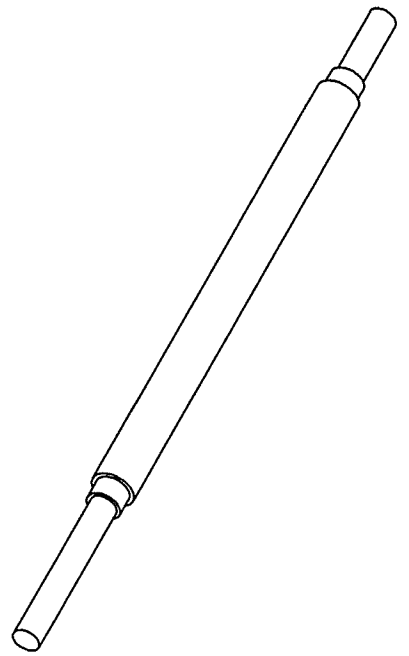
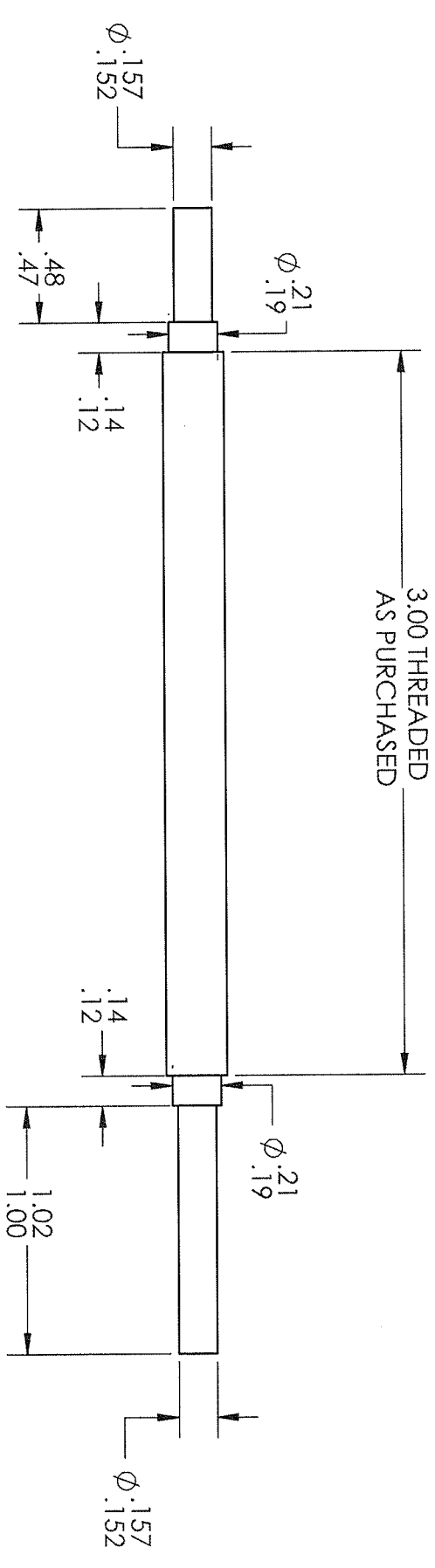
UNLESS OTHERWISE STATED
 DIMENSIONS ARE IN INCHES
 TOLERANCES:
 TWO PLACE DECIMAL ± .01
 THREE PLACE DECIMAL ± .005

NAME	DATE	PART NAME:
DRAWN RW H	2/28/2012	CYLINDER SUPPORT BLOCK
CHECKED		

MATERIAL
 ALUMINUM

COMMENTS:

SCALE: 1:1

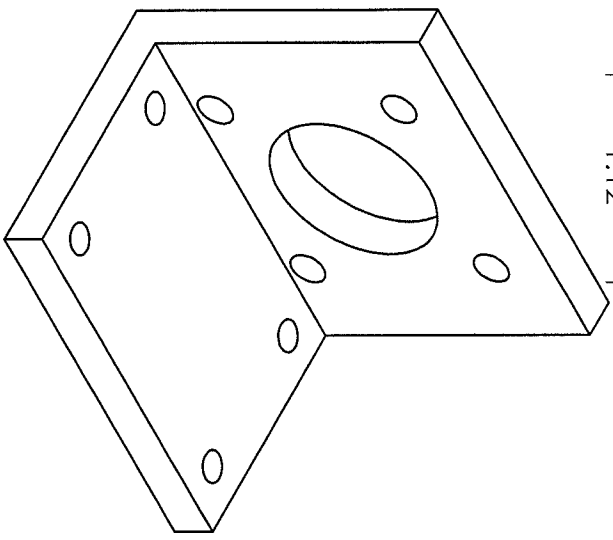
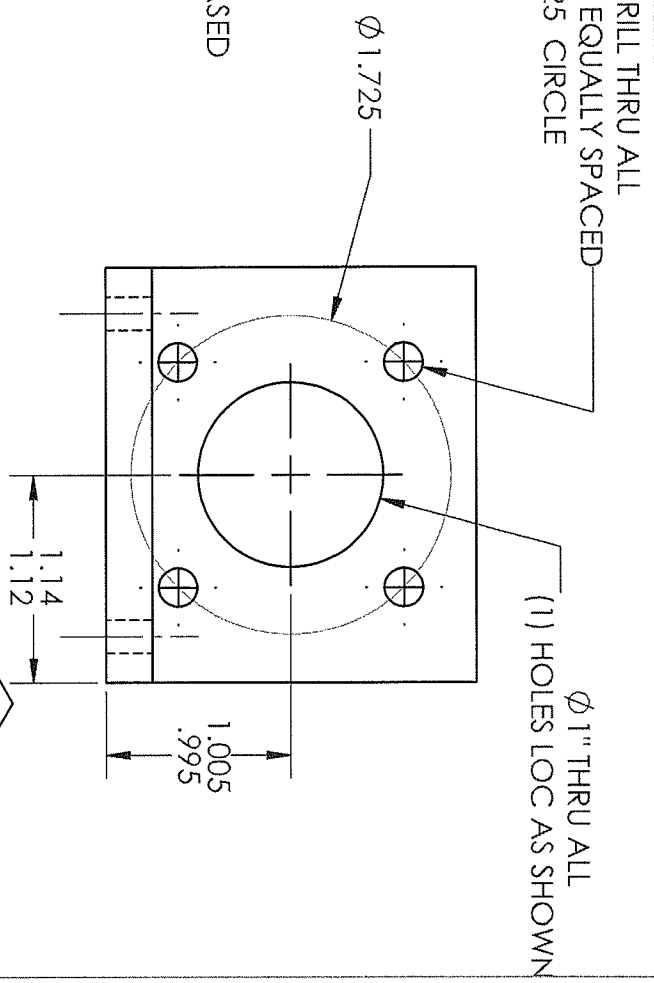
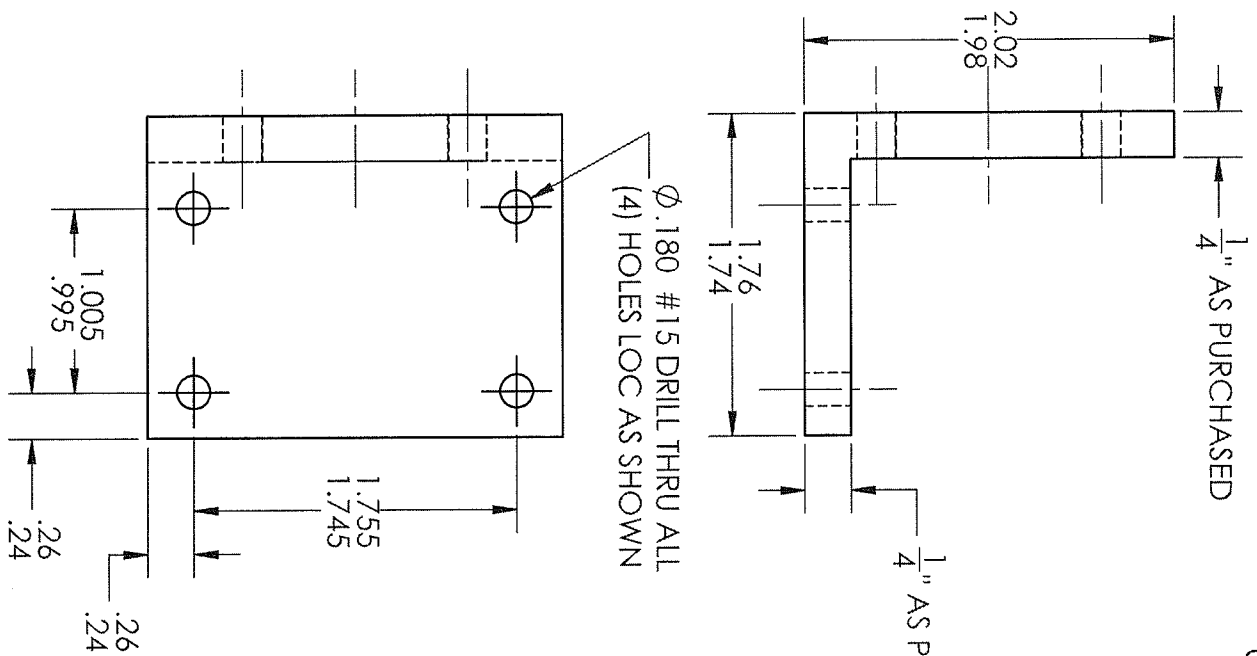


UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME	DATE	PART NAME: PUMP LEAD SCREW	
TOLERANCES: TWO PLACE DECIMAL ± .01		DRAWN	RWH		2/28/2012
THREE PLACE DECIMAL ± .005		CHECKED			

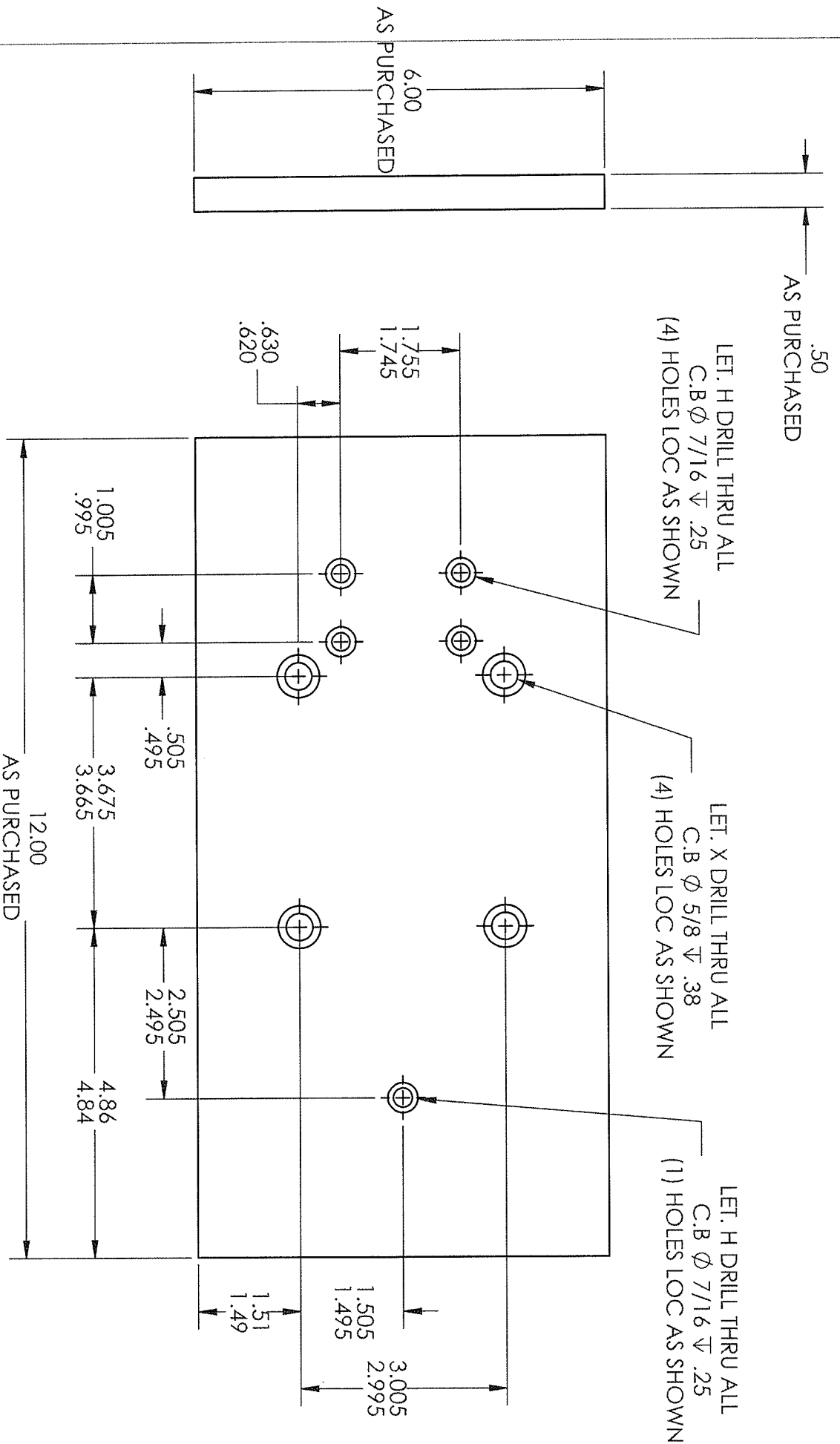
MATERIAL: STAINLESS STEEL

COMMENTS:

SCALE: 1.5:1



UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME	DATE	PART NAME: MOTOR MOUNTING BLOCK
TOLERANCES: TWO PLACE DECIMAL $\pm .01$ THREE PLACE DECIMAL $\pm .005$		DRAWN	2/28/2012	
MATERIAL ALUMINUM		CHECKED		
		COMMENTS:		SCALE: 1:1



UNLESS OTHERWISE STATED
DIMENSIONS ARE IN INCHES
TOLERANCES:
TWO PLACE DECIMAL ± .01
THREE PLACE DECIMAL ± .005

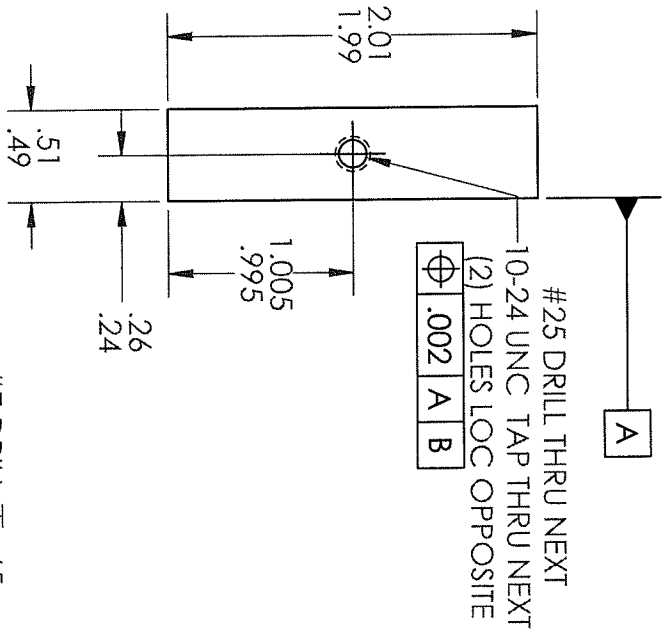
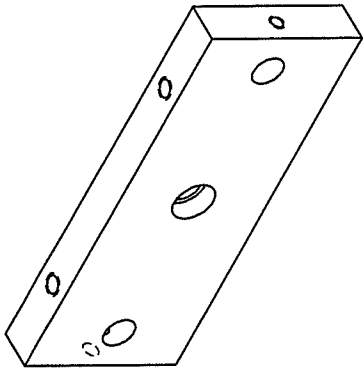
NAME	DATE
DRAWN	
CHECKED	

PART NAME:
BASE JIG PLATE

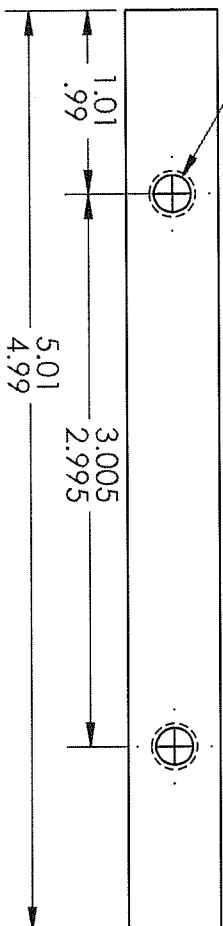
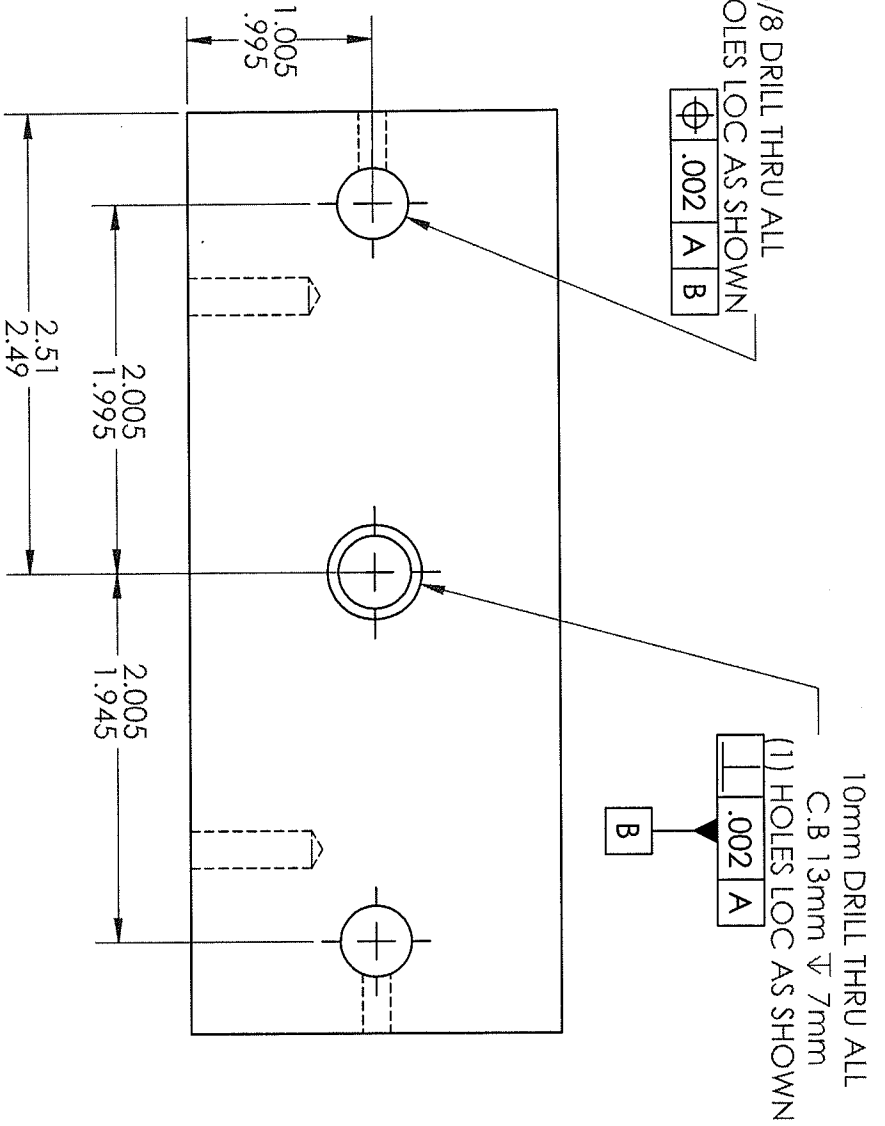
MATERIAL
ALUMINUM

COMMENTS:

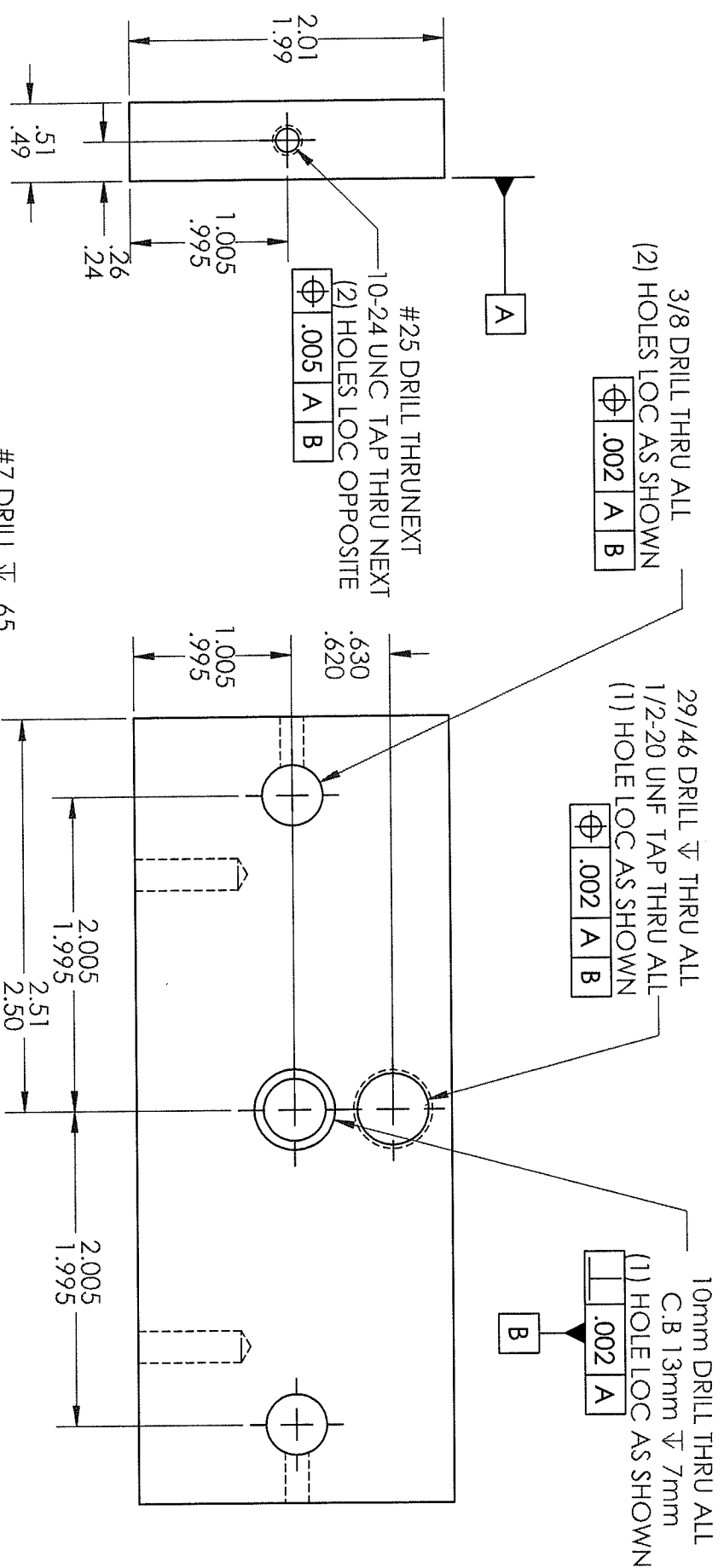
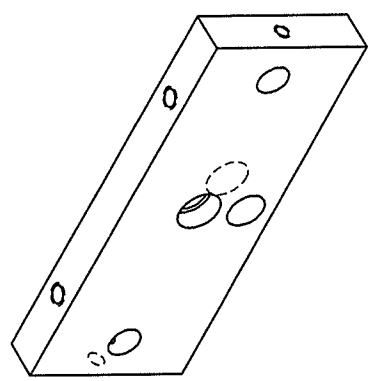
SCALE: 1:1



#7 DRILL ∇ .65
1/4-20 UNC TAP ∇ .50
(2) HOLES LOC AS SHOWN



UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES TOLERANCES: TWO PLACE DECIMAL \pm .01 THREE PLACE DECIMAL \pm .005		PART NAME: MOTOR SIDE RAIL MOUNTING BLOCK	
DRAWN	NAME	DATE	
CHECKED	RWH	12/28/2012	
MATERIAL ALUMINUM		COMMENTS:	
		SCALE: 1:1	

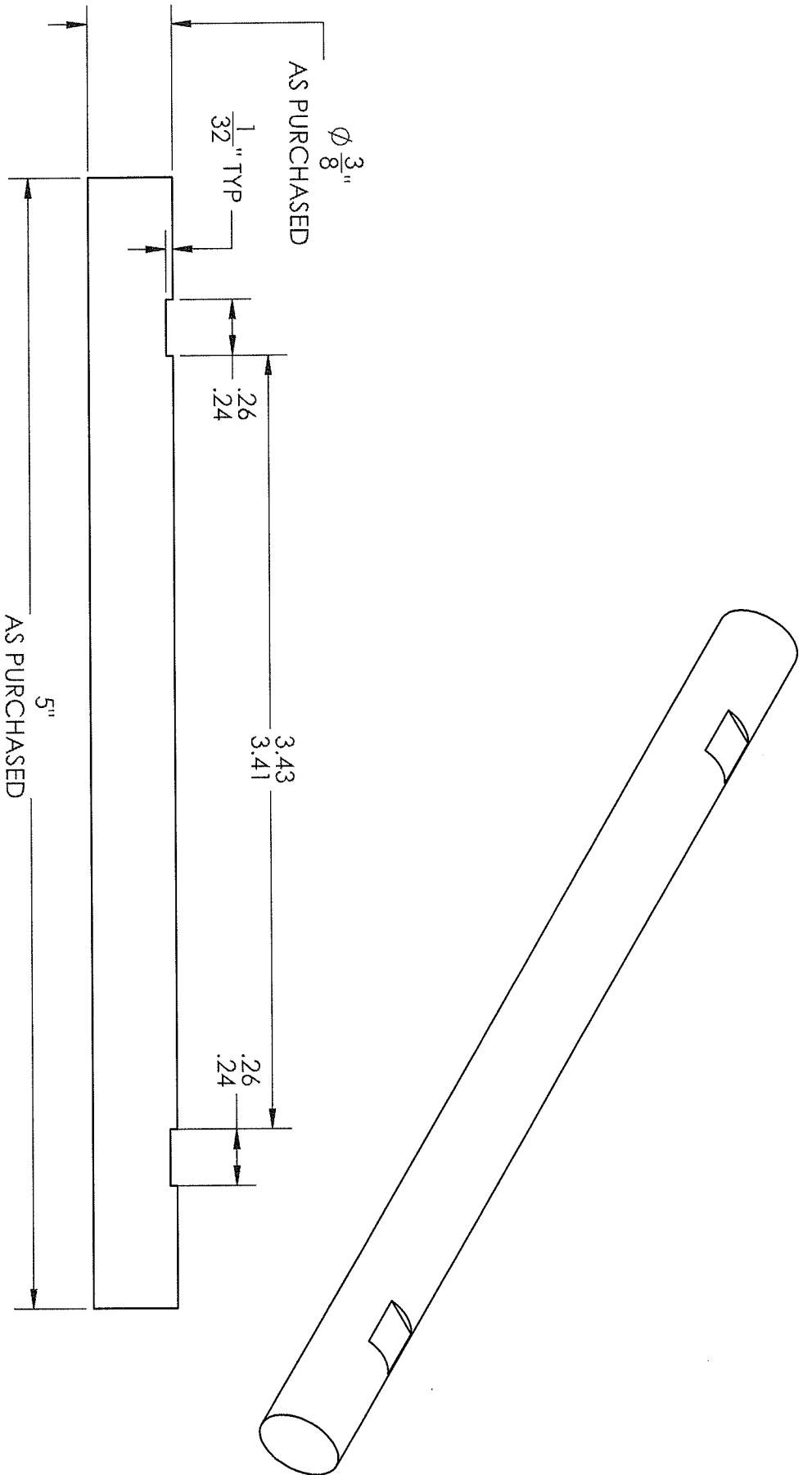


UNLESS OTHERWISE STATED
DIMENSIONS ARE IN INCHES
TOLERANCES:
TWO PLACE DECIMAL $\pm .01$
THREE PLACE DECIMAL $\pm .005$

DRAWN	NAME	DATE	PART NAME:
CHECKED	RWH	2/28/2012	CYLINDER SIDE RAIL MOUNTING BLOCK
COMMENTS:			

MATERIAL: ALUMINUM

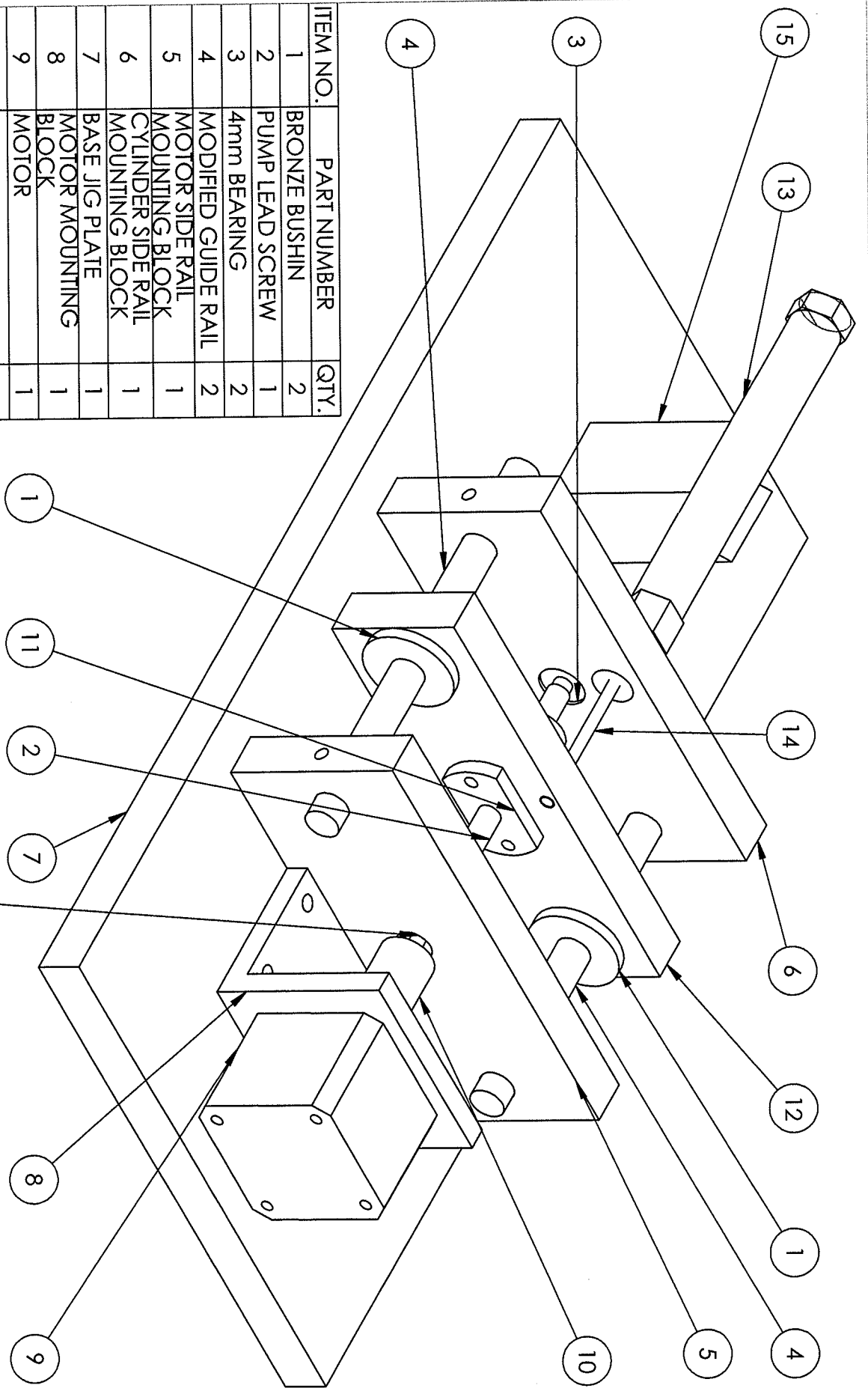
SCALE: 1:1



UNLESS OTHERWISE STATED DIMENSIONS ARE IN INCHES		NAME		DATE		PART NAME:	
TOLERANCES: TWO PLACE DECIMAL ± .01 THREE PLACE DECIMAL ± .005		DRAWN		RWI		2/28/2012	
		CHECKED					
MATERIAL ALUMINUM		COMMENTS:				MODIFIED GUIDE RAIL	

SCALE: 1.5:1

ITEM NO.	PART NUMBER	QTY.
1	BRONZE BUSHIN	2
2	PUMP LEAD SCREW	1
3	4mm BEARING	2
4	MODIFIED GUIDE RAIL	2
5	MOTOR SIDE RAIL MOUNTING BLOCK	1
6	CYLINDER SIDE RAIL MOUNTING BLOCK	1
7	BASE JIG PLATE	1
8	MOTOR MOUNTING BLOCK	1
9	MOTOR	1
10	SHAFT COUPLING	1
11	LEAD SCREW FLANGE	1
12	CONNECTING BLOCK	1
13	CYLINDER BODY	1
14	PISTON ROD CYLINDER SUPPORT	1
15	BLOCK	1



(1) BRONZE BUSHING LOCATED INSIDE BLOCK

NAME	DATE	ASSEMBLY NAME:
DRAWN	RWH	2/28/2012
CHECKED	XXXXXX	
COMMENTS:		
SCALE: .75:1		