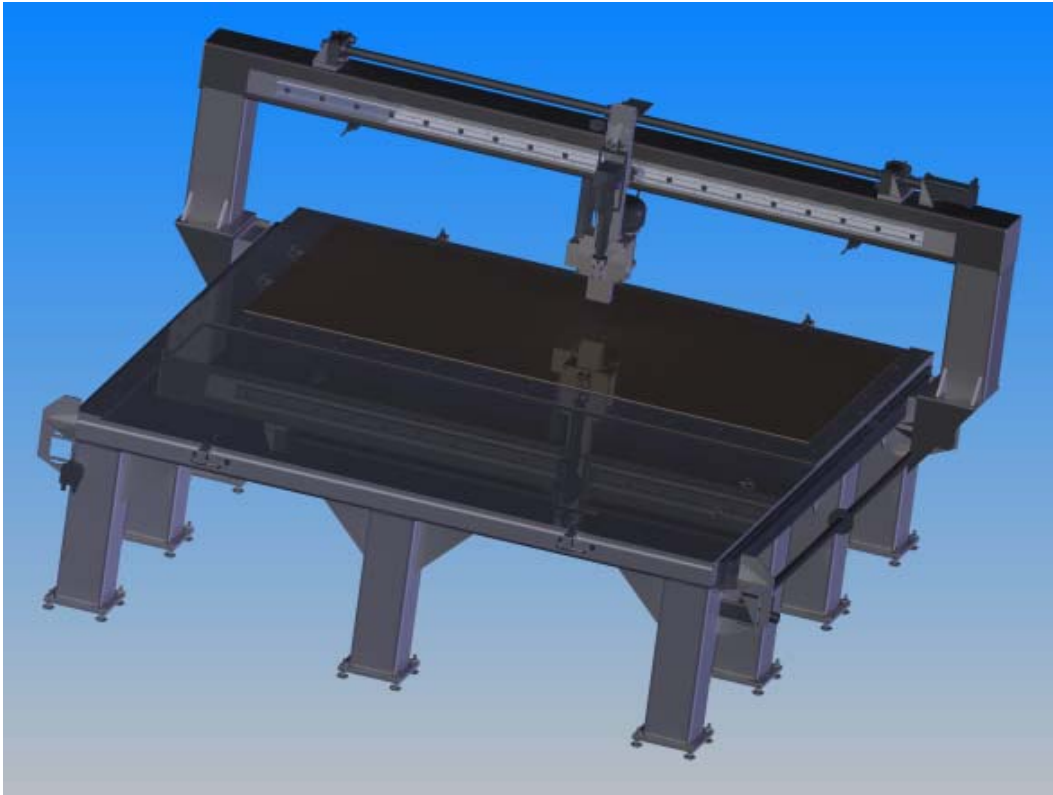


Dual Bay CNC Plywood Router



Sean Munson

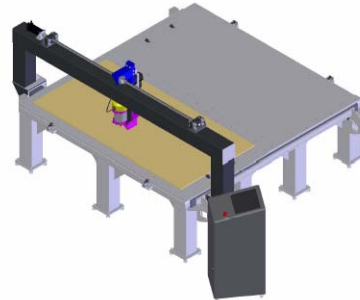
Team members: Matt Hill, Bret Richmond, Jeff Satwicz

Executive Summary

The Dual Bay three-axis CNC Plywood Router makes it possible for wooden boat companies to cut wood panels in sequence without stopping the router bit. Work-piece clamps and datum surfaces ensure a single operator the ability to keep up with the router, while a dust collection system that integrates with the factory's own systems helps keep the work environment clean. All components were designed or selected for a maximal lifetime of high precision operation.



Work Piece Clamp and Mount



Implementation of the CNC Router

Structure

The structure is divided into two primary segments – the machining carriage that moves in the x-axis and contains the components for movement in the y- and z-axes, as well as the table which supports the plywood and carriage.

The table is a post-and-lintel structure, designed to maximize stiffness, which is required in order to achieve the specified precision for the router. The table measures 9 x 9.5 x 4' and supports an 8' x 8' x 3/4" work surface. In addition to steel tubing at the perimeter of the table, two crossbeams are added to increase rigidity and to support the work surface. The table sits on ten eight inch by eight inch legs; each of which has four leveling feet.

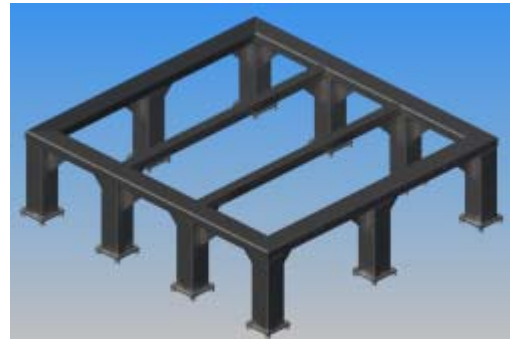


Table Structure (work surface removed)



Complete Carriage

The carriage sits above the table and is attached at four points: twice at the ball nuts that control movement in the x-axis and twice on Bishop Wisecarver Utilitrack rails running parallel to the ball screws. The load of the carriage is well below the maximum rating of the screws and Utilitrack system. Alternative designs that would have required a cantilevered carriage were avoided.

because of concerns about stiffness and ability to support the structure.

The carriage is also a post and lintel structure, fabricated of steel tubing and gusseted as necessary to ensure stiffness. The z-axis control and router head hang from the carriage, attached using one Bishop Wisecarver cart and also at a ballnut. Torque is minimized by placing the majority of the z-axis's mass under the carriage and mounting the ballscrew-ballnut joint off-axis to improve rotational restraint.

Materials

Steel was the most commonly used material in the router, primarily for stiffness, and is found in both the machined parts and a number of the COTS parts such as the Nook ball screws and the Bishop WiseCarver rails. Steel also offers numerous advantages over aluminum for construction, in terms of hardness, ease of welding, and cost. Steel's primary disadvantage – weight – was actually advantageous in this industrial application.

Fasteners and Joints

A mix of butt and miter joints were used. The majority joints were welded, including essentially all structural joints. Welded joints resist vibration the resulting gradual decay in tolerances that can be found when using fasteners, a key strength in this high-use, industrial tool, and so the advantages justify the cost.

Components that were determined to possibly require replacement – the servo motors, the router, Utilitrack rails, limit switches, and work surface – were mounted with fasteners that could be quickly changed in order to minimize downtime when replacement becomes necessary. Standard hex head bolts and socket head cap screws were used throughout the machine, with a goal of minimizing the number of different tools required for assembly or maintenance. The design of a few COTS components did not permit the use of washers, but in general, washers and lock-washers were used through the router's construction. To ensure the security of the fasteners, anywhere that the depth of a component would have been insufficient to ensure at least two diameters of threading (such as on some of the tubing), a plate was welded on and then used to tap into.

Drive Train and Power Transmission

Each axis requires at least one actuator. The x- and y-axes use identical servo motors with integrated encoders. Two are used on the x-axis and one on the y-axis. These motors are coupled directly to the shafts of the ball screws using a COTS coupling, requiring no gearing. As the ball screws turn, the force a ballnut – rotationally restrained by the component it drives – to move along the length of the screw. The entire assembly, including ball screw, ballnut, EZMount bearings, and shaft for attachment, is purchased as a unit from Nook Industries to ensure compatibility and performance.

For the z-axis, a Nook CCHD-5368 linear actuator controls movement.

Shafts and Bearings

In order to ensure the required tolerances are met, all shafts and bearings must be properly aligned. On the y-axis, this challenge is largely addressed by mounting the ball screw and the rail to the same piece of structural tubing. On the x-axis, the ball screws are mounted in slotted brackets to permit alignment.

The Nook ball screws have a reputation for performance in industrial settings, as do the Bishop Wisecarver rails, which were selected in part because they are self-clearing and operate within tolerance even with significant sawdust accumulation.

Areas of Responsibility

Top level design was completed as a group; subsystems then became individuals' responsibilities.

- Matt Hill: Router work surface, x-axis drive systems, and interface with carriage
- Sean Munson: Carriage, y-axis systems, x- and y- drive component selection, and interface with x-axis drive and z-axis unit
- Bret Richmond: Table structure and clamping systems
- Jeff Satwicz: Z-axis Unit

CNC Router Project
Project Costing

Matt Hill, Sean Munson, Bret Richmond, Jeff Satwicz

Labor

Item	Name	Rate	Design Hours	Machining Hours	Assembly Hours	Testing Hours	Total Hours on Project	Cost
1	Div. Dir.	\$125	1	0			1	\$ 125.00
2	Matt Hill	\$9	24	40	20	5	89	\$ 801.00
3	Sean Munson	\$9	30	20	20	12	82	\$ 738.00
4	Bret Richmond	\$9	24	80	30	6	140	\$ 1,260.00
5	Jeff Satwicz	\$9	24	50	20	30	124	\$ 1,116.00
6	Welder	\$18	-	-	80	-	80	\$ 1,440.00

Total Labor \$ 4,040.00

Labor + Overhead \$ 4,848.00

Materials

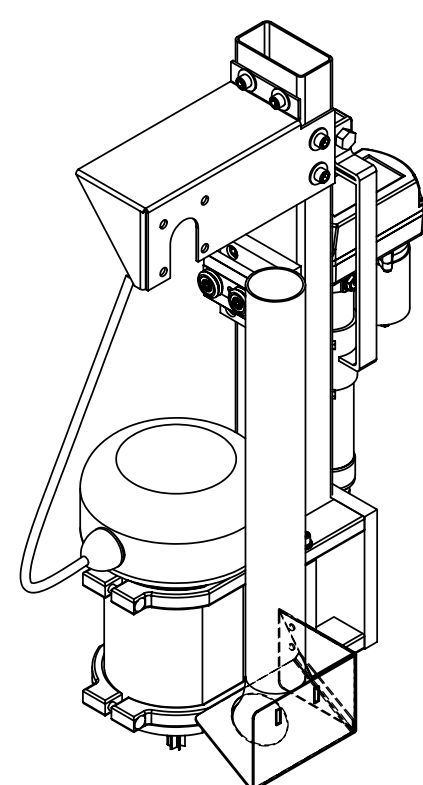
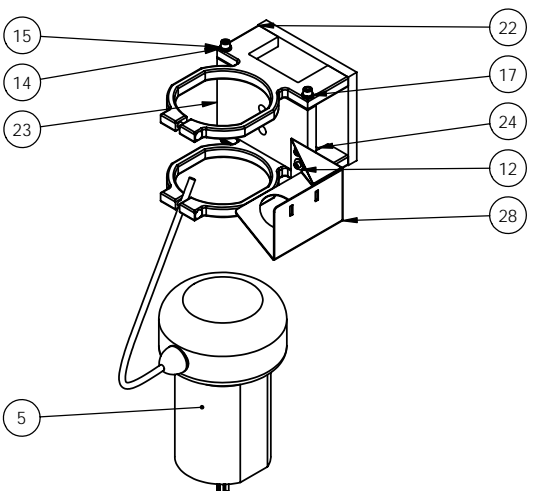
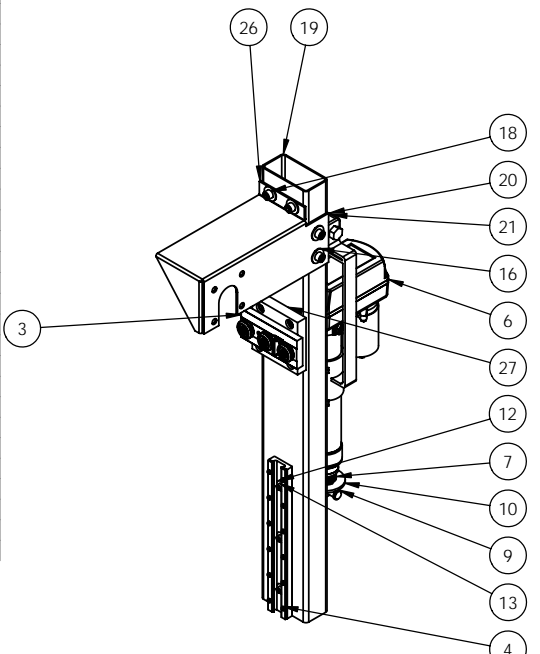
Item	Description	Vendor	Part Number	Unit Cost	Units	Quantity	Cost
1	8" x 1/4" wall square tubing	Davis Structural Steel		\$ 19.37	ft.	25	\$ 484.25
2	4" x 8" x 1/4" wall rectangular tubing	Davis Structural Steel		\$ 14.27	ft.	40	\$ 570.80
3	4" x 1/4" wall square tubing	Davis Structural Steel		\$ 8.65	ft.	20	\$ 173.00
4	1" plate - 4' x 4'	Davis Structural Steel		\$ 456.90	each	1	\$ 456.90
5	1/4" plate - 4' x 4'	Davis Structural Steel		\$ 114.35	each	1	\$ 114.35
6	Linear guide track (z axis)	Bishop Wisecarver	UTCPA1-0290	\$ 41.04	each	1	\$ 41.04
7	Linear guide cart (z axis)	Bishop Wisecarver	UTCCA1	\$ 110.02	each	1	\$ 110.02
8	Linear guide track (x,y axis)	Bishop Wisecarver	UTCTPA2-2790	\$ 447.40	each	3	\$ 1,342.20
9	Linear guide cart (x,y axis)	Bishop Wisecarver	UTCCA2-SS	\$ 159.96	each	3	\$ 479.88
10	0.75" 6061 plate (8" x 6')	McMaster	8975K449	\$ 169.04	each	1	\$ 169.04
11	Dewalt Router Motor	Amazon	DW618M	\$ 169.99	each	1	\$ 169.99
12	Linear Actuator	Nook	CCHD-5368	\$ 324.00	each	1	\$ 324.00
13	Ball screw assembly (y-axis)	Nook	1500-1875 SRT RH/EK/CN/120.00/SBN7654/S	\$ 2,660.00	each	3	\$ 7,980.00
14	2"x4" x 3/16" wall rectangular tubing	Davis Structural Steel		\$ 4.85	ft.	6	\$ 29.10
15	1" square steel tube	McMaster	6527K13	\$ 11.20	6'	1	\$ 11.20
16	Clevis Pin 2.25" x .5"	McMaster	98306A391	\$ 7.61	10	1	\$ 7.61
17	Cotter Pin 1.5" x 5/32"	McMaster	98338A230	\$ 4.36	100	1	\$ 4.36
18	3/8"x16 x 1" SHCS	McMaster	91251A624	\$ 4.71	25	1	\$ 4.71
19	3/8"x16 x 1.5" SHCS	McMaster	91251A628	\$ 5.66	25	1	\$ 5.66
20	1/4"x20 x 1" SHCS	McMaster	91251A542	\$ 13.23	100	1	\$ 13.23
21	1/4" washer	McMaster	90108A413	\$ 1.88	100	1	\$ 1.88
22	3/8" washer	McMaster	90108A417	\$ 3.88	100	1	\$ 3.88
23	1/2" washer	McMaster	90108A033	\$ 9.07	130	1	\$ 9.07
24	1" washer	McMaster	90108A038	\$ 8.99	26	1	\$ 8.99
25	Compression Spring	McMaster	9657K103	\$ 14.80	12	1	\$ 14.80
26	2_13/26" - 3_3/4" Hose clamp	McMaster	5415L25	\$ 8.17	1	1	\$ 8.17
27	0.125" sheet	McMaster	9517K103	\$ 45.36	1	2	\$ 90.72
28	0.075" sheet	McMaster	6544K16	\$ 21.00	1	1	\$ 21.00
29	2 1/2" Vacuum hose	McMaster	5397K14	\$ 2.30	1	25	\$ 57.50
30	De-Sta-Co 685-L	Pnuematic Technology	685-L		each	2	\$ -
31	Custom Bracket for #22	McMaster	6552K511	\$ 115.60	each	1	\$ 115.60
32	3/4" Steel Plate - 4' x 8'	Davis Structural Steel		\$ 500.00	each	1	\$ 500.00

33	1/2"-13 x 1.25" Cap Screw	McMaster	92245A715	\$ 8.08	5	1	\$ 8.08
34	1/2" Steel Plate - 4' x 8'	Davis Structural Steel		\$ 420.00	each	1	\$ 420.00
35	1/4" Lock Washer	McMaster	91101A029	\$ 7.43	1000	1	\$ 7.43
36	1/4"-20 Washer-Head Bolt	McMaster	90316A542	\$ 4.45	25	4	\$ 17.80
37	5/16"-18 x1." SHCS	McMaster	92185A583	\$ 10.45	10	1	\$ 10.45
38	5/16" Washer	McMaster	91090A110	\$ 5.67	100	1	\$ 5.67
39	2"x2"x0.25" Angle Iron	Davis Structural Steel		\$ 1.35	ft.	40	\$ 54.00
40	Omron ZE-NJ-2S Lever Limit Switch	DigiKey	Z1059-ND	\$ 41.28	each	6	\$ 247.68
41	4"x.75"x{3-120", 2-7"}	Davis Structural Steel			linear ft	32	
42	1/4"-20 x .75" MachScrew	McMaster	94613A540	\$ 6.84	100		\$ -
43	bronze flanged bearing for 1/2" shaft	McMaster	6338K418	\$0.47	each	8	\$ 3.76
44	#10-24 x 0.625 SHCS	McMaster	91251A244	\$ 9.56	100	1	\$ 9.56
45	#10 narrow flat washer	McMaster	98029A011	\$4.35	lb.	1	\$ 4.35
46	#10-24 nut	McMaster	90480A011	\$ 1.19	100	1	\$ 1.19
47	#3/8-16 x 1 SHCS	McMaster	91251A624	\$4.71	25	1	\$ 4.71
48	3/8 narrow flat washer	McMaster	91083A031	\$3.60	140	1	\$ 3.60
49	1/4-20 x 4 square neck carriage bolt	McMaster	93548A558	\$8.44	100	1	\$ 8.44
50	1/2 narrow flat washer	McMaster	91201A033	\$7.31	10	11	\$ 80.41
51	1/2-13 x 9 hex bolt	McMaster	91247A742	\$6.01	each	12	\$ 72.12
52	1/2-13 nut	McMaster	95462A033	\$7.76	100	1	\$ 7.76
53	toggle clamp	Carr-Lane	CL-100-SPC	\$20.95	each	8	\$ 167.60
54	Servo motor with Encoder	JVL Industri Electronics		\$125.00	each	3	\$ 375.00
55	1/2-13 stud leveling foot	Carr-Lane	CL-8-SLF	\$10.04	each	40	\$ 401.60

Total Materials \$ 15,234.16

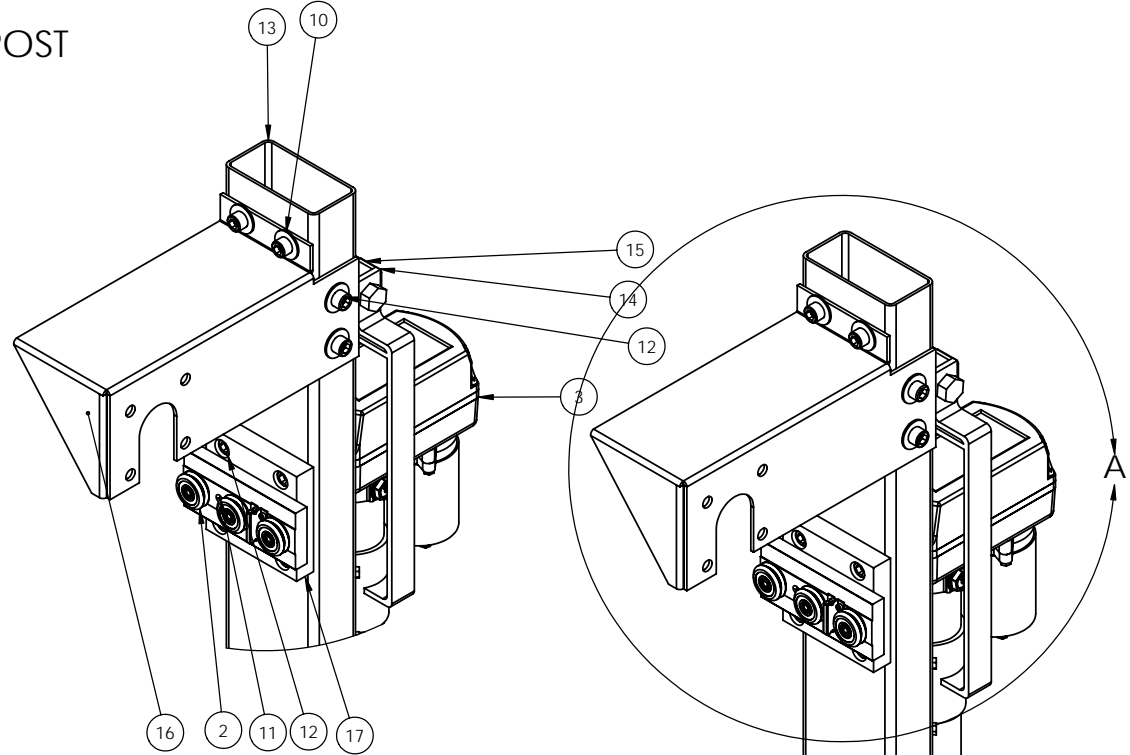
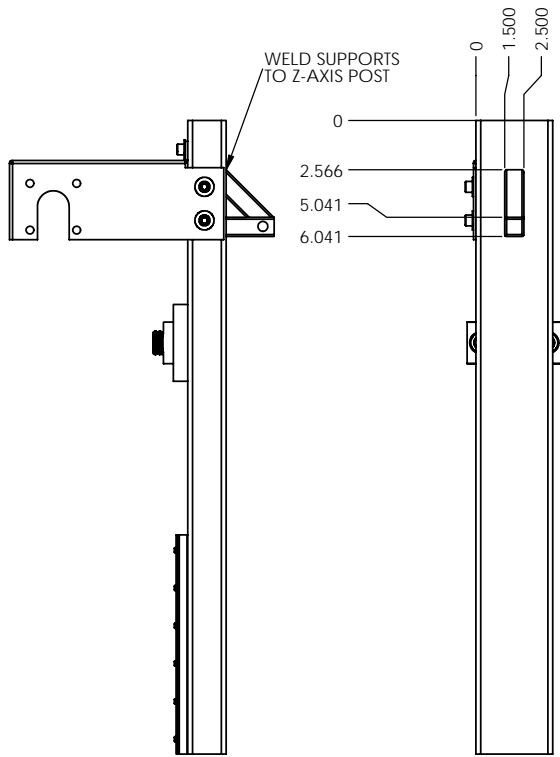
Projected Cost	\$ 20,082.16
PC and G&A	-
Fee	-
Total Project Cost	\$ 20,082.16

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2		LINEAR BEARING CART Z	1
3		LINEAR BEARING CART XY	1
4		LINEAR BEARING Z	1
5		DEWALT ROUTER	1
6		NOOK LINEAR ACTUATOR	1
7		SPRING	1
8		COTTER PIN	1
9		1/2" CLEVIS PIN	1
10		1" FLAT WASHER	1
11		1/2" FLAT WASHER	1
12		1/4" FLAT WASHER	5
13		SHCS 1/4"-20 X 1"	7
14		3/8" FLAT WASHER	4
15		3/8" LOCK WASHER	4
16		3/8" FLAT WASHER	4
17		SHCS 3/8"-16 X 1.5"	6
18		SHCS 3/8"-16 X 1"	16
19	PB-4-01	Z-AXIS POST	1
20	PB-4-02	NOOK TO Z POST	1
21	PB-4-03	NOOK TO Z POST GUSSET	1
22	PB-4-04	ROUTER GRIP FLEXURE	2
23	PB-4-05	CART TO ROUTER PLATE	1
24	PB-4-06	NOOK TO ROUTER PLATE	1
25	PB-4-07	NOOK TO ROUTER PLATE ATTACHMENT	2
26	PB-4-08	ZPOST-BALLNUT	1
27	PB-4-09	ZPOST TO XY CART	1
28	PB-4-10	VACUUM HOSE MOUNT	1

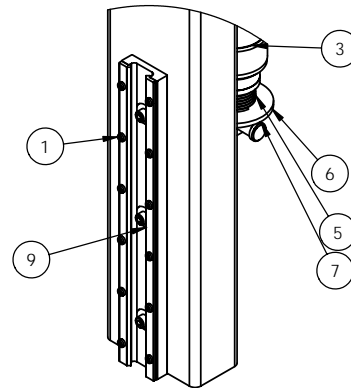


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SIZE	FSCM NO.	PART NO.	PART REV					DOC REV																		
C		PB-4-00						-																		
SCALE	1:8	WT	72.1797	SHEET 1 OF 3																						
X.X ± .03 ∠ ± .5°		CHECKED																								
X.XX ± .01		RESP ENG																								
X.XXX ± .005 125/		MFG ENG																								
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX		QUAL ENG			= (CRITICAL DIMENSION)																					

Z-AXIS POST



DETAIL A
SCALE 1 : 3



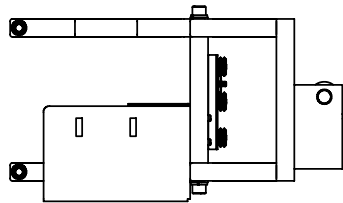
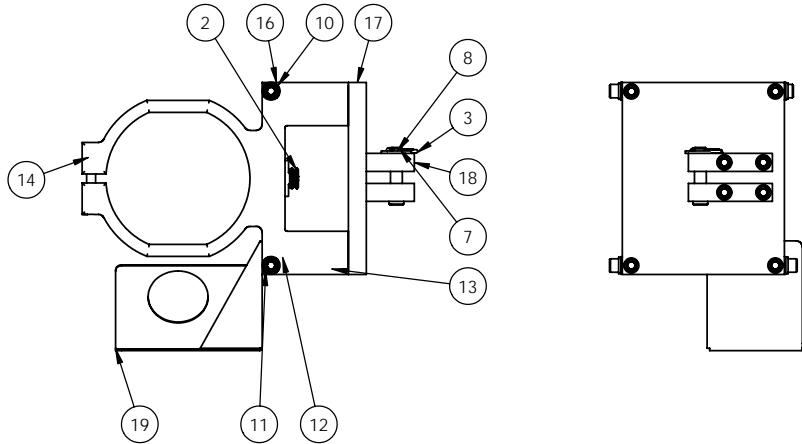
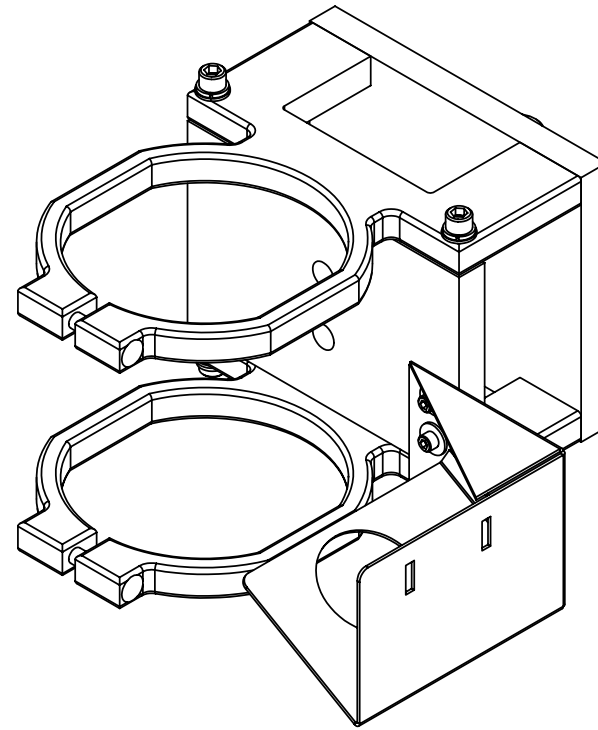
DETAIL B
SCALE 1 : 3

ITEM NO.	Number	DESCRIPTION	ZPost/QTY.
1		LINEAR BEARING	1
2		LINEAR BEARING CART	1
3		NOOK LINEAR ACTUATOR	1
4		COTTER PIN	1
5		SPRING	1
6		1" FLAT WASHER	1
7		1/2" CLEVIS PIN	1
8		1/2" FLAT WASHER	1
9		1/4" FLAT WASHER	3
10		3/8" FLAT WASHER	4
11		SHCS 1/4"-20 X 1"	5
12		SHCS 3/8"-16 X 1"	8
13	PB-4-01	Z-AXIS POST	1
14	PB-4-02	NOOK TO Z POST	1
15	PB-4-03	NOOK TO Z POST GUSSET	1
16	PB-4-08	ZPOST-BALLNUT	1
17	PB-4-09	ZPOST TO XY CART	1

SIZE C	FSCM NO.	PART NO. PB-4-00	PART REV.	DOC REV.
SCALE 1:8	72.1797		2	OF 3

ITEM NO.	Number	DESCRIPTION	Carriage/QTY.
1		SHOP VAC HOSE	1
2		LINEAR BEARING CART XY	1
3		COTTER PIN	1
4		DEWALT ROUTER	1
5		SPRING	1
6		1" FLAT WASHER	1
7		1/2" CLEVIS PIN	1
8		1/2" FLAT WASHER	1
9		1/4" FLAT WASHER	2
10		3/8" FLAT WASHER	4
11		3/8" LOCK WASHER	4
12		SHCS 1/4"-20 X 1"	2
13		SHCS 3/8"-16 X 1"	8
14		SHCS 3/8"-16 X 1.5"	6
15	PB-4-04	ROUTER GRIP FLEXURE	2
16	PB-4-05	CART TO ROUTER PLATE	1
17	PB-4-06	NOOK TO ROUTER PLATE	1
18	PB-4-07	NOOK TO ROUTER PLATE ATTACHMENT	2
19	PB-4-10	VACUUM HOSE MOUNT	1

ROUTER CARRIAGE



SIZE	FSCM NO.	PART NO.	PART REV.	DOC REV.
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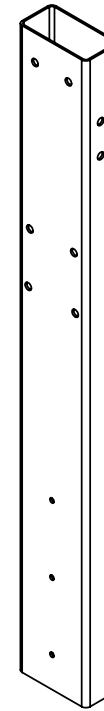
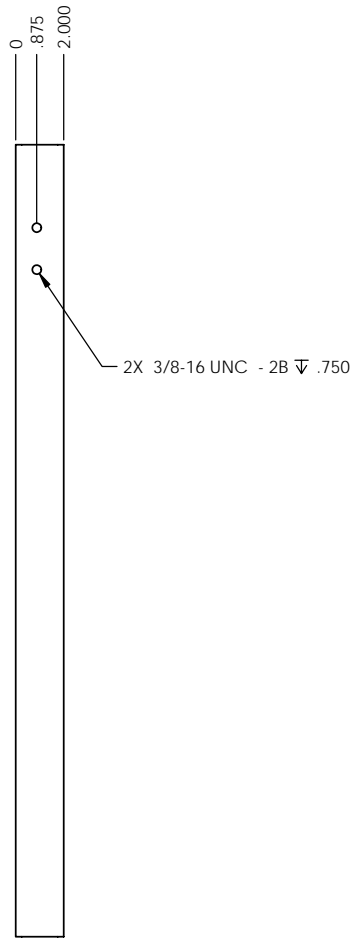
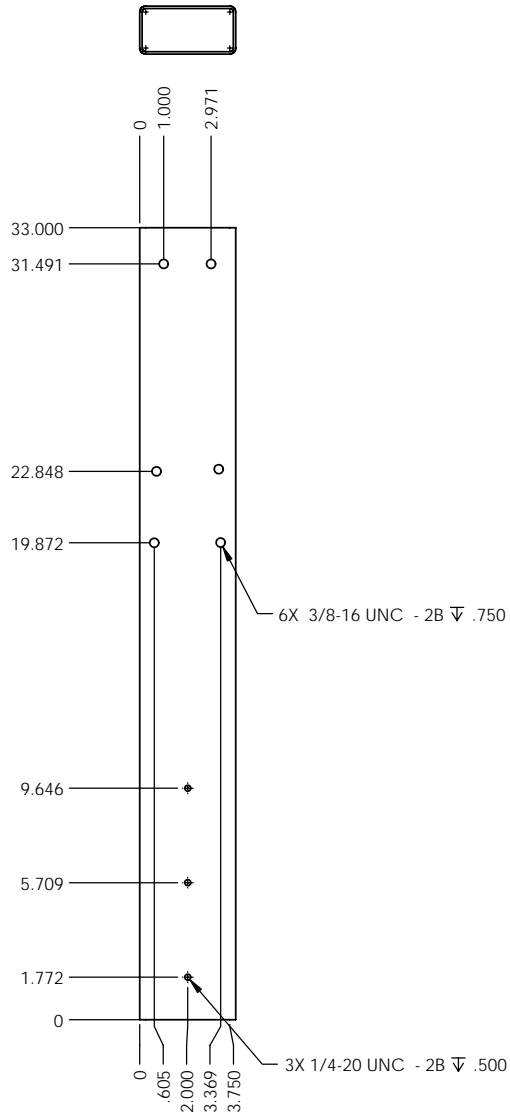
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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 2" X 4" X 1/8" RECTANGULAR TUBING



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/√

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY J. SATWICZ	12.9.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



Z-AXIS POST 1020 CARBON STEEL 2"X4"X0.065" RECT TUBE				
SIZE C	FSCM NO.	PART NO. PB-4-01	PART REV	DOC REV
SCALE 1:8	WT 10.3049	SHEET 1	OF 1	

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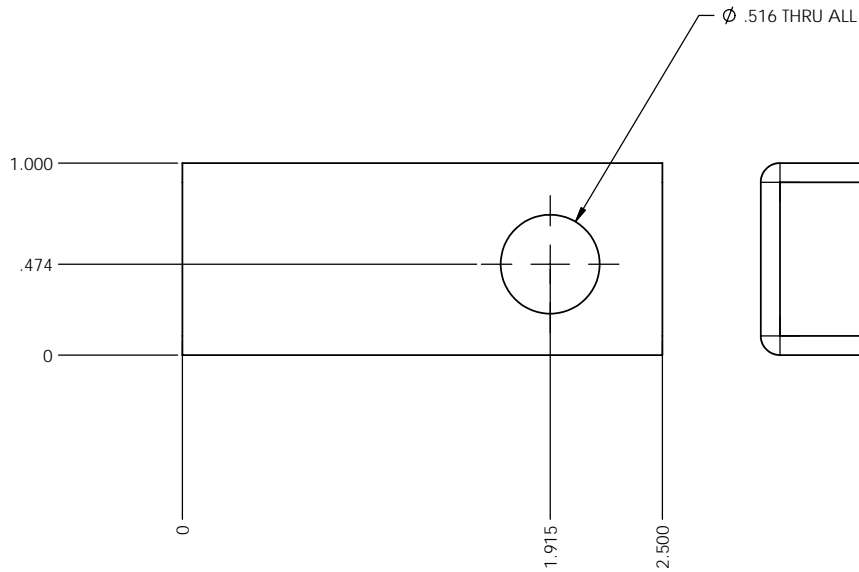
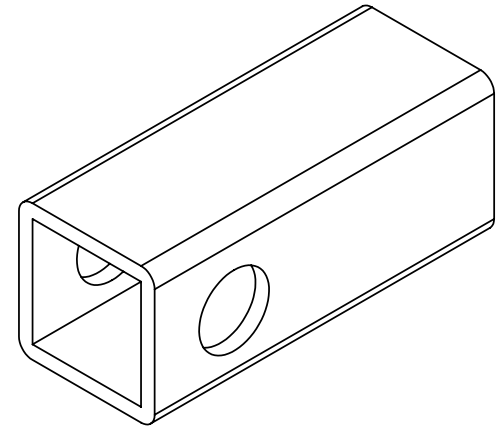
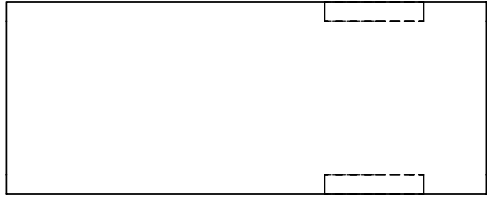
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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 1" X 1" X 0.065" SQUARE TUBING



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X $\pm .03$ $\angle \pm .5^\circ$ X.XX $\pm .01$ X.XXX $\pm .005$ $125/\sqrt{}$ REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	APPROVED	DATE					
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	CHECKED						
	RESP ENG						
MFG ENG							
QUAL ENG			SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
			C		PB-4-02	-	-
	◆ = (CRITICAL DIMENSION)		SCALE	2:1	WT	0.2328	SHEET 1 OF 1

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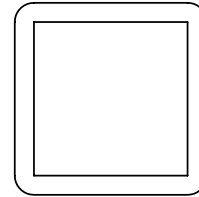
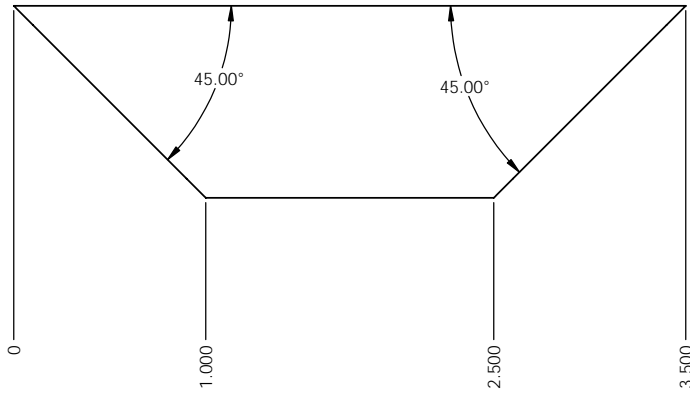
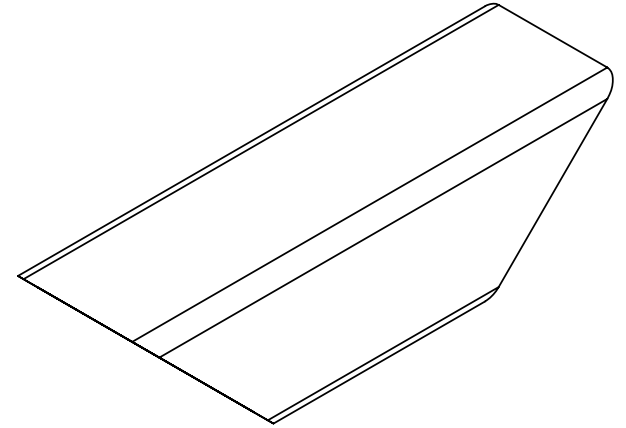
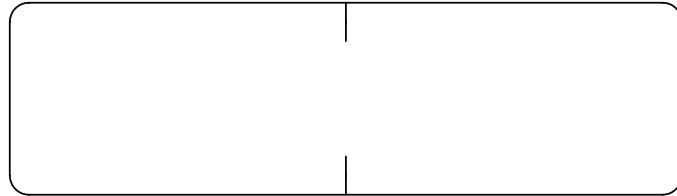


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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 1" X 1" X 0.065" SQUARE TUBING



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994	APPROVED	DATE					
	PREP BY	J. SATWICZ					12.9.2004
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√	CHECKED		NOOK TO Z POST GUSSET Alloy Steel 1" X 0.065" SQUARE TUBE				
	RESP ENG						
	MFG ENG						
	QUAL ENG						
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	◆ = (CRITICAL DIMENSION)	SCALE 2:1	SIZE C	FSCM NO.	PART NO. PB-4-03	PART REV	DOC REV -
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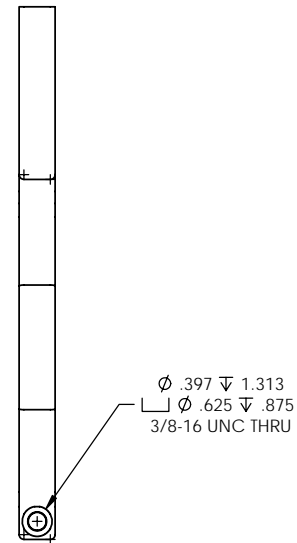
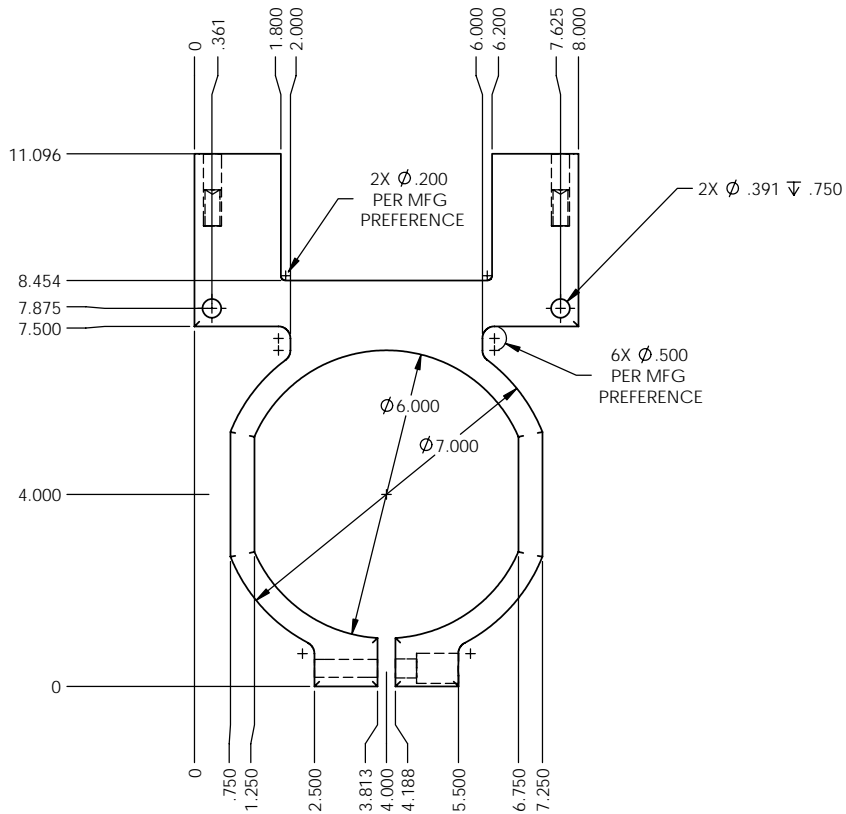
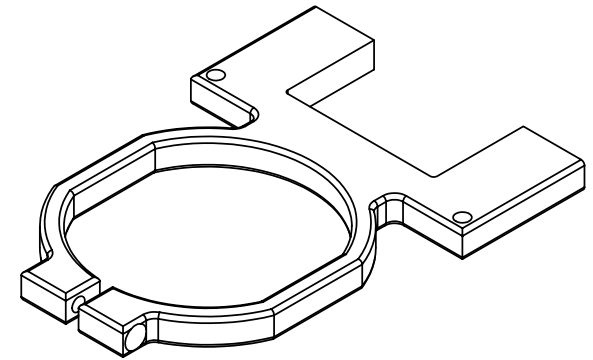
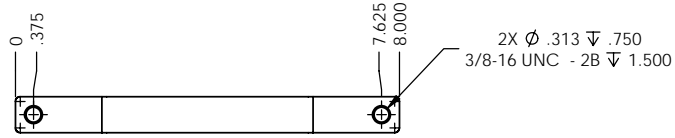
3

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1

NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 3/8" PLATE



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√	APPROVED	DATE					
	PREP BY	J. SATWICZ					12.9.2004
	CHECKED			ROUTER GRIP FLEXURE 1020 CARBON STEEL 0.75" STOCK			
	RESP ENG						
MFG ENG							
QUAL ENG			SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	◆ = (CRITICAL DIMENSION)	SCALE 1:2	C		PB-4-04		
			WT	5.8712	SHEET	1	OF 1

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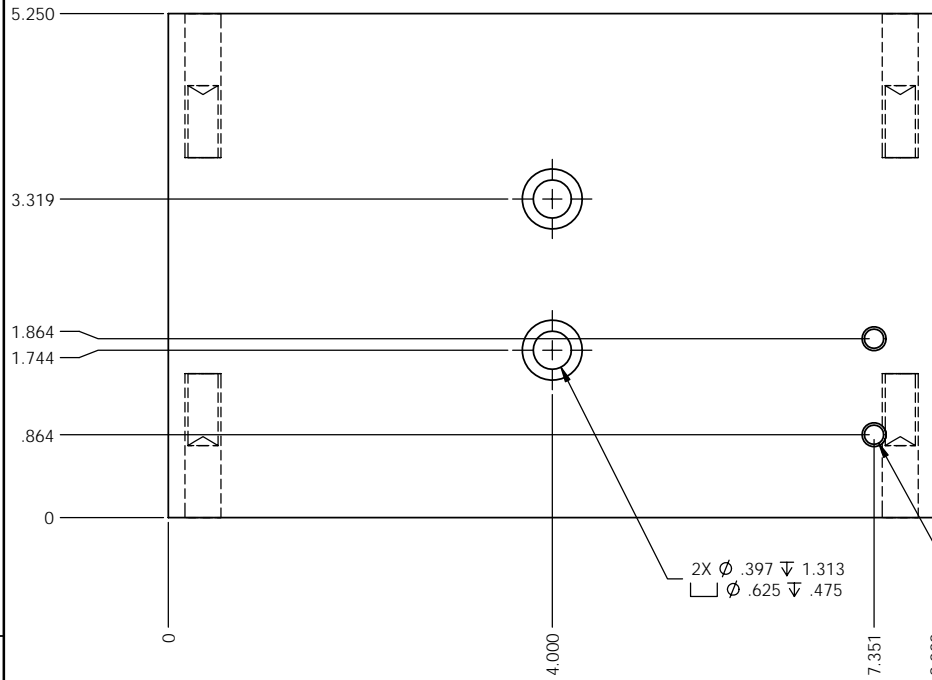
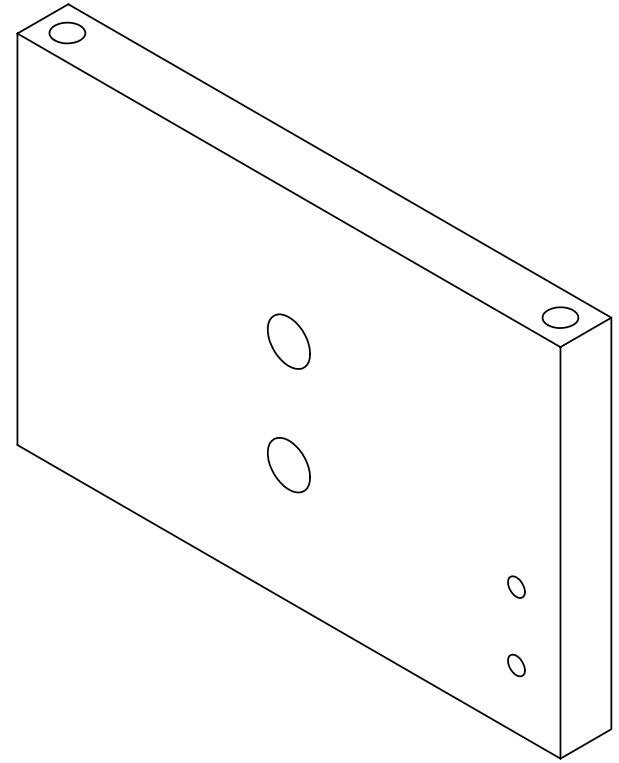
1

NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 3/8" PLATE



4X \varnothing .313 ∇ .750
3/8-16 UNC - 2B ∇ 1.500



2X \varnothing .201 THRU ALL
1/4-20 UNC - 2B ∇ .500

.750

ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
X.X \pm .03 \angle \pm .5°
X.XX \pm .01
X.XXX \pm .005 \surd 125/

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY J. SATWICZ	12.9.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



CART TO ROUTER PLATE
1020 CARBON STEEL
0.75" STOCK

SIZE C	FSCM NO.	PART NO. PB-4-05	PART REV	DOC REV
SCALE 1:2	WT 8.5218	SHEET 1	OF 1	

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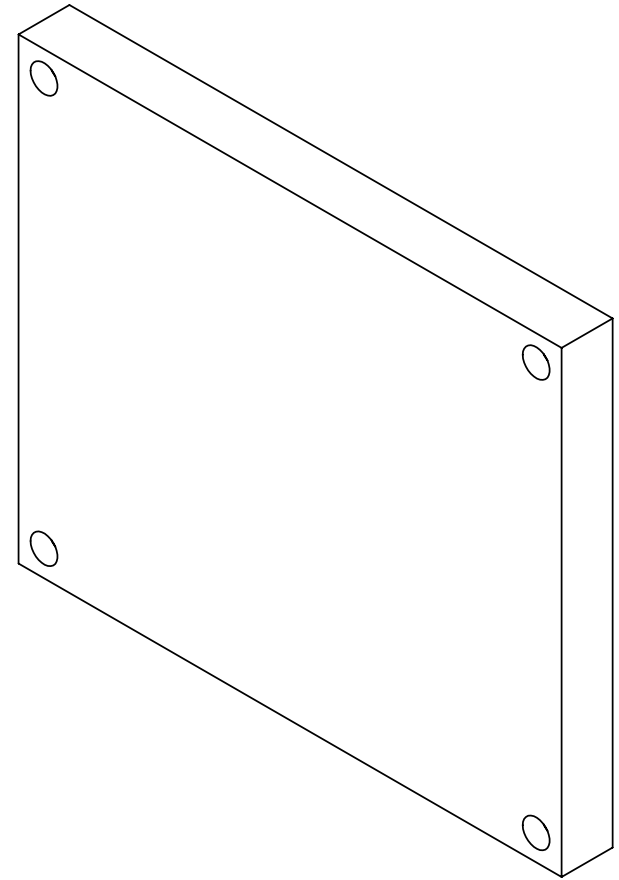
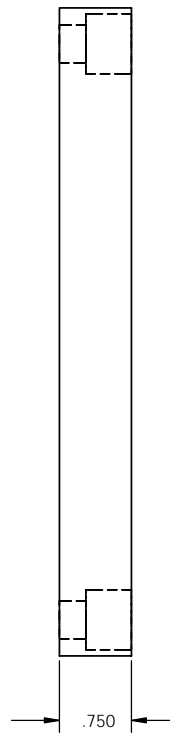
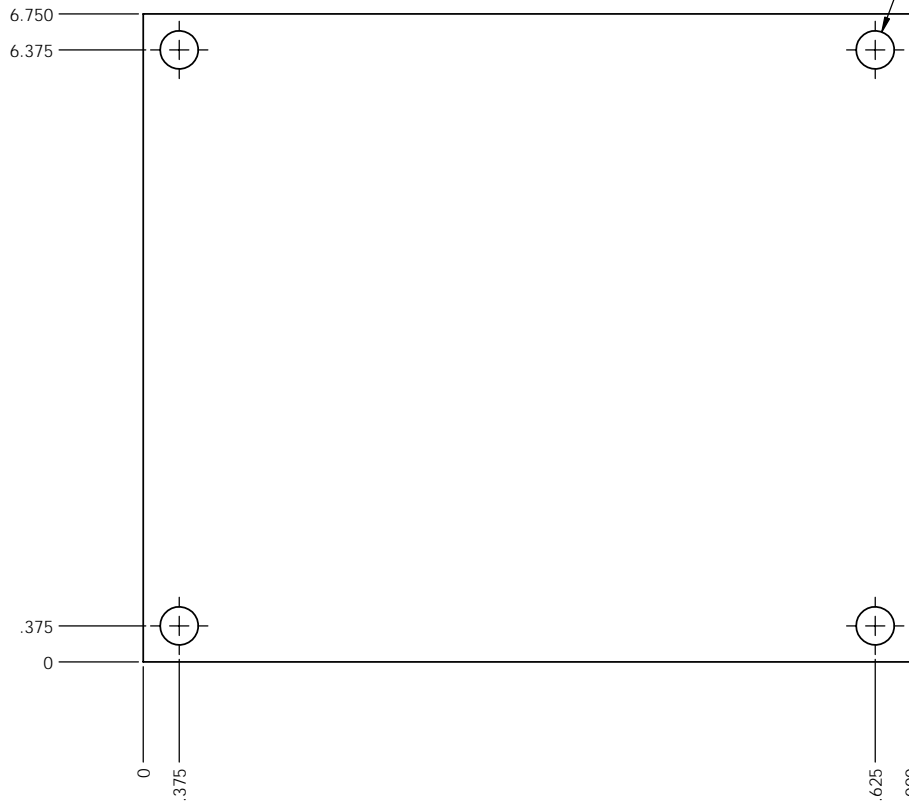
1

NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 3/4" PLATE



4X Ø .397 THRU ALL
 □ Ø .625 ▽ .475



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY J. SATWICZ	12.9.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



NOOK TO ROUTER PLATE
 Alloy Steel
 0.75" PLATE

SIZE C	FSCM NO.	PART NO. PB-4-06	PART REV	DOC REV -
SCALE 1:2	WT 11.0663	SHEET 1	OF 1	

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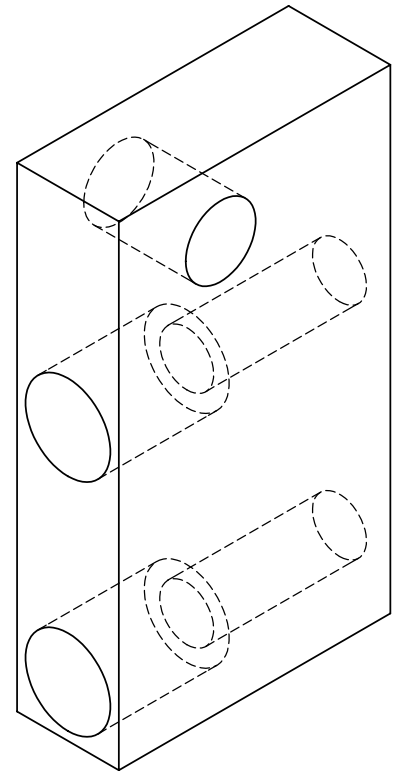
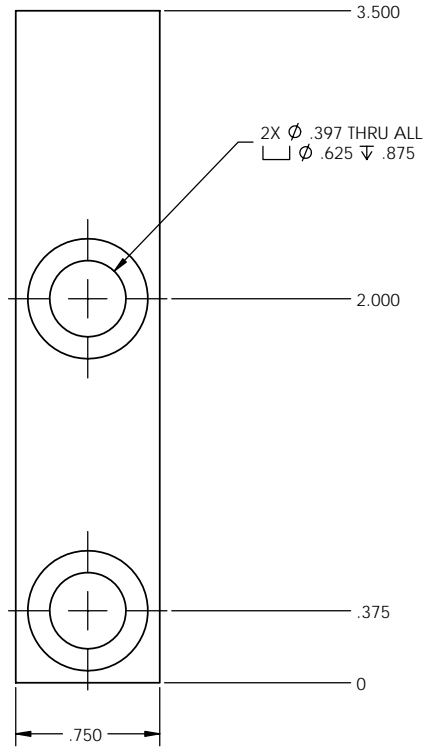
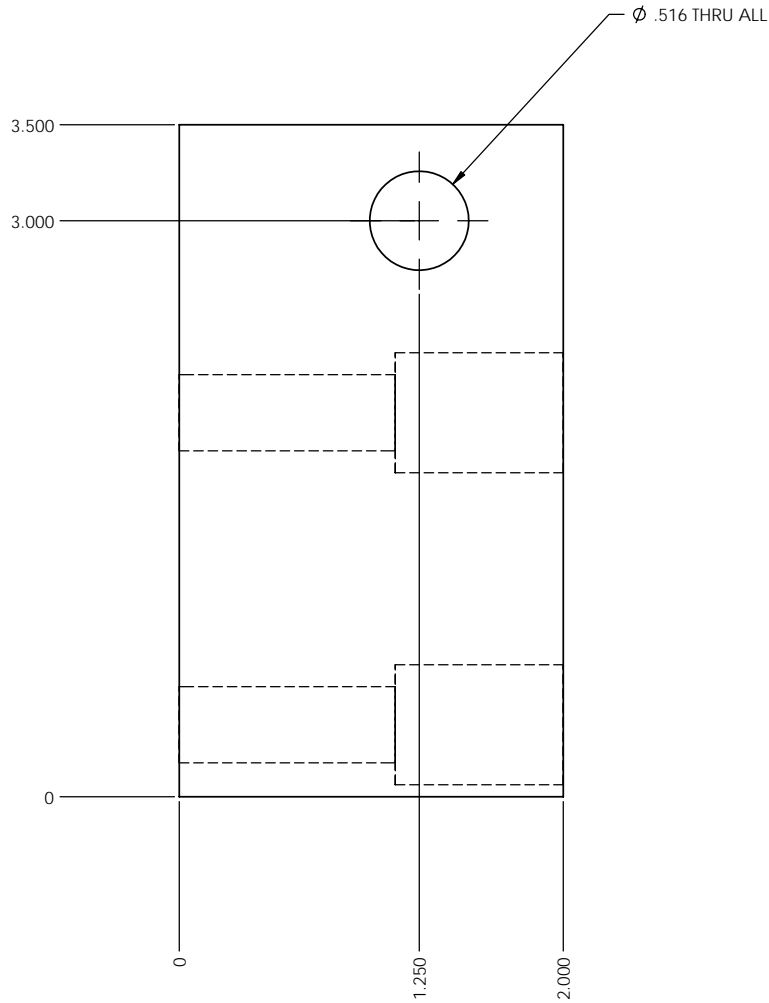
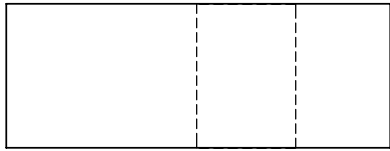
3

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 3/4" PLATE



ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 $\angle \pm .5^\circ$
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY J. SATWICZ	12.9.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



NOOK TO ROUTER PLATE ATTACHMENT

Alloy Steel
0.75" PLATE

SIZE C	FSCM NO.	PART NO. PB-4-07	PART REV	DOC REV
SCALE 1:1	WT 1.1900	SHEET 1	OF 2	

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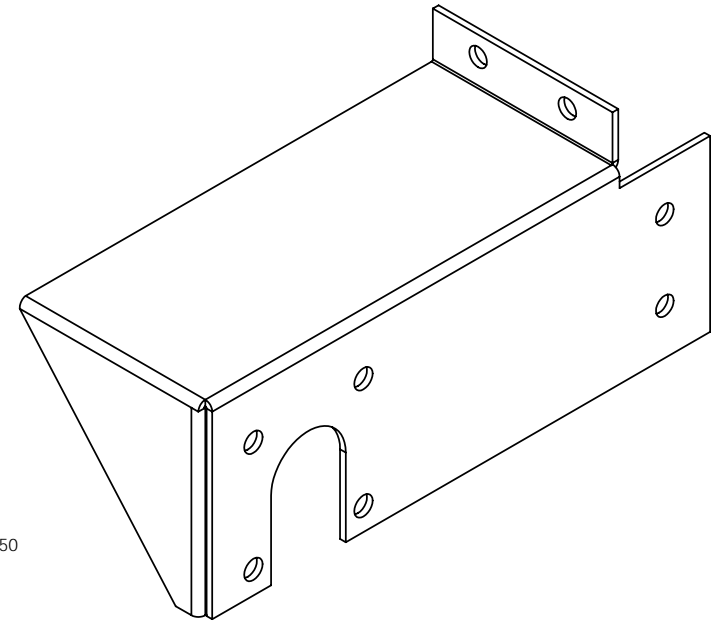
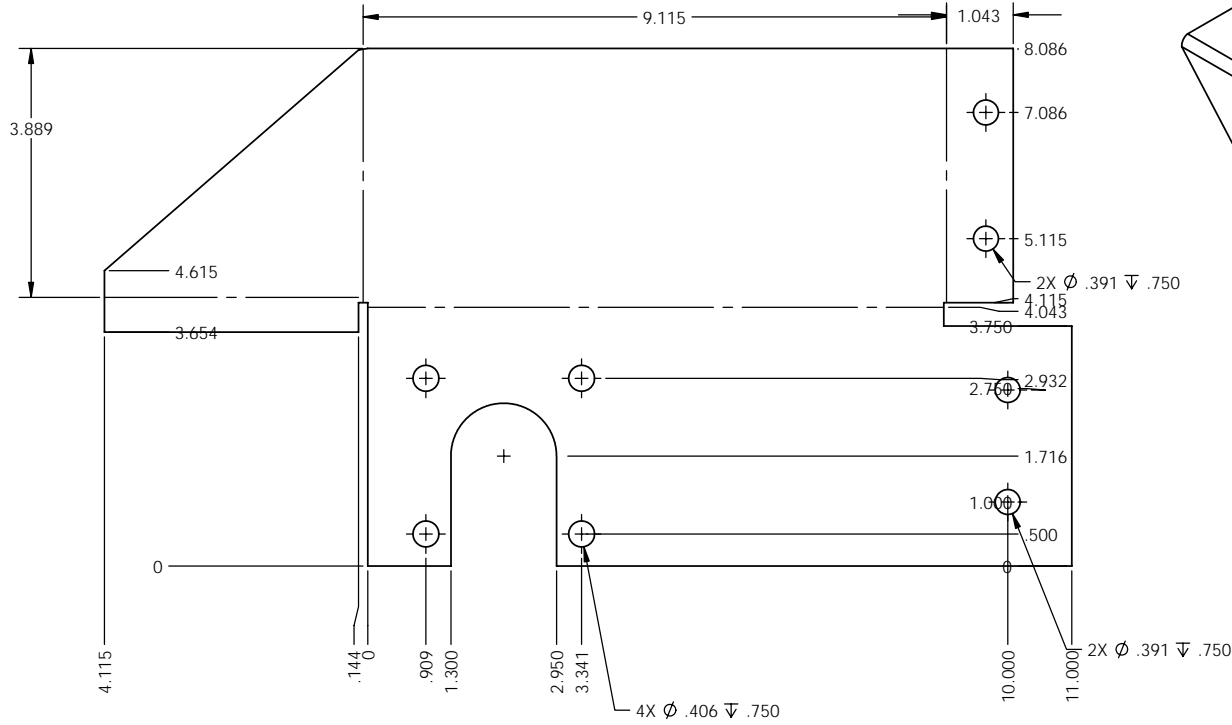
3

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 0.125" SHEET



ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY J. SATWICZ	12.11.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



ZPOST-BALLNUT Alloy Steel 0.125" SHEET		SIZE C	FSCM NO.	PART NO. PB-4-08	PART REV	DOC REV -
SCALE 1:2	WT 3.1612	SHEET 1	OF 1			

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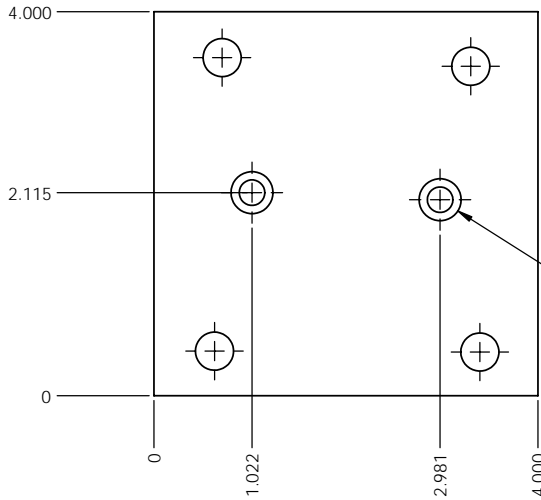
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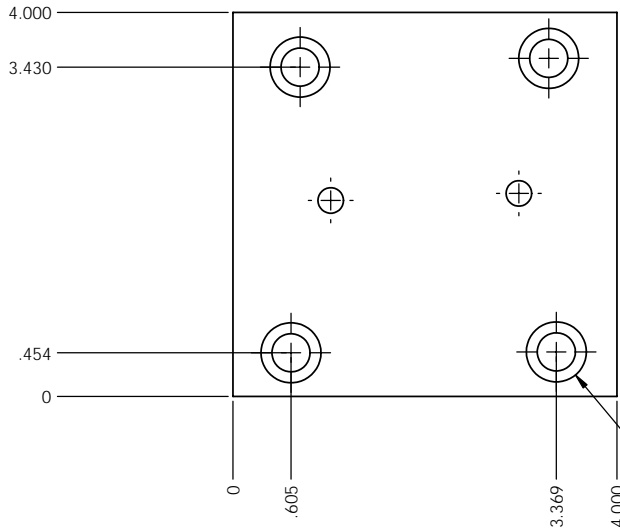
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NOTES, UNLESS OTHERWISE SPECIFIED

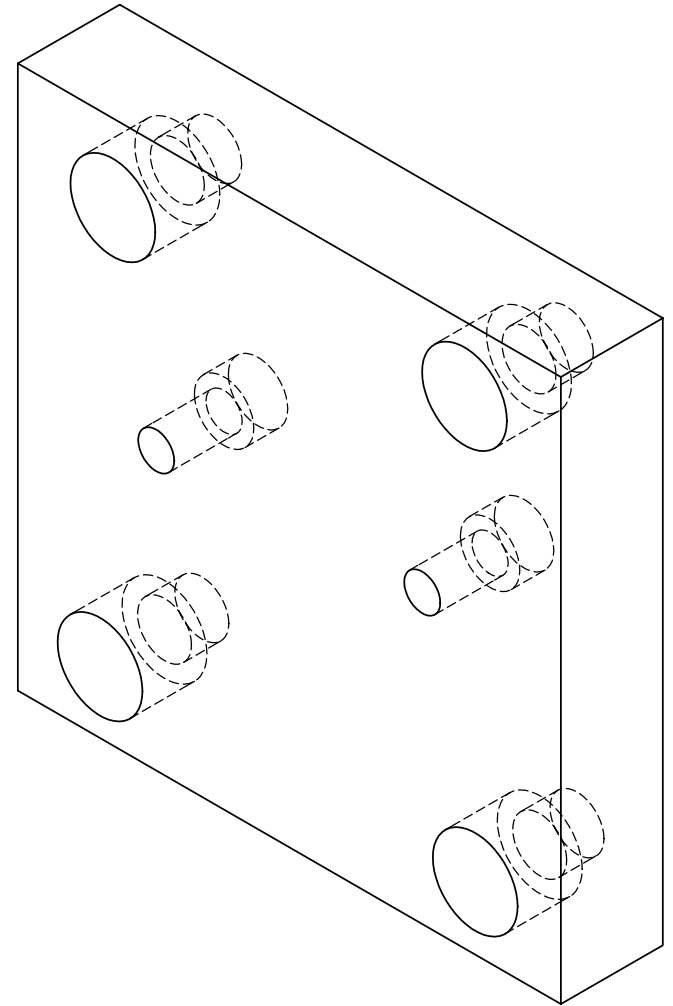
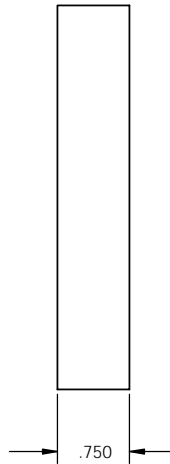
- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 3/4" PLATE



2X ϕ .266 ∇ 1.313
 \square ϕ .438 ∇ .250



4X ϕ .397 ∇ 1.313
 \square ϕ .625 ∇ .475



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X \pm .03 \angle \pm .5° X.XX \pm .01 X.XXX \pm .005 \surd 125/ REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	APPROVED	DATE					
	PREP BY	J. SATWICZ	12.11.2004	ZPOST TO XY CART Alloy Steel 0.75" PLATE			
	CHECKED						
	RESP ENG						
MFG ENG							
QUAL ENG			SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
			C		PB-4-09		-
			SCALE	1:1	WT	3.1018	SHEET 1 OF 1

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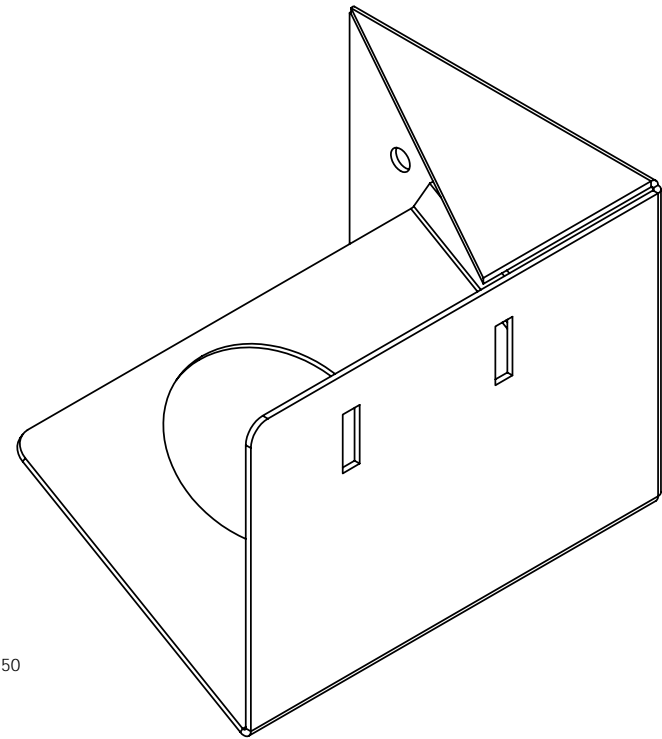
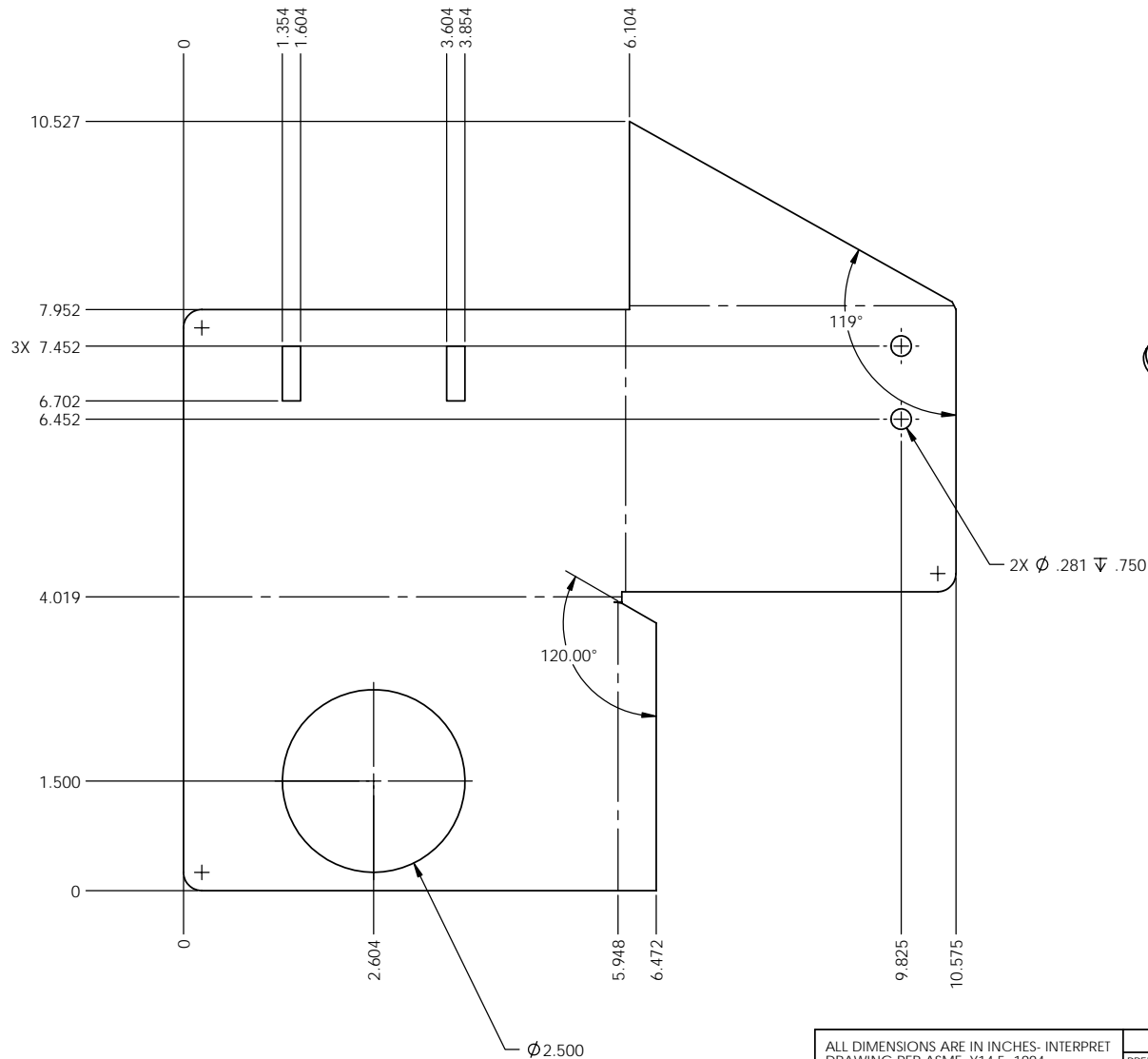
3

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 0.075" SHEET (14 GAUGE)



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:

X.X ± .03 ∠ ± .5°

X.XX ± .01

X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY J. SATWICZ	12.11.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



VACUUM HOSE MOUNT
Alloy Steel
0.075" SHEET

SIZE C	FSCM NO.	PART NO. PB-4-10	PART REV	DOC REV -
SCALE 1:1	WT 1.4058	SHEET 1	OF 2	

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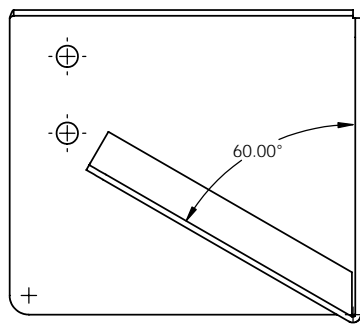
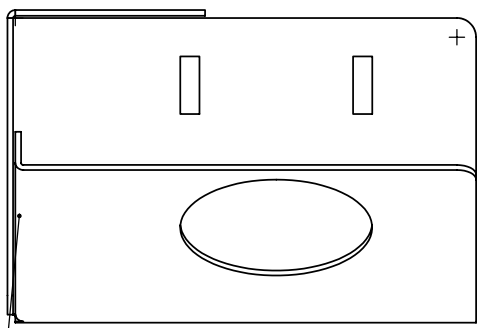
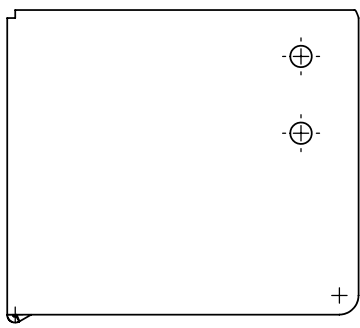
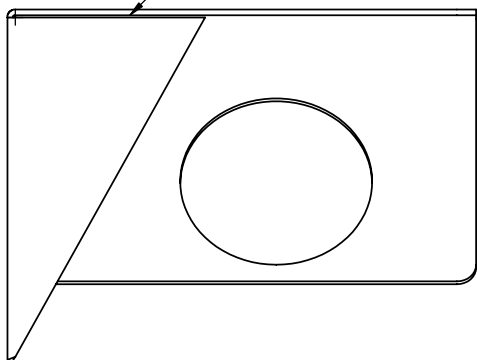
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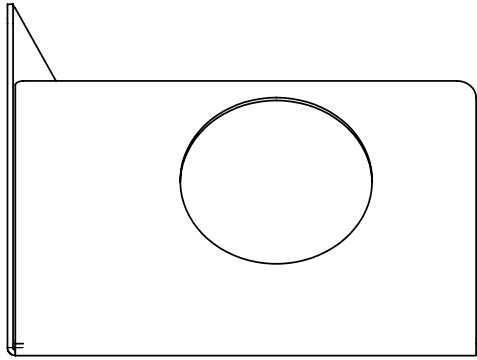
A

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0.125" WELD 2.5" LONG



0.125" WELD 3" LONG



SIZE	FSCM NO.	PART NO.	PART REV.	DOC REV.
C		PB-4-10		-
SCALE	1:1	1/14058	SHEET 2	OF 2

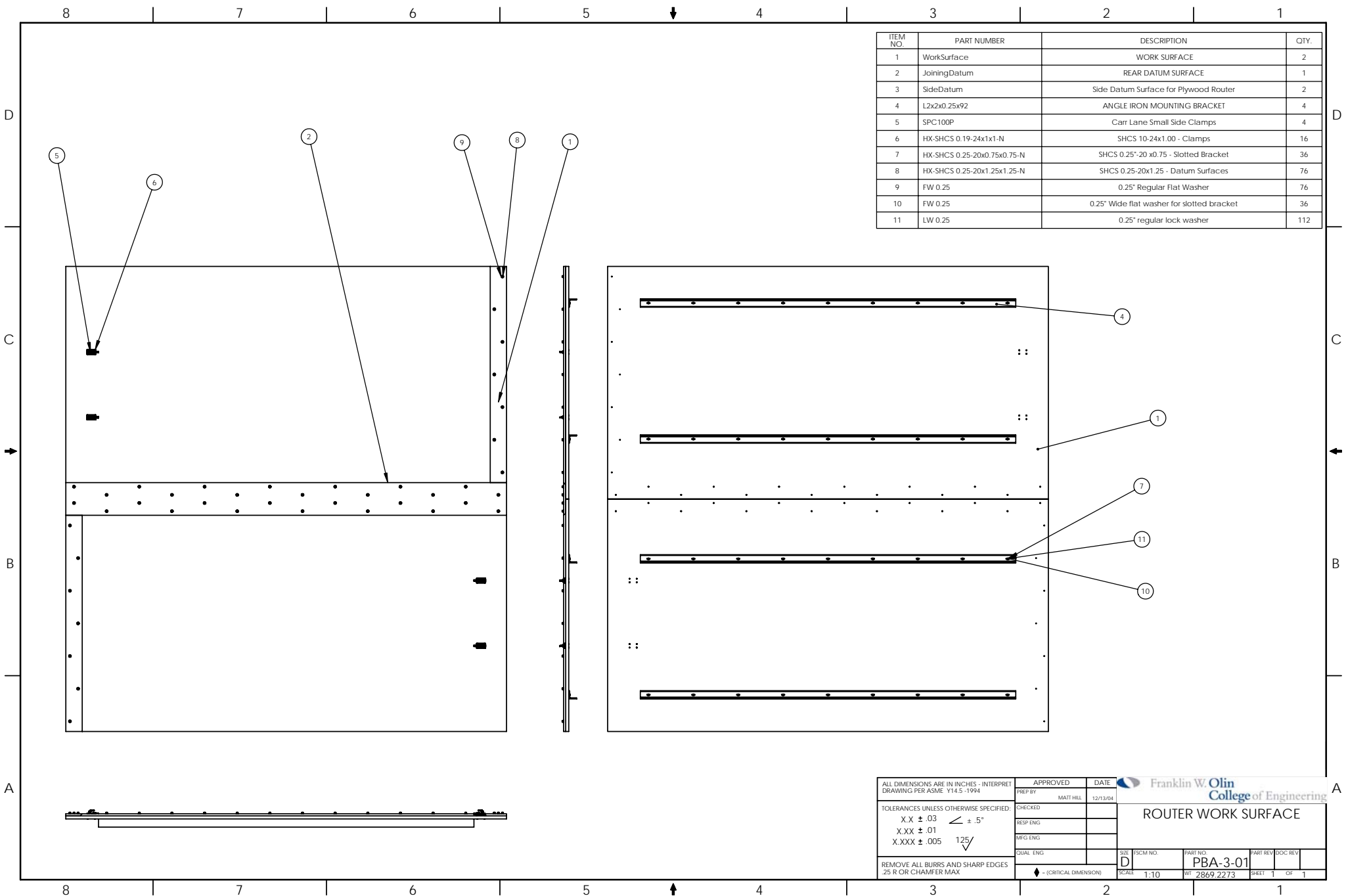
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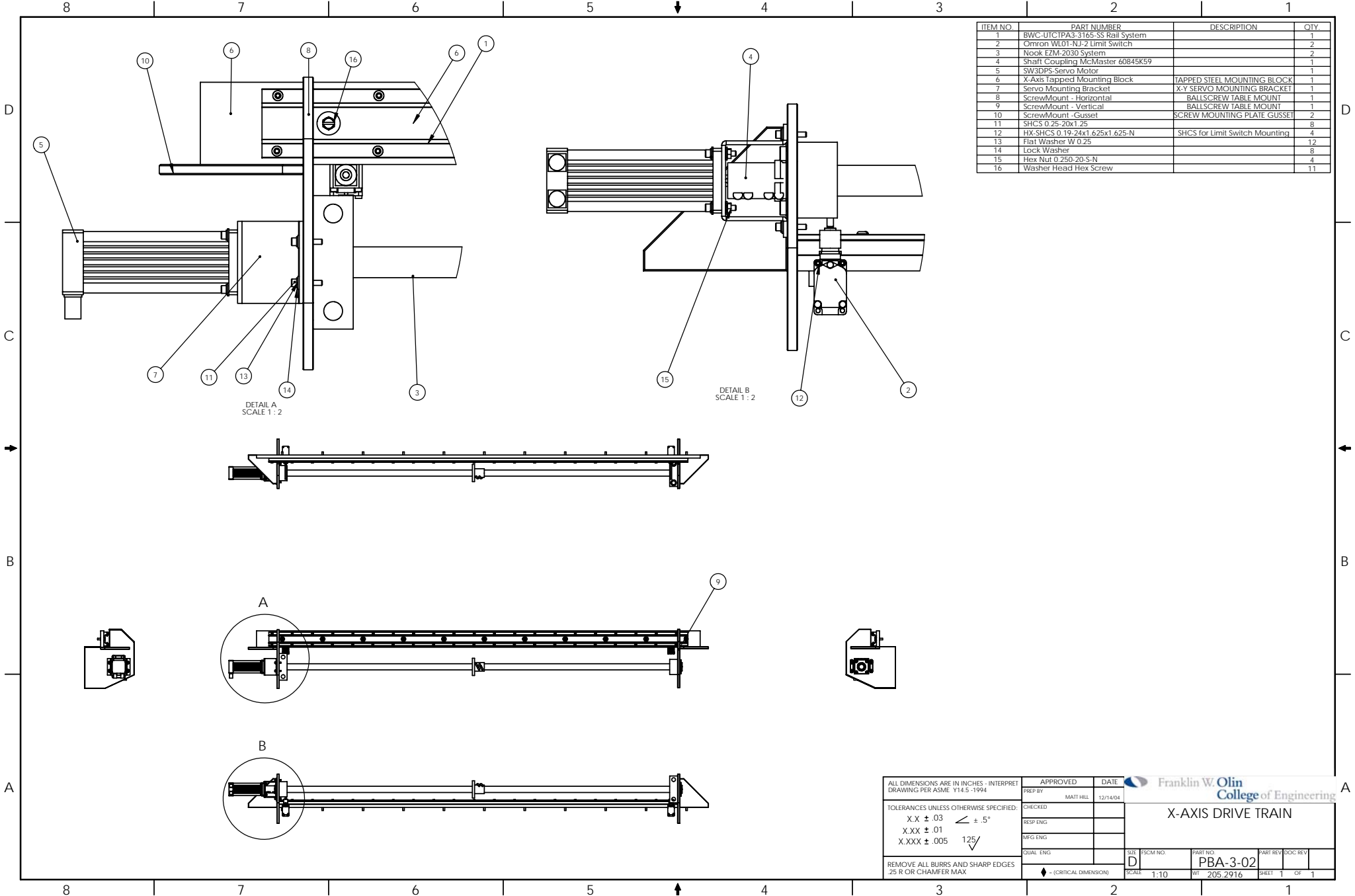
2

1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	WorkSurface	WORK SURFACE	2
2	JoiningDatum	REAR DATUM SURFACE	1
3	SideDatum	Side Datum Surface for Plywood Router	2
4	L2x2x0.25x92	ANGLE IRON MOUNTING BRACKET	4
5	SPC100P	Carr Lane Small Side Clamps	4
6	HX-SHCS 0.19-24x1x1-N	SHCS 10-24x1.00 - Clamps	16
7	HX-SHCS 0.25-20x0.75x0.75-N	SHCS 0.25"-20 x0.75 - Slotted Bracket	36
8	HX-SHCS 0.25-20x1.25x1.25-N	SHCS 0.25-20x1.25 - Datum Surfaces	76
9	FW 0.25	0.25" Regular Flat Washer	76
10	FW 0.25	0.25" Wide flat washer for slotted bracket	36
11	LW 0.25	0.25" regular lock washer	112

ALL DIMENSIONS ARE IN INCHES - INTERPRET DRAWING PER ASME Y14.5-1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 $\angle \pm .5^\circ$ X.XX ± .01 X.XXX ± .005 125/√	APPROVED	DATE		
	PREP BY	MATT HILL	12/13/04	ROUTER WORK SURFACE
	CHECKED			
	RESP ENG			
MFG ENG				
QUAL ENG				
REMOVE ALL BURRS AND SHARP EDGES .25 R OR CHAMFER MAX	SIZE D SCALE: 1:10 (CRITICAL DIMENSION)	ESCM NO. PART NO. PBA-3-01 Wt 2869.2273	PART REV DOC REV	SHEET 1 OF 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	BWC-UTC/PA3-3165-SS Rail System		1
2	Omron WL01-NJ-2 Limit Switch		2
3	Nook EZM-2030 System		2
4	Shaft Coupling McMaster 60845K59		1
5	SW3DPS-Servo Motor		1
6	X-Axis Tapped Mounting Block	TAPPED STEEL MOUNTING BLOCK	1
7	Servo Mounting Bracket	X-Y SERVO MOUNTING BRACKET	1
8	ScrewMount - Horizontal	BALLSCREW TABLE MOUNT	1
9	ScrewMount - Vertical	BALLSCREW TABLE MOUNT	1
10	ScrewMount - Gusset	SCREW MOUNTING PLATE GUSSET	2
11	SHCS 0.25-20x1.25		8
12	HX-SHCS 0.19-24x1.625x1.625-N	SHCS for Limit Switch Mounting	4
13	Flat Washer W 0.25		12
14	Lock Washer		8
15	Hex Nut 0.250-20-5-N		4
16	Washer Head Hex Screw		11

DETAIL A
SCALE 1:2

DETAIL B
SCALE 1:2

ALL DIMENSIONS ARE IN INCHES - INTERPRET DRAWING PER ASME Y14.5-1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 $\angle \pm .5^\circ$ X.XX ± .01 X.XXX ± .005 125/√	APPROVED	DATE		
	PREP BY	MATT HILL	12/18/04	X-AXIS DRIVE TRAIN
	CHECKED			
	RESP ENG			
REMOVE ALL BURRS AND SHARP EDGES .25 R OR CHAMFER MAX	QUAL ENG		SIZE D SCALE 1:10	PART NO. PBA-3-02 WT 205.2916
			PART REV 1 DOC REV 1	SHEET 1 OF 1

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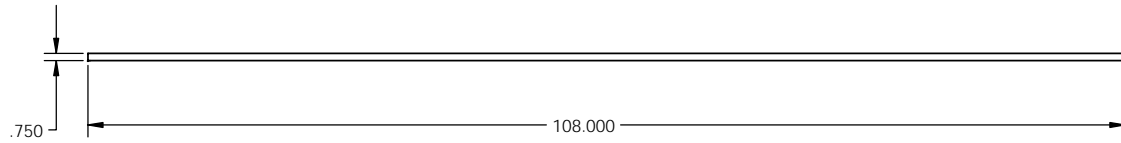
1

NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 108"X57"X0.75"

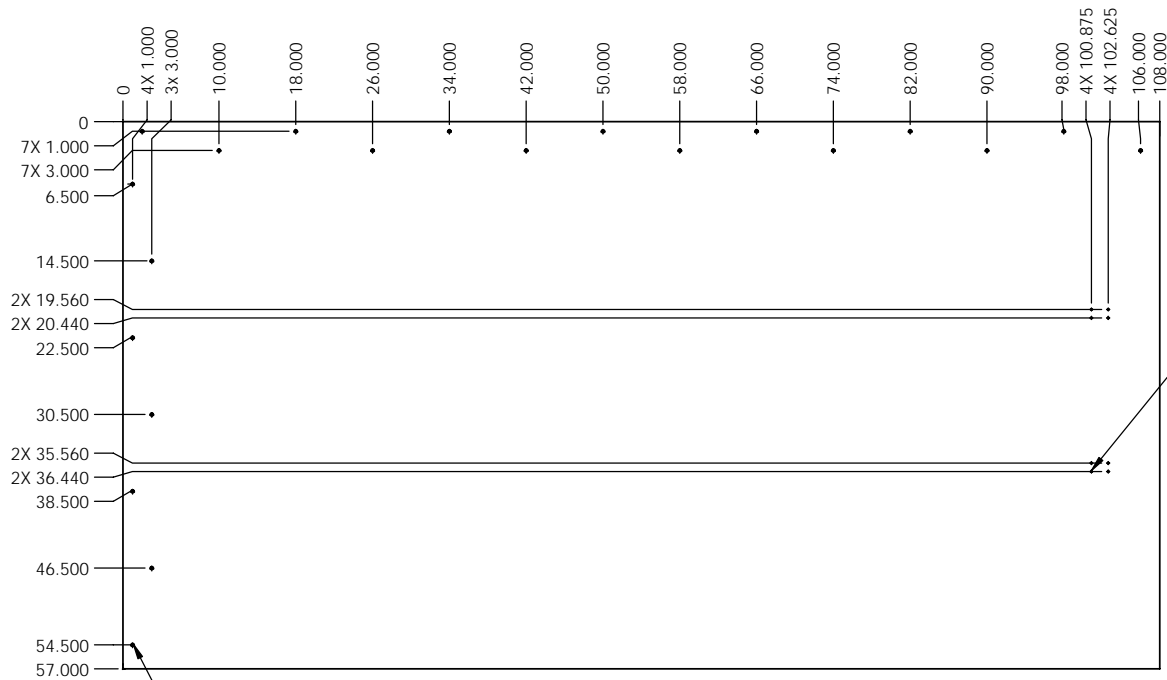
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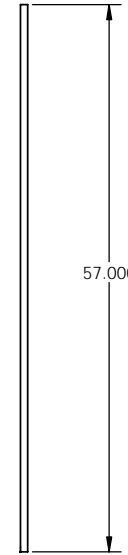
B

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A

21X 1/4"-20 THRU

#10-24 Tapped Hole



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

APPROVED DATE

PREP BY MATT HILL 12/13/04

TOLERANCES UNLESS OTHERWISE SPECIFIED:

X.X ± .03 ∠ ± .5°

X.XX ± .01

X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

CHECKED

RESP ENG

MFG ENG

QUAL ENG

◆ = (CRITICAL DIMENSION)

Franklin W. Olin College of Engineering

WORK SURFACE

SIZE FSCM NO. PART NO. PART REV DOC REV

C 1:16 SCALE WT 1300.7560 SHEET 1 OF 2

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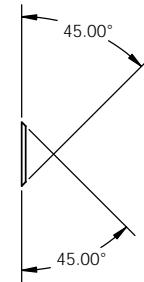
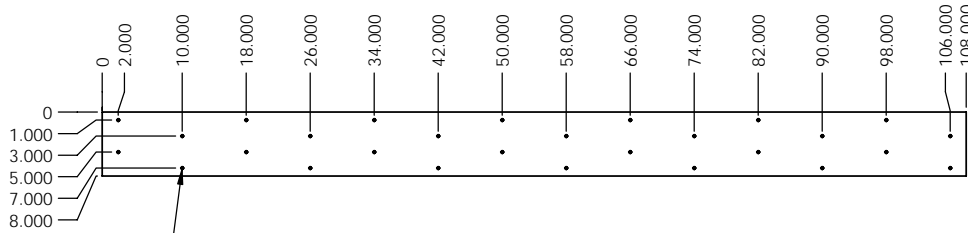
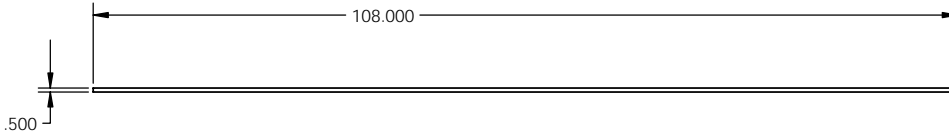
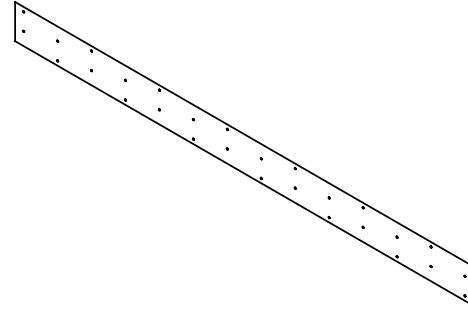
3

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 108"x8"x0.5" PLATE



56X ϕ .261 THRU ALL
 \surd ϕ .313 X 90°, Near Side

ALL DIMENSIONS ARE IN INCHES- INTERPRET
 DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X \pm .03 \sphericalangle \pm .5°
 X.XX \pm .01
 X.XXX \pm .005 \sphericalangle 125/

REMOVE ALL BURRS AND SHARP EDGES
 .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY MATT HILL	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



REAR DATUM SURFACE

SIZE C	FSCM NO.	PART NO. PB-3-02	PART REV	DOC REV
SCALE 1:12	WT 113.9127	SHEET 1	OF 2	

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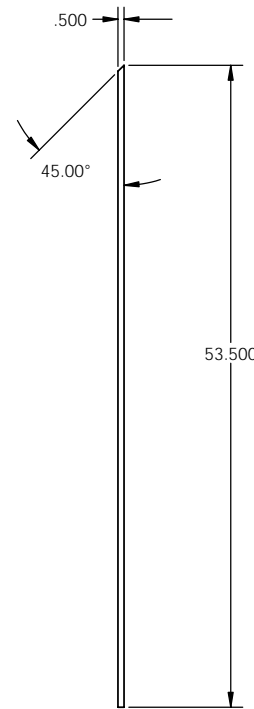
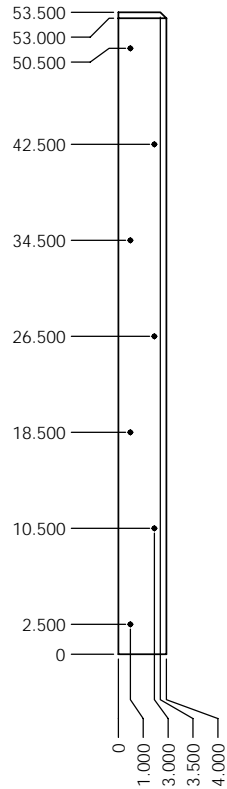
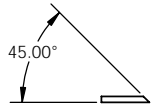
3

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 4"x53.5"x0.5" Bar Stock



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01 125/
 X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY	MATT HILL
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



Side Datum Surface for Plywood Router

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-3-03		
SCALE	1:8	WT	28.0790	SHEET 1 OF 2

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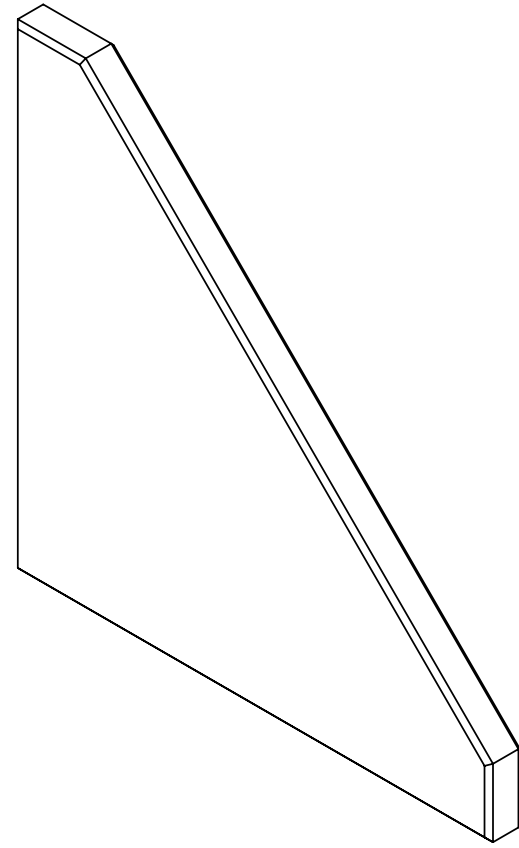
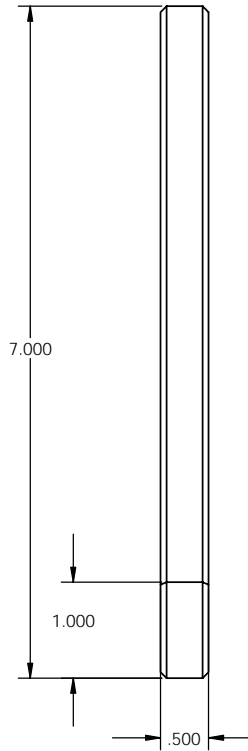
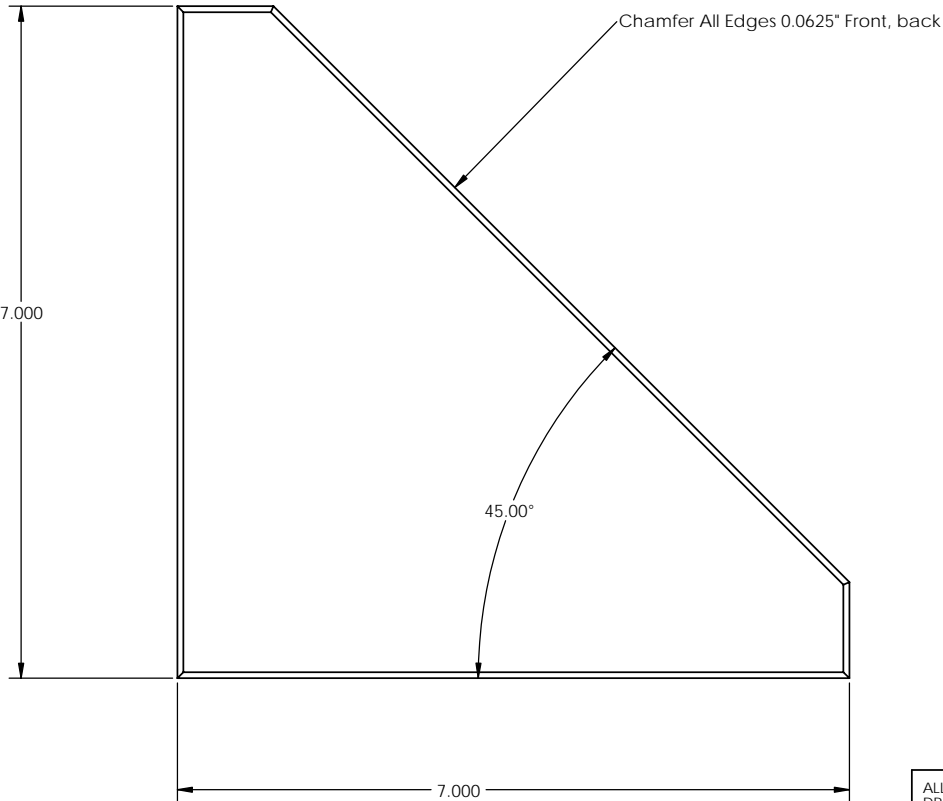
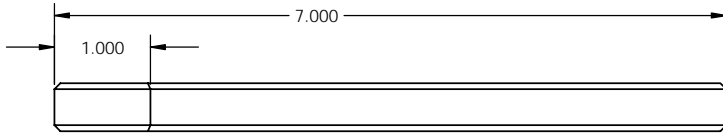
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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 7"x7"x0.50" Plate



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01 125/
 X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY MATT HILL	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	

Franklin W. Olin College of Engineering		SCREW MOUNTING PLATE GUSSET			
SIZE C	FSCM NO.				
SCALE 1:1	WT 4.3410	SHEET 1	OF 2		

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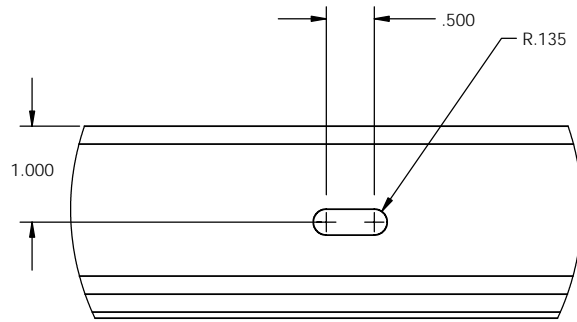
C

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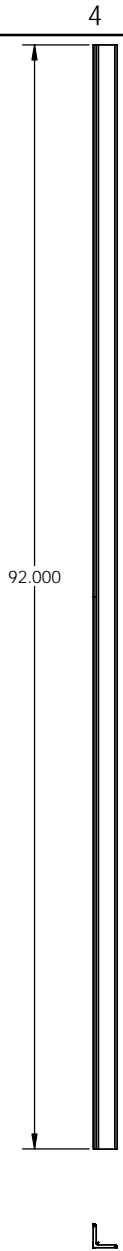
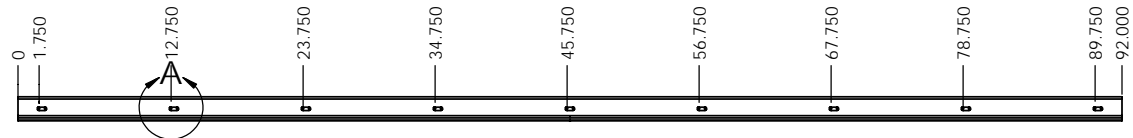
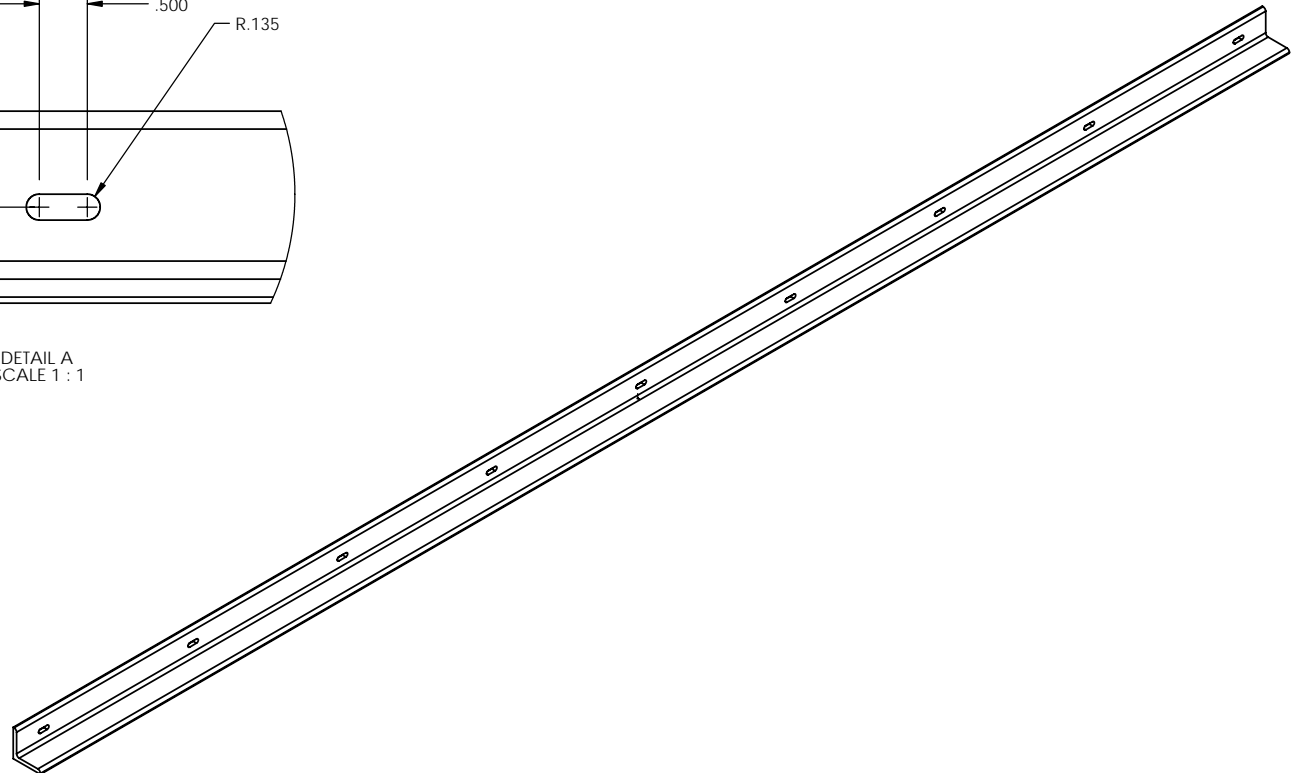
A

NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 2" X 2" X 1/4" Angle Iron



DETAIL A
SCALE 1 : 1



ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:

X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY MATT HILL	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



ANGLE IRON MOUNTING BRACKET

SIZE C	FSCM NO.	PART NO. PB-3-05	PART REV	DOC REV
SCALE 1:8	WT 23.9886	SHEET 1	OF 2	

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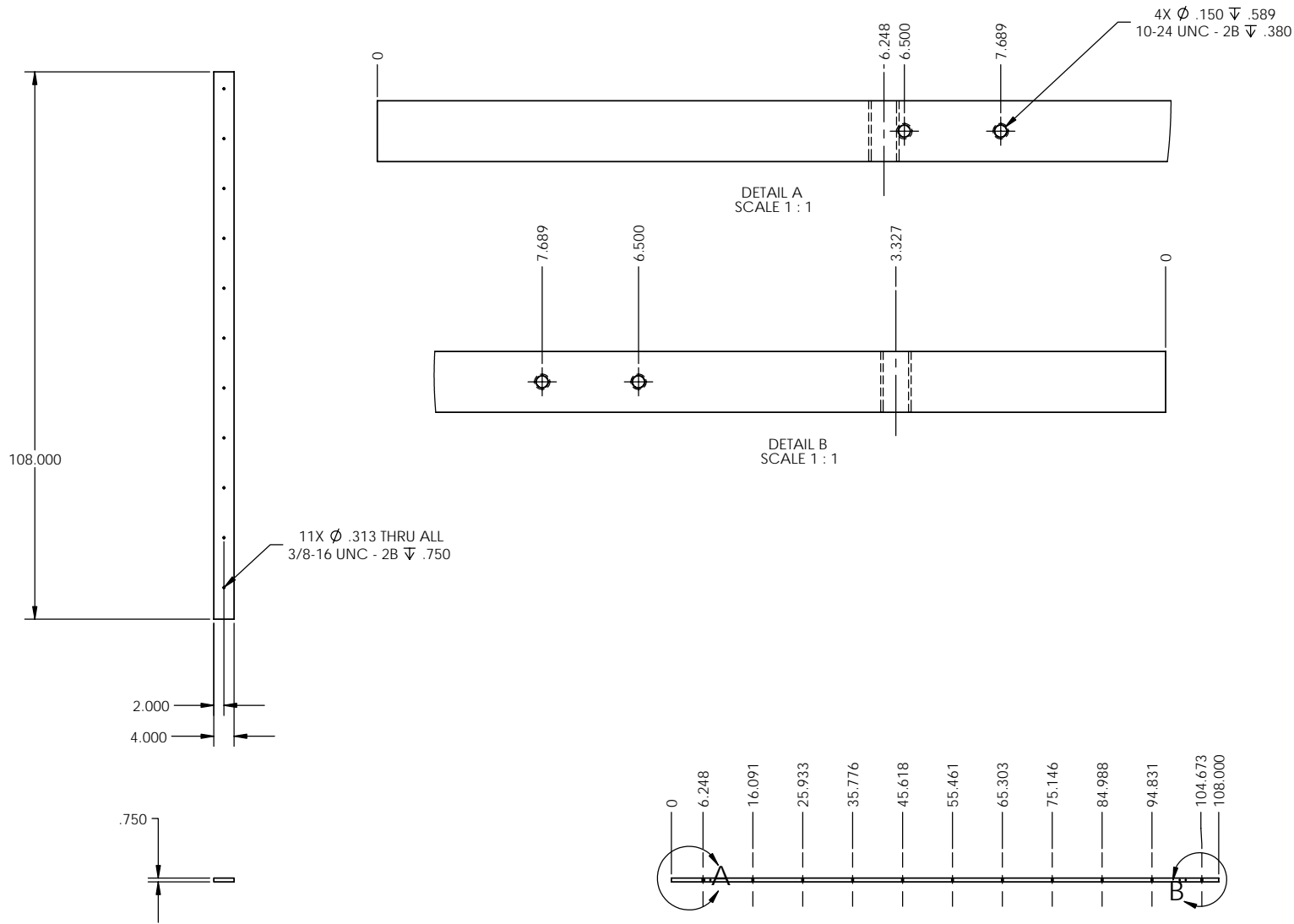
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NOTE:
All holes 3/8"-16 THRU.
Hole spacing is 9.843 in, which is equivalent to 250mm

ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994	APPROVED	DATE					
	PREP BY	MATT HILL					12/13/04
	CHECKED						
	RESP ENG						
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X \pm .03 \angle \pm .5° X.XX \pm .01 X.XXX \pm .005 \surd 125/	MFG ENG						
	QUAL ENG						
	REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX						
	◆ = (CRITICAL DIMENSION)		SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
			C		PB-3-06		
	SCALE	1:16	WT	89.9425	SHEET	1	OF 2

APPROVED		DATE					
PREP BY		MATT HILL					12/13/04
CHECKED							
RESP ENG							
MFG ENG							
QUAL ENG							
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX							
	◆ = (CRITICAL DIMENSION)		SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
			C		PB-3-06		
	SCALE	1:16	WT	89.9425	SHEET	1	OF 2

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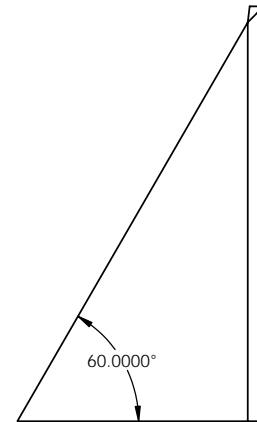
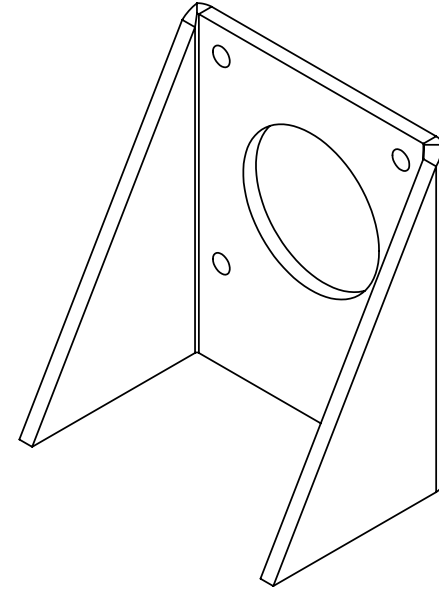
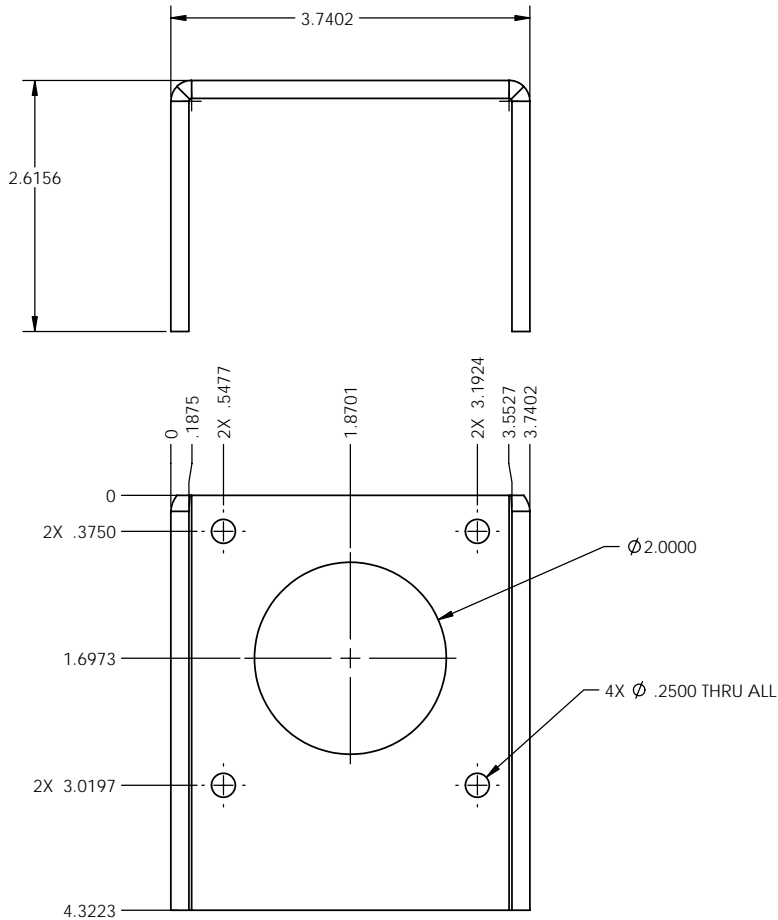
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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 3/16" STEEL PLATE



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994	APPROVED	DATE	Franklin W. Olin College of Engineering				
	PREP BY MATT HILL	12/13/04	X-Y SERVO MOUNTING BRACKET				
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 $\angle \pm .5^\circ$ X.XX ± .01 X.XXX ± .005 125°	CHECKED						
	RESP ENG						
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	MFG ENG		SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
	QUAL ENG		C		PB-3-07		
	◆ = (CRITICAL DIMENSION)		SCALE	1:1	WT	1.1928	SHEET 1 OF 2

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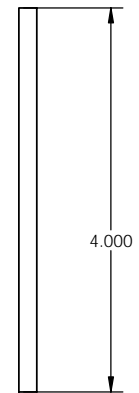
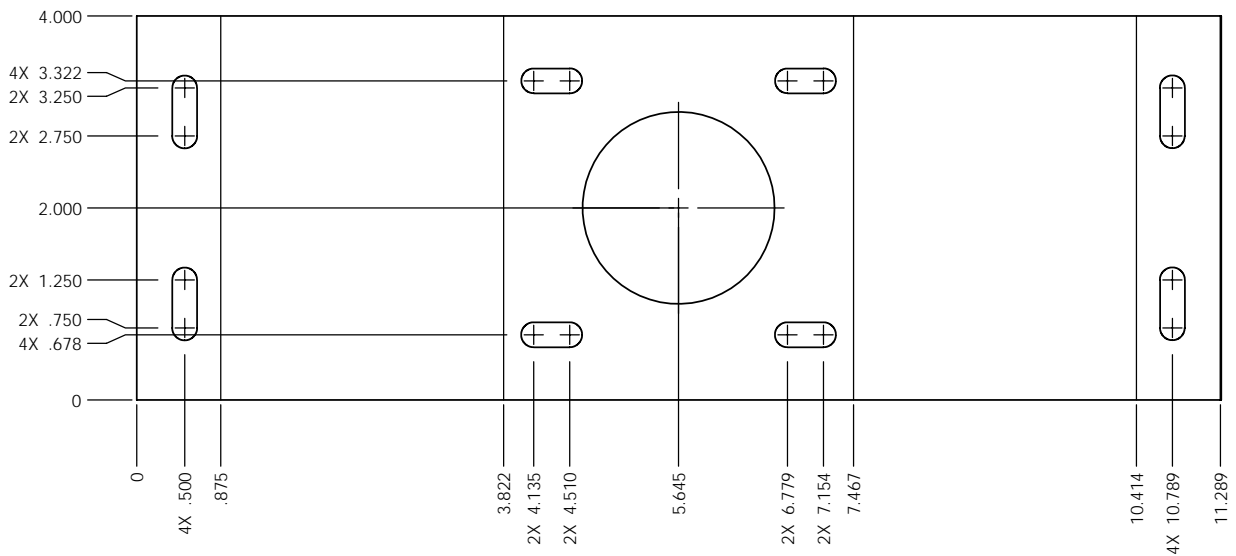
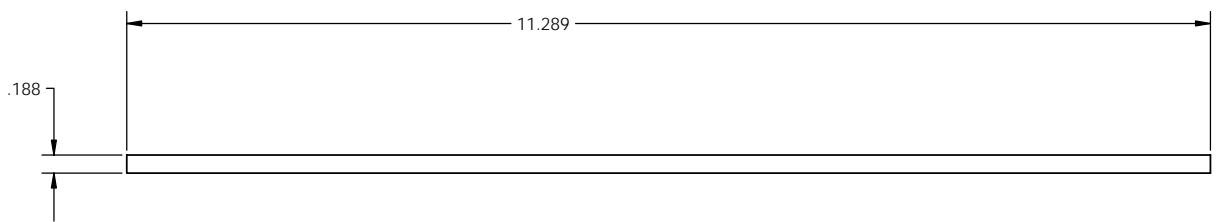
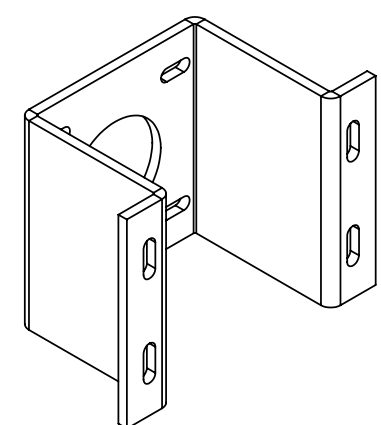
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ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√	APPROVED	DATE				
	PREP BY	MATT HILL	12/13/04	X-Y SERVO MOUNTING BRACKET MATERIAL: PLAIN CARBON STEEL		
	CHECKED			SIZE	FSCM NO.	PART NO.
	RESP ENG			C		PB-3-07
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	QUAL ENG		SCALE	1:1	WT	2.1498
	◆ = (CRITICAL DIMENSION)		SHEET	1	OF	2

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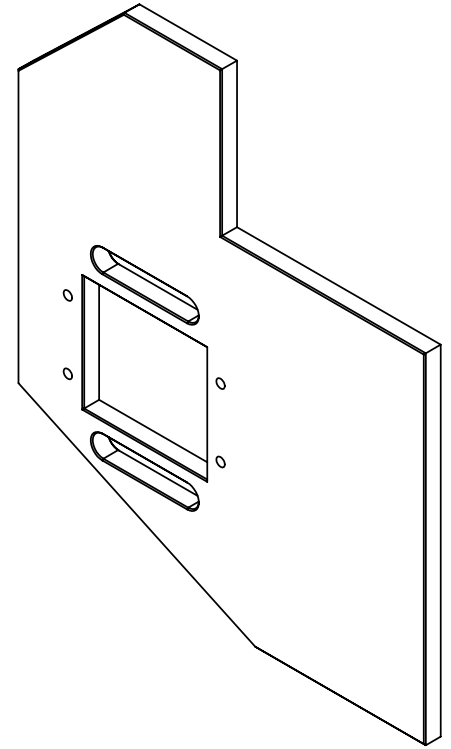
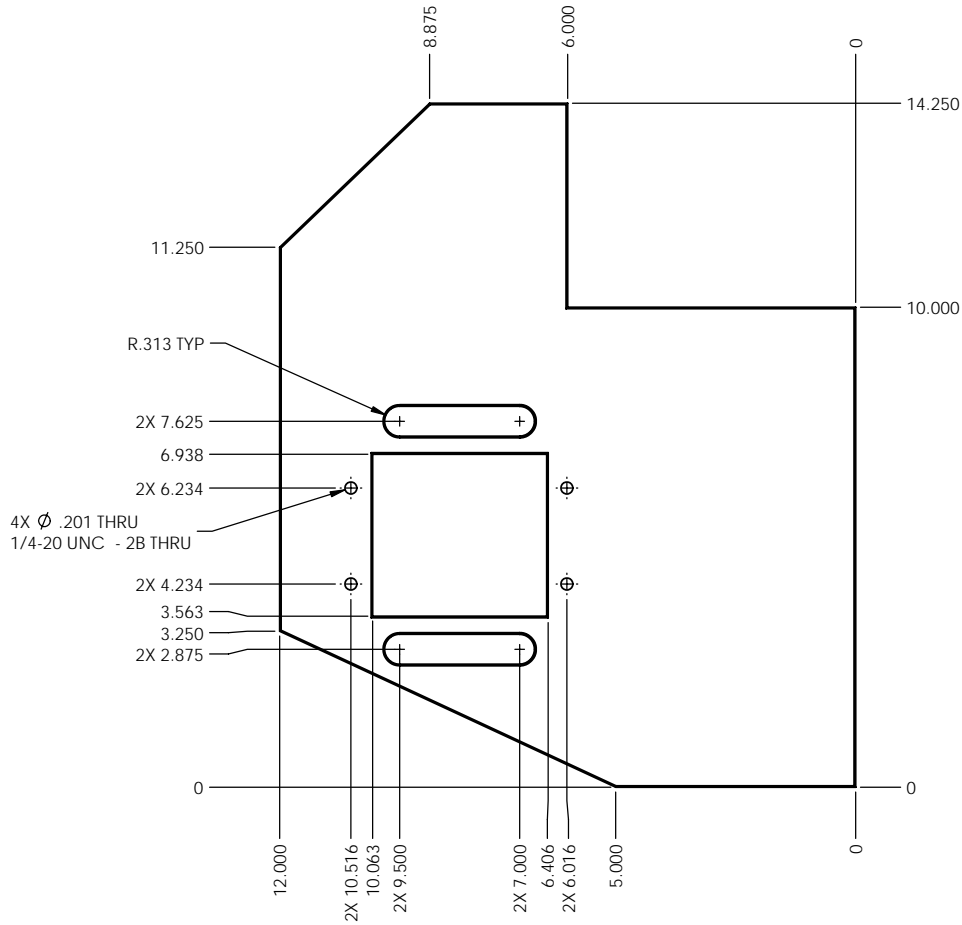
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 0.5 PLATE

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01 125/
 X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



**BALLSCREW TABLE MOUNT
 HORIZONTAL SLOTS
 CNC ROUTER TABLE**

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-07		
SCALE	1:2	WT	15.9381	SHEET 1 OF 1

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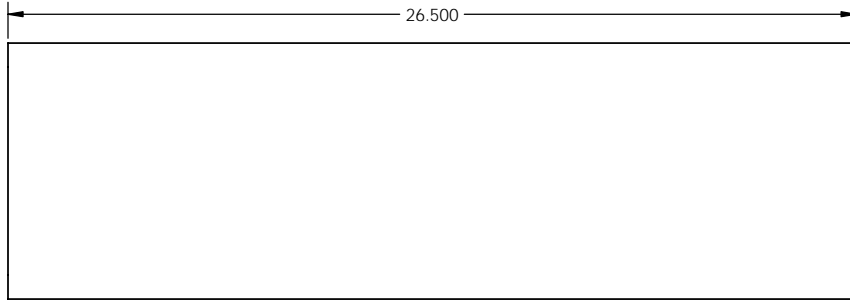
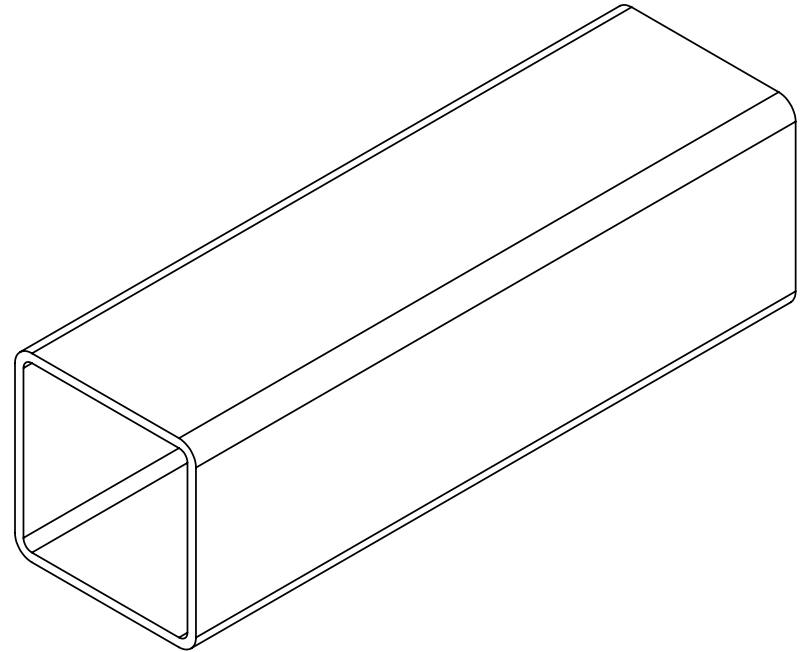
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 8 X .25 SQUARE TUBING

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:

- X.X ± .03 $\angle \pm .5^\circ$
- X.XX ± .01
- X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/10/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



TABLE POST
CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-01		
SCALE	1:3	WT	82.7053	SHEET 1 OF 1

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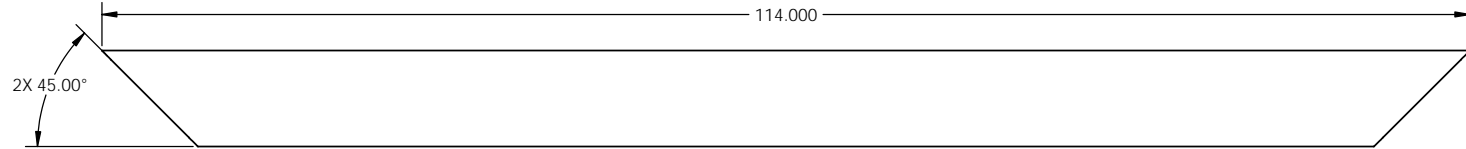
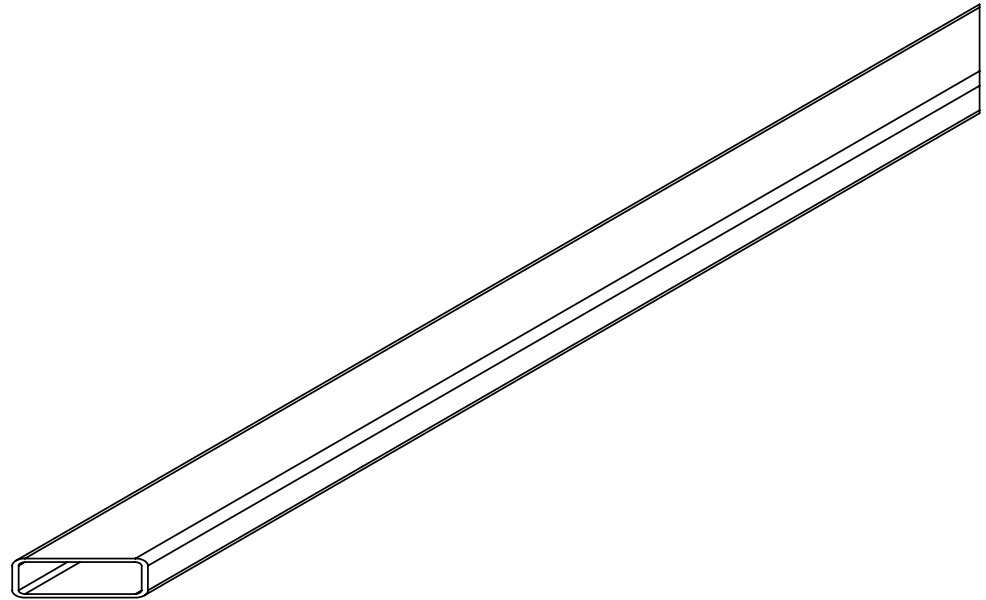
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 4 X 8 X .25 RECTANGULAR TUBING

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:

X.X ± .03 $\angle \pm .5^\circ$

X.XX ± .01 $\sqrt{125}$

X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/10/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	

Franklin W. Olin College of Engineering

**TOP LATERAL MEMBER
CNC ROUTER TABLE**

SIZE C	FSCM NO.	PART NO. PB-2-02	PART REV	DOC REV
SCALE 1:8	WT 241.1280	SHEET 1	OF 1	

◆ = (CRITICAL DIMENSION)

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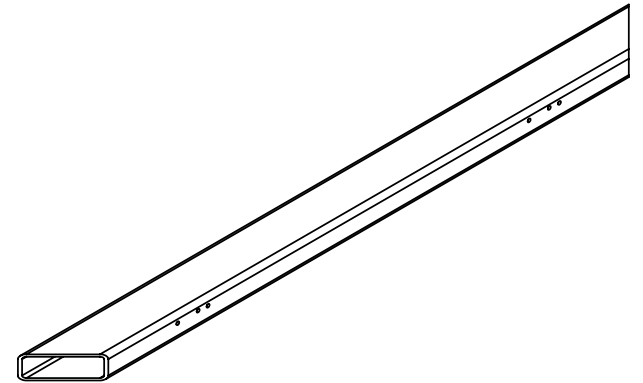
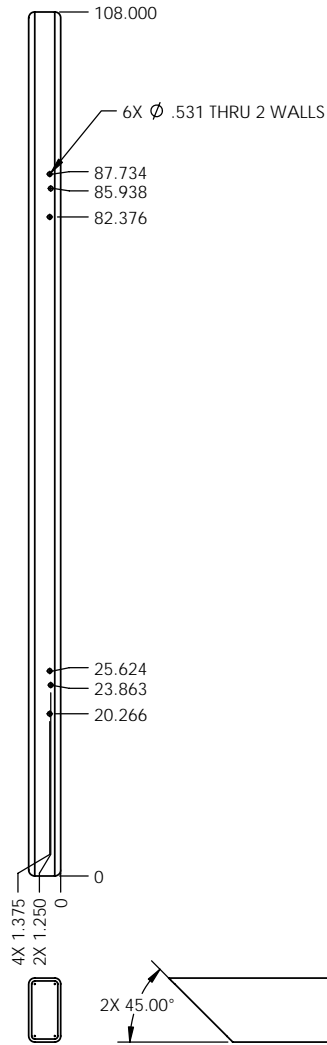
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 4 X 8 X .25 RECTANGULAR TUBING

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:

X.X ± .03 ∠ ± .5°

X.XX ± .01

X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/10/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



TOP CROSS MEMBER
CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-03		
SCALE	1:12	WT	227.2823	SHEET 1 OF 1

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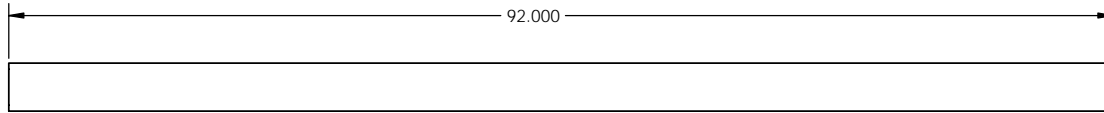
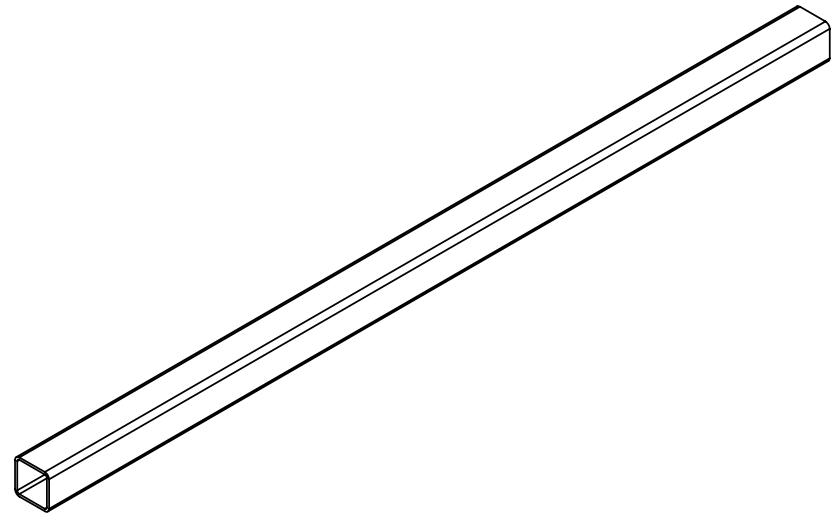
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 4 X .25 SQUARE TUBING

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√ REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	APPROVED	DATE					
	PREP BY B. RICHMOND	12/10/04					TABLE CROSS MEMBER CNC ROUTER TABLE
	CHECKED						
	RESP ENG						
MFG ENG							
QUAL ENG			SIZE C	FSCM NO.	PART NO. PB-2-04	PART REV	DOC REV
◆ = (CRITICAL DIMENSION)	SCALE 1:8	WT 93.0459	SHEET 1	OF 1			

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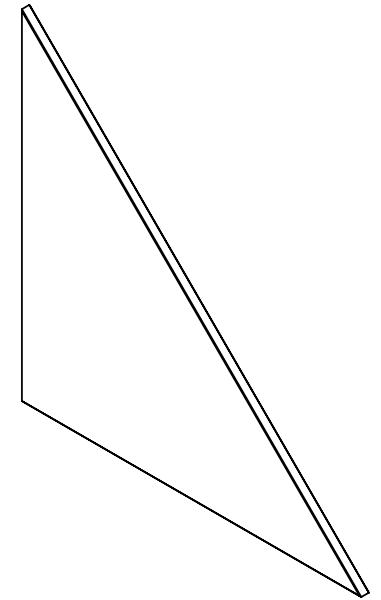
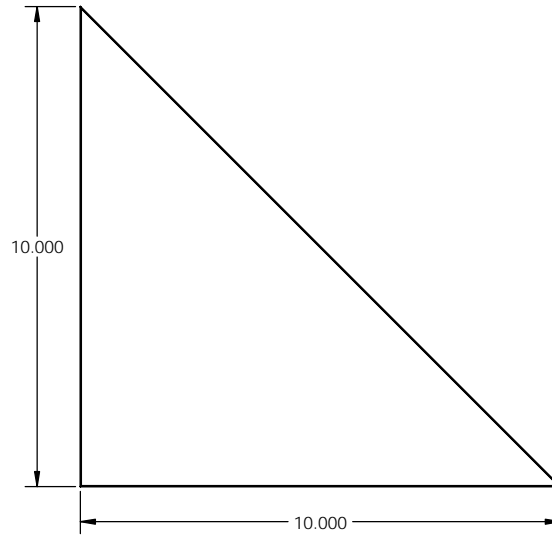
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: .25 PLATE

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:

- X.X ± .03 ∠ ± .5°
- X.XX ± .01
- X.XXX ± .005 √ 125

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED

DATE

PREP BY

B. RICHMOND

12/13/04

CHECKED

RESP ENG

MFG ENG

QUAL ENG

◆ = (CRITICAL DIMENSION)



GUSSET
CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-05		
SCALE	1:2	WT	3.5201	SHEET 1 OF 1

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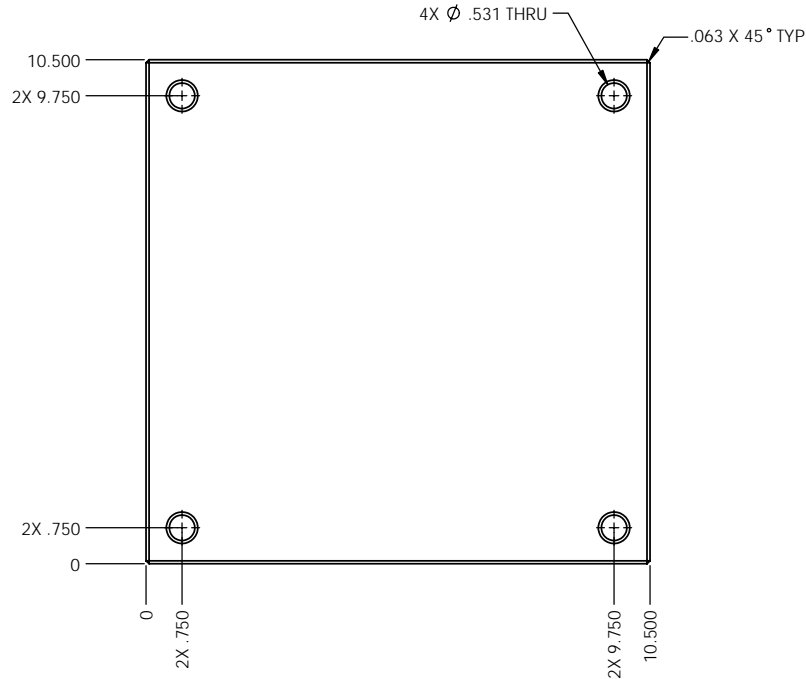
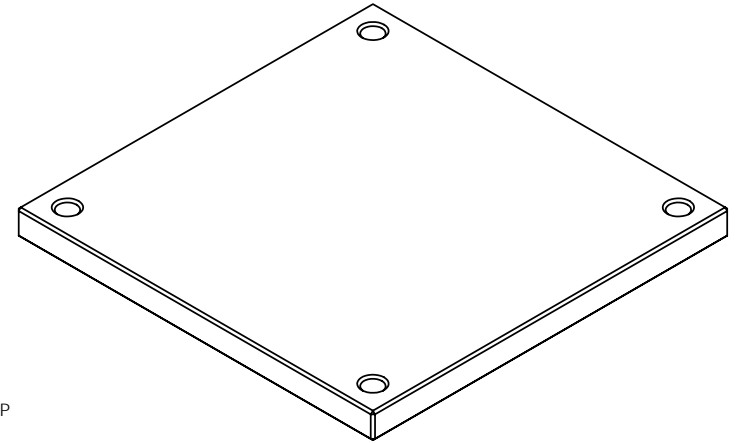
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: .75 PLATE

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01 125/
 X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/11/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	



FOOT PLATE
CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-06		
SCALE	1:2	WT	23.0579	SHEET 1 OF 1

◆ = (CRITICAL DIMENSION)

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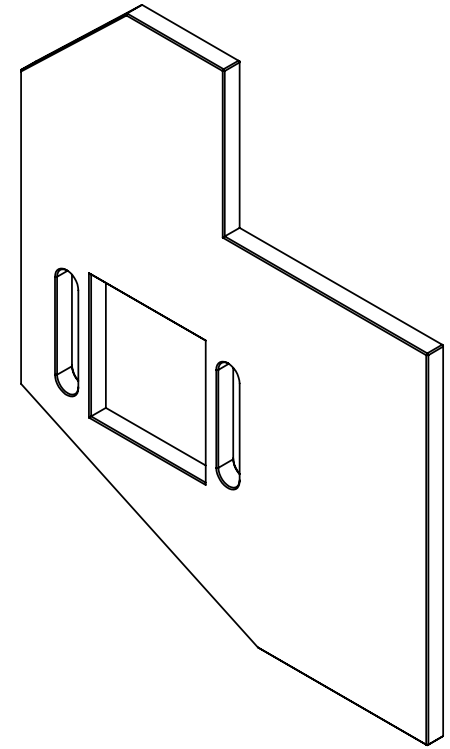
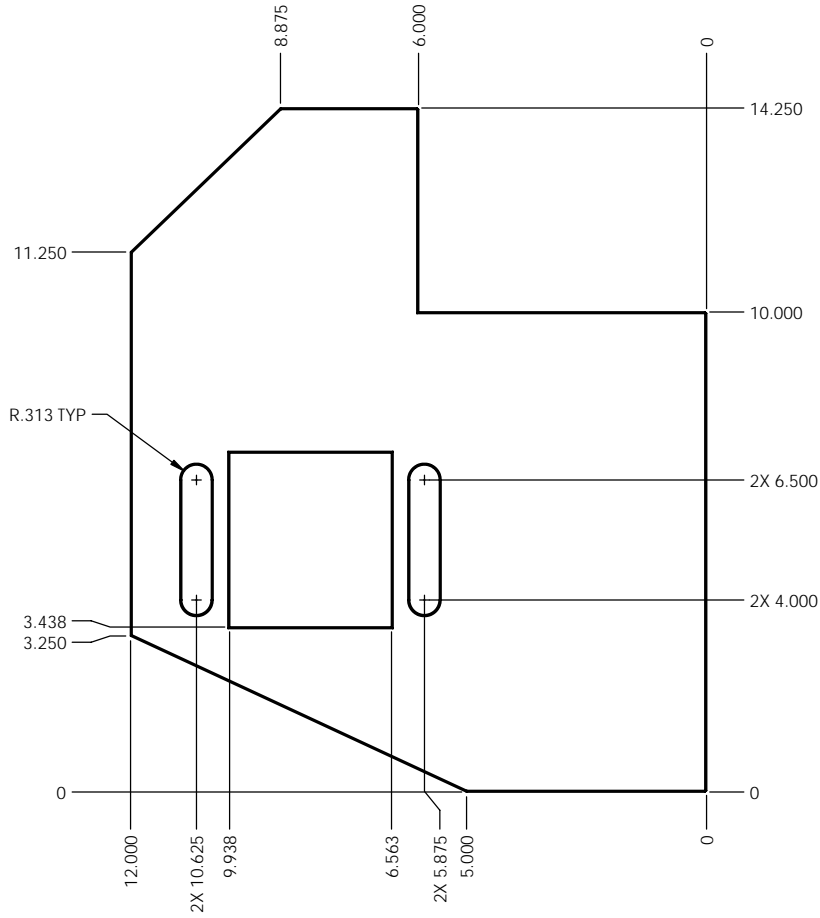
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 0.5 PLATE

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	



**BALLSCREW TABLE MOUNT
 VERTICAL SLOTS
 CNC ROUTER TABLE**

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-08		
SCALE	1:2	WT	15.9656	SHEET 1 OF 2

◆ = (CRITICAL DIMENSION)

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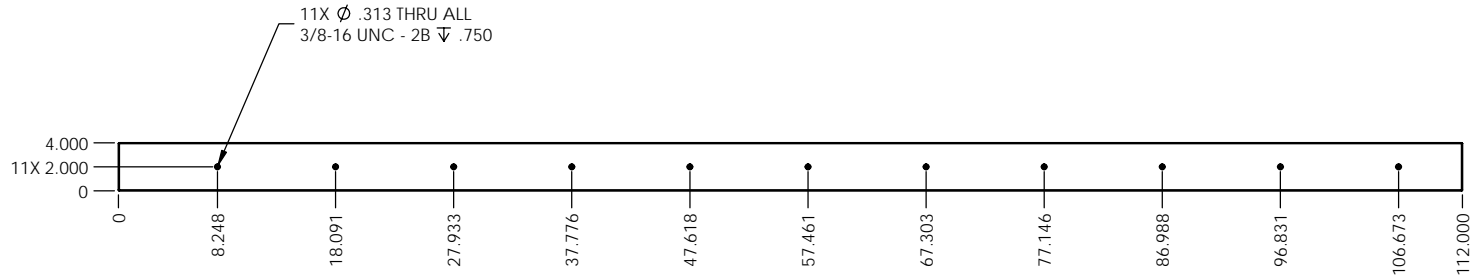
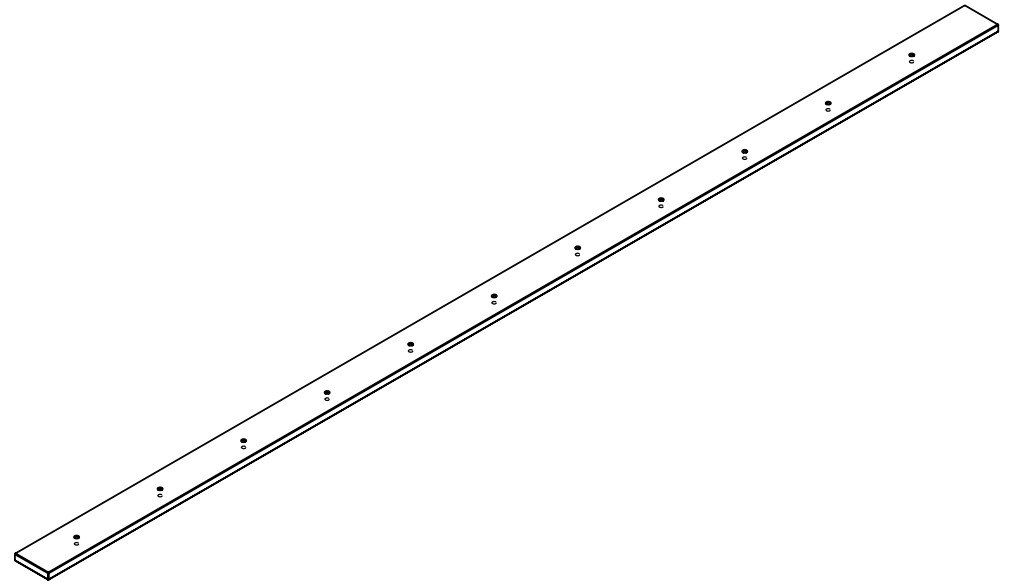
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 4 X .75 BAR

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X \pm .03 $\angle \pm .5^\circ$ X.XX \pm .01 X.XXX \pm .005 $\sqrt{125}$ REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	APPROVED	DATE					
	PREP BY B. RICHMOND	12/13/04					Y-AXIS TRACK MOUNT PLATE CNC ROUTER TABLE
	CHECKED		SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
	RESP ENG		C		PB-2-09		
MFG ENG		SCALE	2:1	WT	94.2339	SHEET	1 OF 1
QUAL ENG		◆ = (CRITICAL DIMENSION)					

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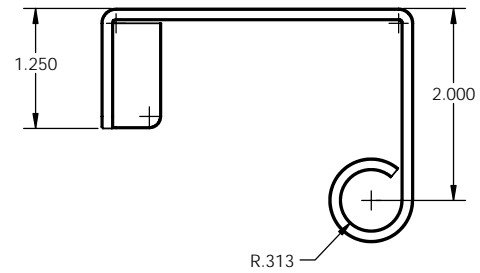
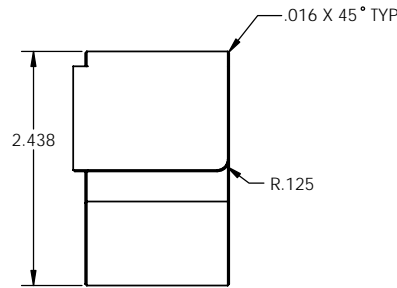
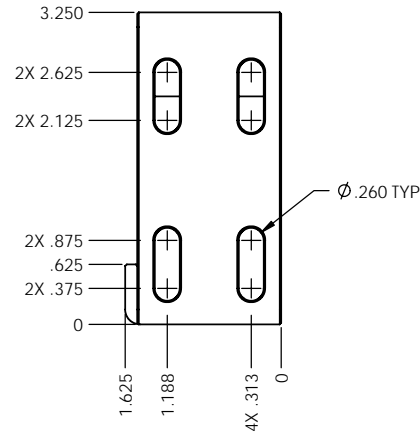
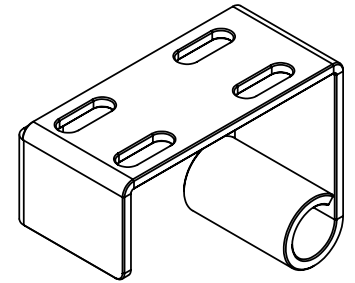
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 0.125 SHEET METAL

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	



CLAMP MOUNT BASE
CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-10		
SCALE	1:1	WT	0.4281	SHEET 1 OF 1

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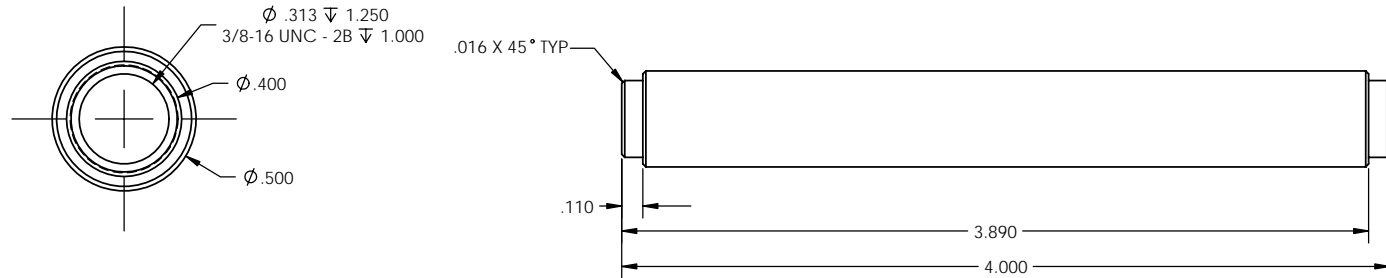
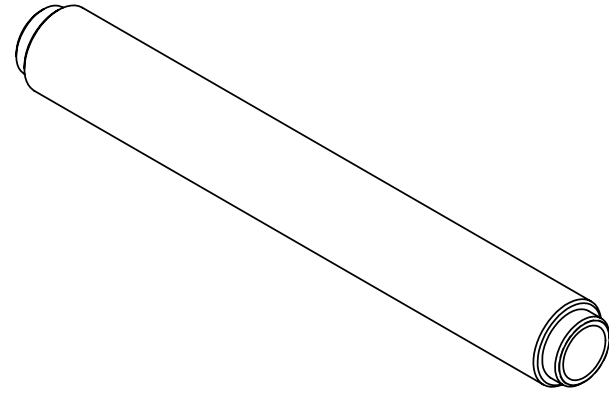
2

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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: .75 ROUND BAR

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X $\pm .03$ $\angle \pm .5^\circ$ X.XX $\pm .01$ X.XXX $\pm .005$ $\sqrt{125}$	APPROVED	DATE								
	PREP BY B. RICHMOND	12/13/04					CLAMP HINGE BAR		CNC ROUTER TABLE	
	CHECKED		SIZE	FSCM NO.	PART NO.	PART REV	DOC REV			
	RESP ENG		C		PB-2-11					
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	QUAL ENG		SCALE	2:1	WT	0.1627	SHEET	1	OF	1
	◆ = (CRITICAL DIMENSION)									

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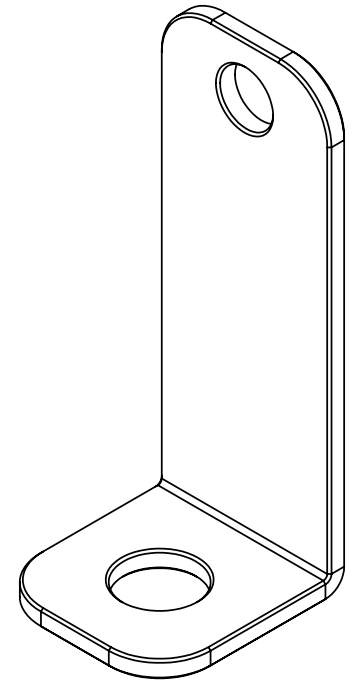
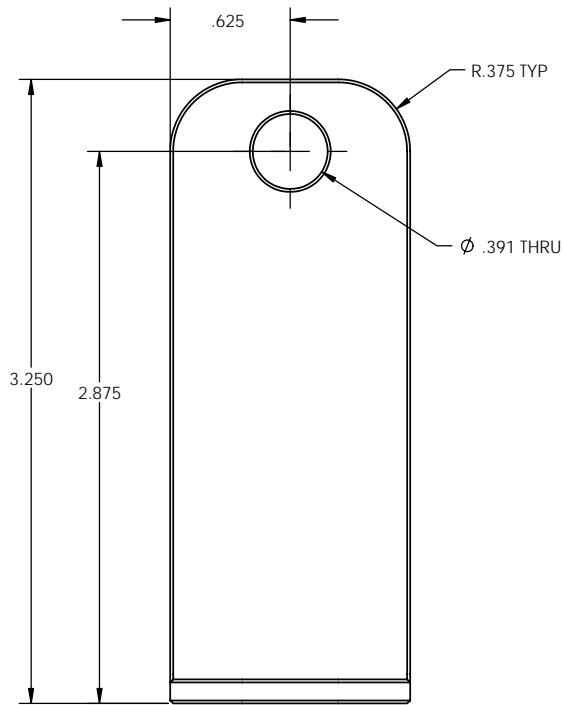
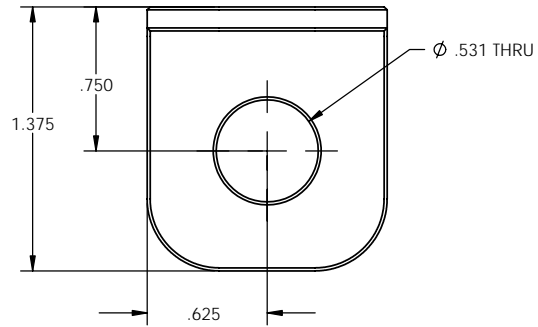
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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 0.125 SHEET METAL

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



CLAMP HINGE MOUNT CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-12		
SCALE	2:1	WT	0.1792	SHEET 1 OF 1

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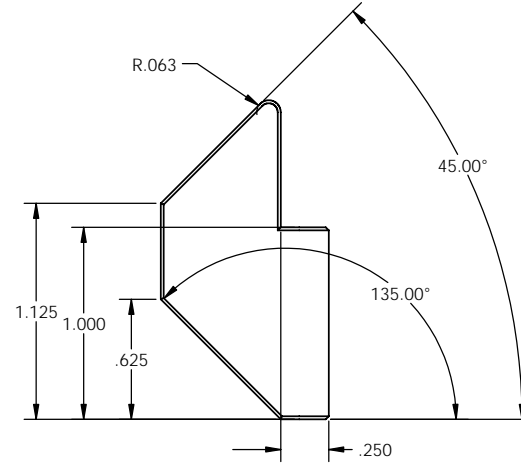
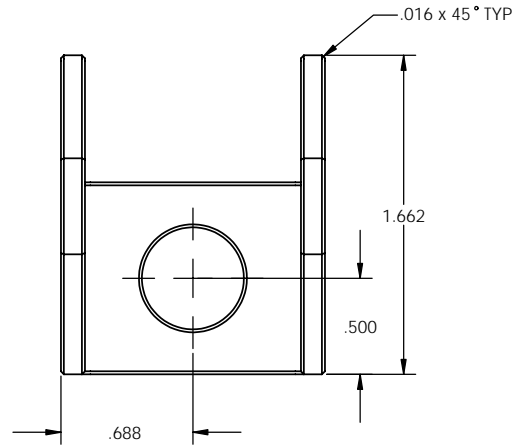
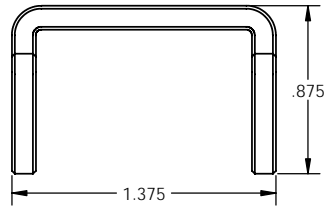
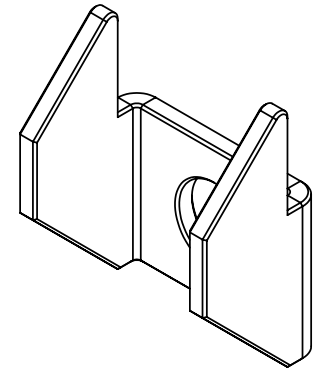
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NOTES, UNLESS OTHERWISE SPECIFIED

- 1. MATERIAL: PLAIN CARBON STEEL
- 2. STOCK SIZE: 0.125 SHEET METAL

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01 125/
 X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES
 .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	



CLAMP GUIDE TAB CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-2-13		
SCALE	4:1	WT	0.0951	SHEET 1 OF 2

◆ = (CRITICAL DIMENSION)

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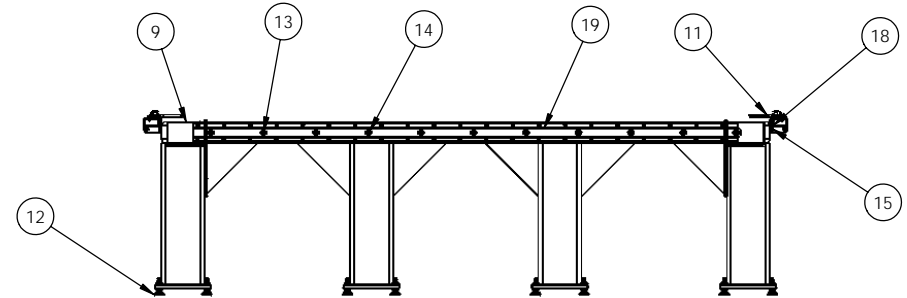
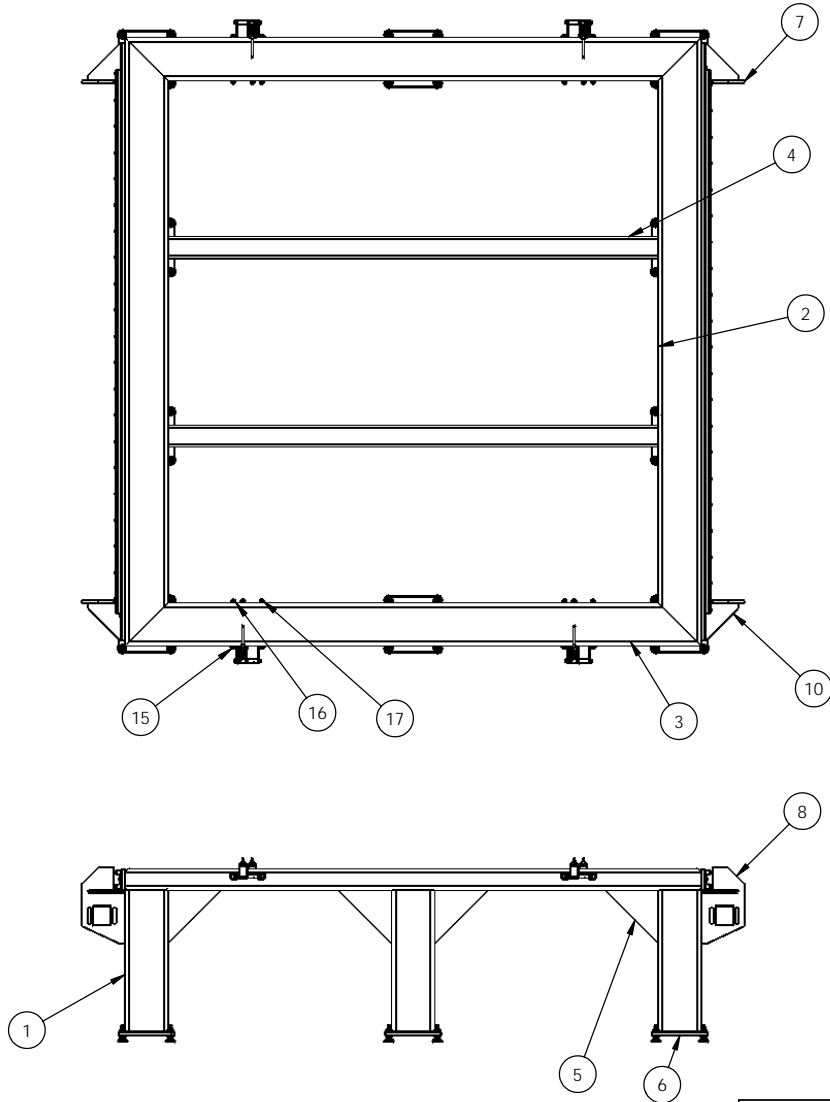
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REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	PB-2-01	TABLE POST	10
2	PB-2-02	TOP LATERAL MEMBER	2
3	PB-2-03	TOP CROSS MEMBER	2
4	PB-2-04	TABLE CROSS MEMBER	2
5	PB-2-05	GUSSET	24
6	PB-2-06	FOOT PLATE	10
7	PB-2-07	BALLSCREW TABLE MOUNT - HORIZONTAL SLOTS	2
8	PB-2-08	BALLSCREW TABLE MOUNT - VERTICAL SLOTS	2
9	PB-2-09	Y-AXIS TRACK MOUNT PLATE	2
10	PB-3-04	SCREW MOUNTING PLATE GUSSET	4
11	PB-A-2-02	CLAMP ASSEMBLY	4
12	CL-8-SLF	1/2-13 STUD LEVELING FOOT	40
13	MM91251A624	3/8-16 X 1 SBHCS	22
14	MM91083A031	3/8 NARROW FLAT WASHER	22
15	MM91247A742	HEX BOLT 1/2-13 X 9	12
16	MM91201A033	1/2 NARROW FLAT WASHER	104
17	MM95462A033	1/2-13 HEX NUT	12
18	PB-2-13	CLAMP GUIDE TAB	4
19	BWC-UTCTPA3-3165-SS	Y-AXIS GUIDE RAIL	2



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY B. RICHMOND	12/13/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	



TABLE STRUCTURE CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-A-2-01		
SCALE	1:16	WT	2584.4119	SHEET 1 OF 2

◆ = (CRITICAL DIMENSION)

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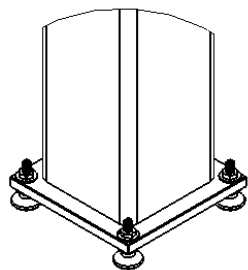
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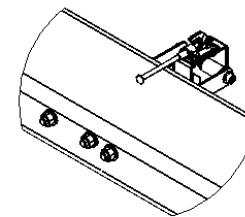


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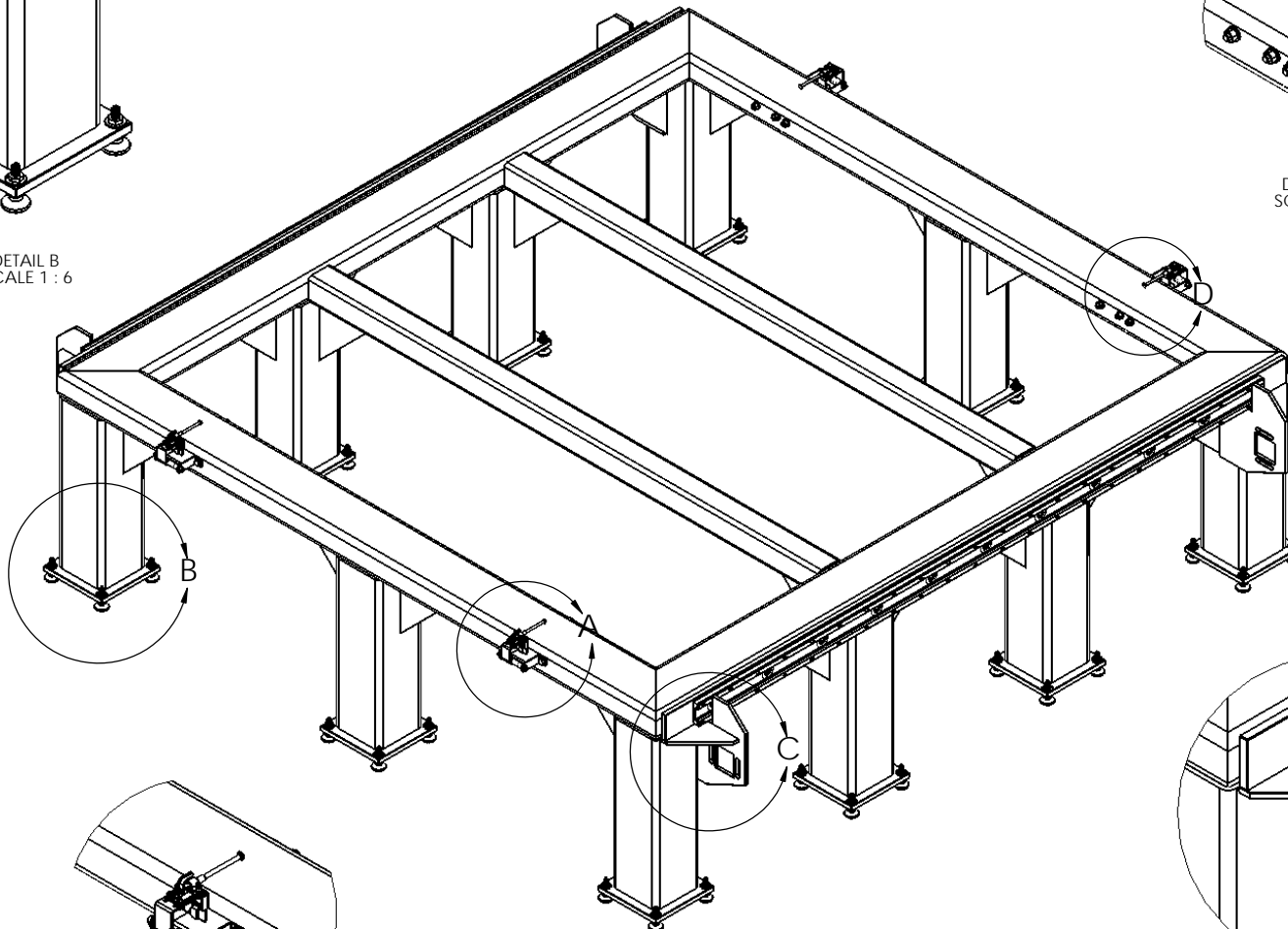
DETAIL B
SCALE 1 : 6



DETAIL D
SCALE 1 : 6

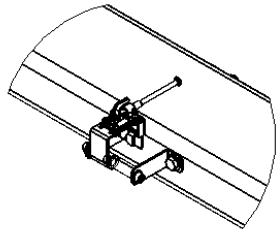
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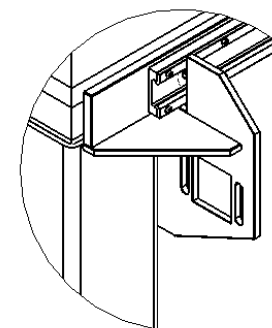


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DETAIL A
SCALE 1 : 6



DETAIL C
SCALE 1 : 6

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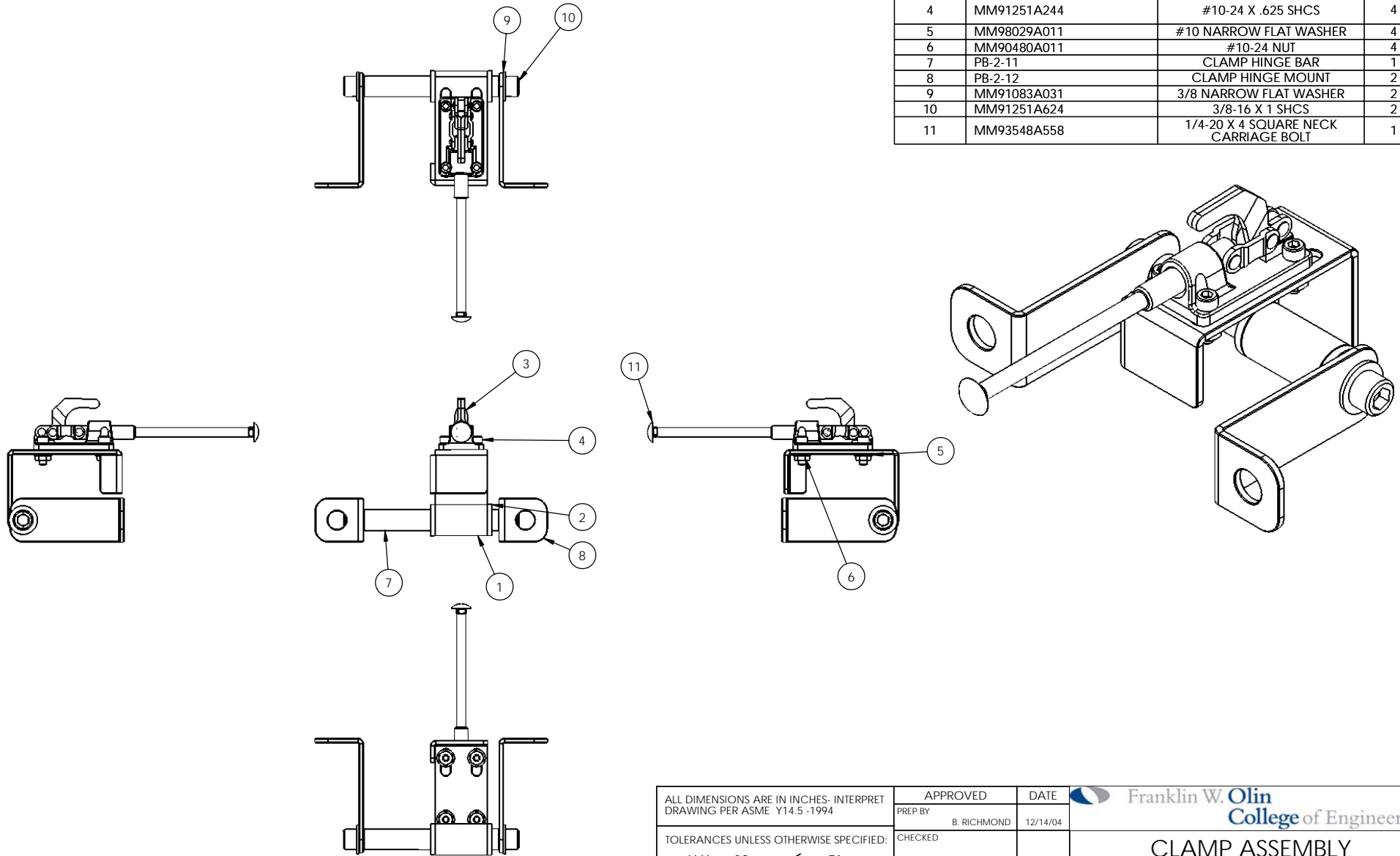


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College of Engineering

SIZE	FSCM NO.	PART NO.	PART REV.	DOC REV.
C		PB-A-2-01		
SCALE	1:16	2584.4119	SHEET 2	OF 2

REV	ZONE	DESCRIPTION	APPROVED	DATE
-		INITIAL RELEASE		

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	PB-2-10	CLAMP MOUNT BASE	1
2	MM6338K418	BRONZE FLANGED BEARING	2
3	CL-100-SPC	TOGGLE CLAMP	1
4	MM91251A244	#10-24 X .625 SHCS	4
5	MM98029A011	#10 NARROW FLAT WASHER	4
6	MM90480A011	#10-24 NUT	4
7	PB-2-11	CLAMP HINGE BAR	1
8	PB-2-12	CLAMP HINGE MOUNT	2
9	MM91083A031	3/8 NARROW FLAT WASHER	2
10	MM91251A624	3/8-16 X 1 SHCS	2
11	MM93548A558	1/4-20 X 4 SQUARE NECK CARRIAGE BOLT	1



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

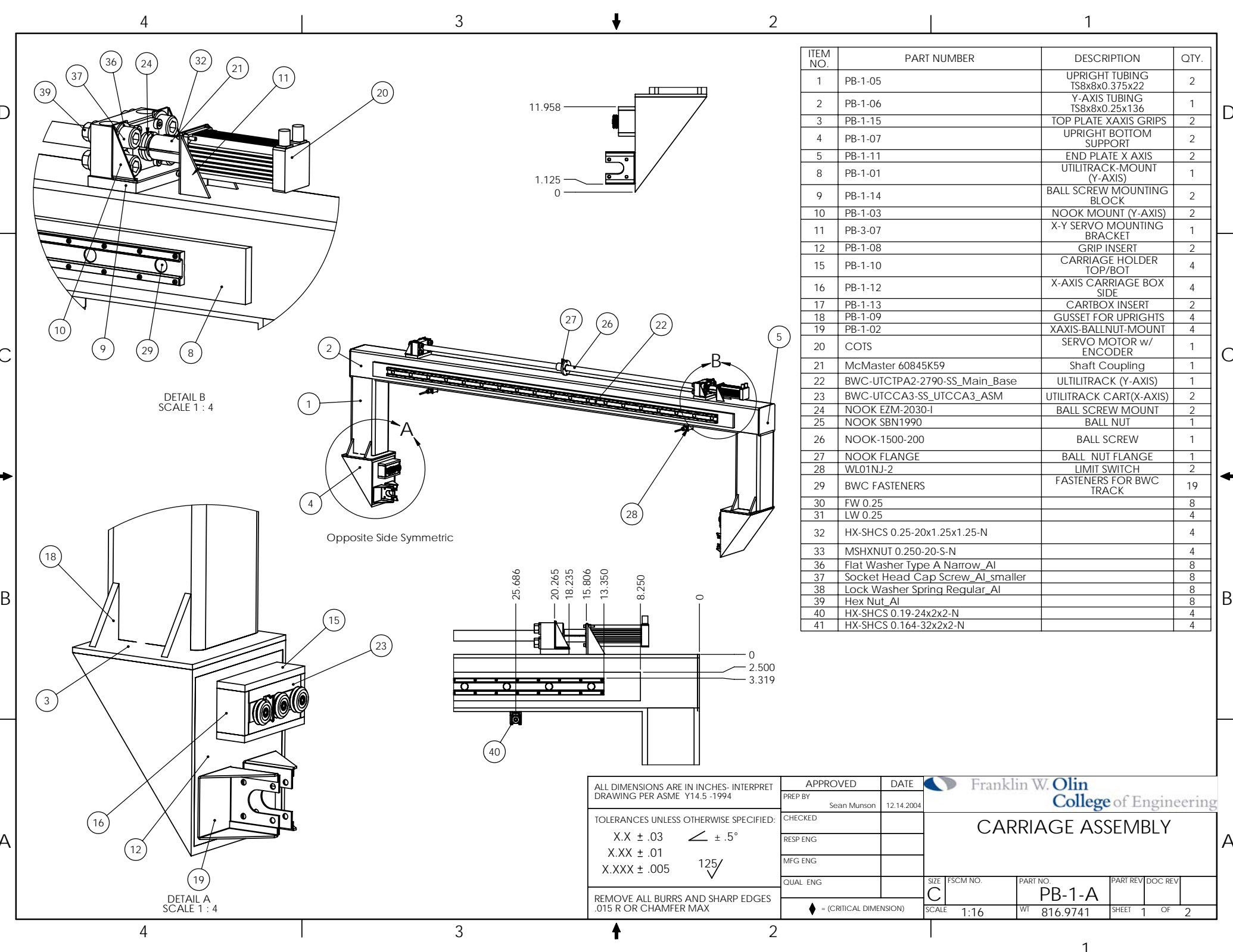
APPROVED	DATE
PREP BY B. RICHMOND	12/14/04
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	



CLAMP ASSEMBLY CNC ROUTER TABLE

SIZE	FSCM NO.	PART NO.	PART REV	DOC REV
C		PB-A-2-02		
SCALE	1:2	WT	1.4246	SHEET 1 OF 1

◆ = (CRITICAL DIMENSION)



DETAIL B
SCALE 1 : 4

DETAIL A
SCALE 1 : 4

Opposite Side Symmetric

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	PB-1-05	UPRIGHT TUBING TS8x8x0.375x22	2
2	PB-1-06	Y-AXIS TUBING TS8x8x0.25x136	1
3	PB-1-15	TOP PLATE XAXIS GRIPS	2
4	PB-1-07	UPRIGHT BOTTOM SUPPORT	2
5	PB-1-11	END PLATE X AXIS	2
8	PB-1-01	UTILITRACK-MOUNT (Y-AXIS)	1
9	PB-1-14	BALL SCREW MOUNTING BLOCK	2
10	PB-1-03	NOOK MOUNT (Y-AXIS)	2
11	PB-3-07	X-Y SERVO MOUNTING BRACKET	1
12	PB-1-08	GRIP INSERT	2
15	PB-1-10	CARRIAGE HOLDER TOP/BOT	4
16	PB-1-12	X-AXIS CARRIAGE BOX SIDE	4
17	PB-1-13	CARTBOX INSERT	2
18	PB-1-09	GUSSET FOR UPRIGHTS	4
19	PB-1-02	XAXIS-BALLNUT-MOUNT	4
20	COTS	SERVO MOTOR w/ ENCODER	1
21	McMaster 60845K59	Shaft Coupling	1
22	BWC-UTCTPA2-2790-SS_Main_Base	UTILITRACK (Y-AXIS)	1
23	BWC-UTCCA3-SS_UTCCA3_ASM	UTILITRACK CART(X-AXIS)	2
24	NOOK EZM-2030-I	BALL SCREW MOUNT	2
25	NOOK SBN1990	BALL NUT	1
26	NOOK-1500-200	BALL SCREW	1
27	NOOK FLANGE	BALL NUT FLANGE	1
28	WL01NJ-2	LIMIT SWITCH	2
29	BWC FASTENERS	FASTENERS FOR BWC TRACK	19
30	FW 0.25		8
31	LW 0.25		4
32	HX-SHCS 0.25-20x1.25x1.25-N		4
33	MSHXNUT 0.250-20-S-N		4
36	Flat Washer Type A Narrow_Al		8
37	Socket Head Cap Screw_Al_smaller		8
38	Lock Washer Spring Regular_Al		8
39	Hex Nut_Al		8
40	HX-SHCS 0.19-24x2x2-N		4
41	HX-SHCS 0.164-32x2x2-N		4

ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 $\angle \pm .5^\circ$
 X.XX ± .01
 X.XXX ± .005 $\sqrt{125}$

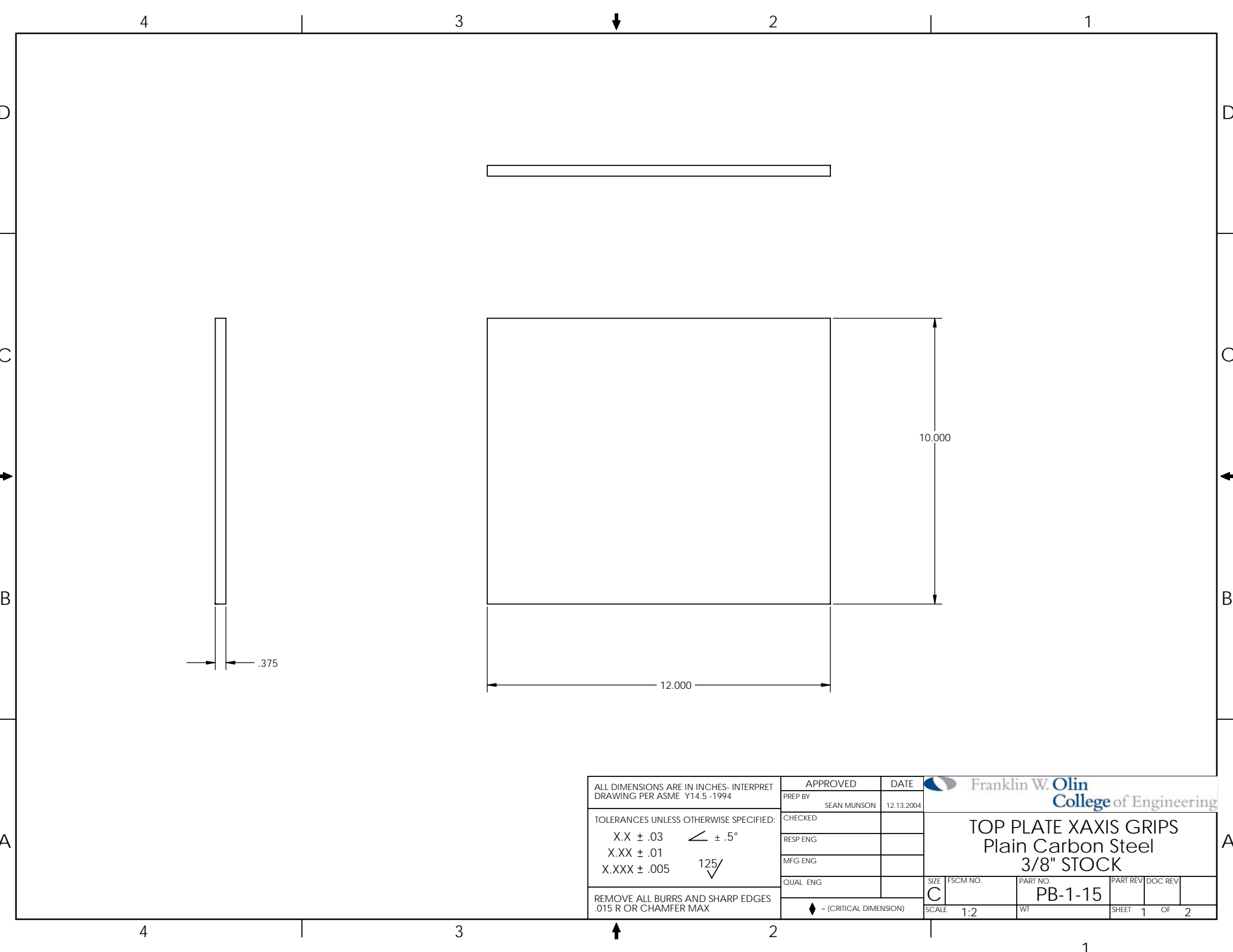
REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY Sean Munson	12.14.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	

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College of Engineering

CARRIAGE ASSEMBLY


SIZE C	FSCM NO.	PART NO. PB-1-A	PART REV	DOC REV
SCALE 1:16	WT 816.9741	SHEET 1	OF 2	

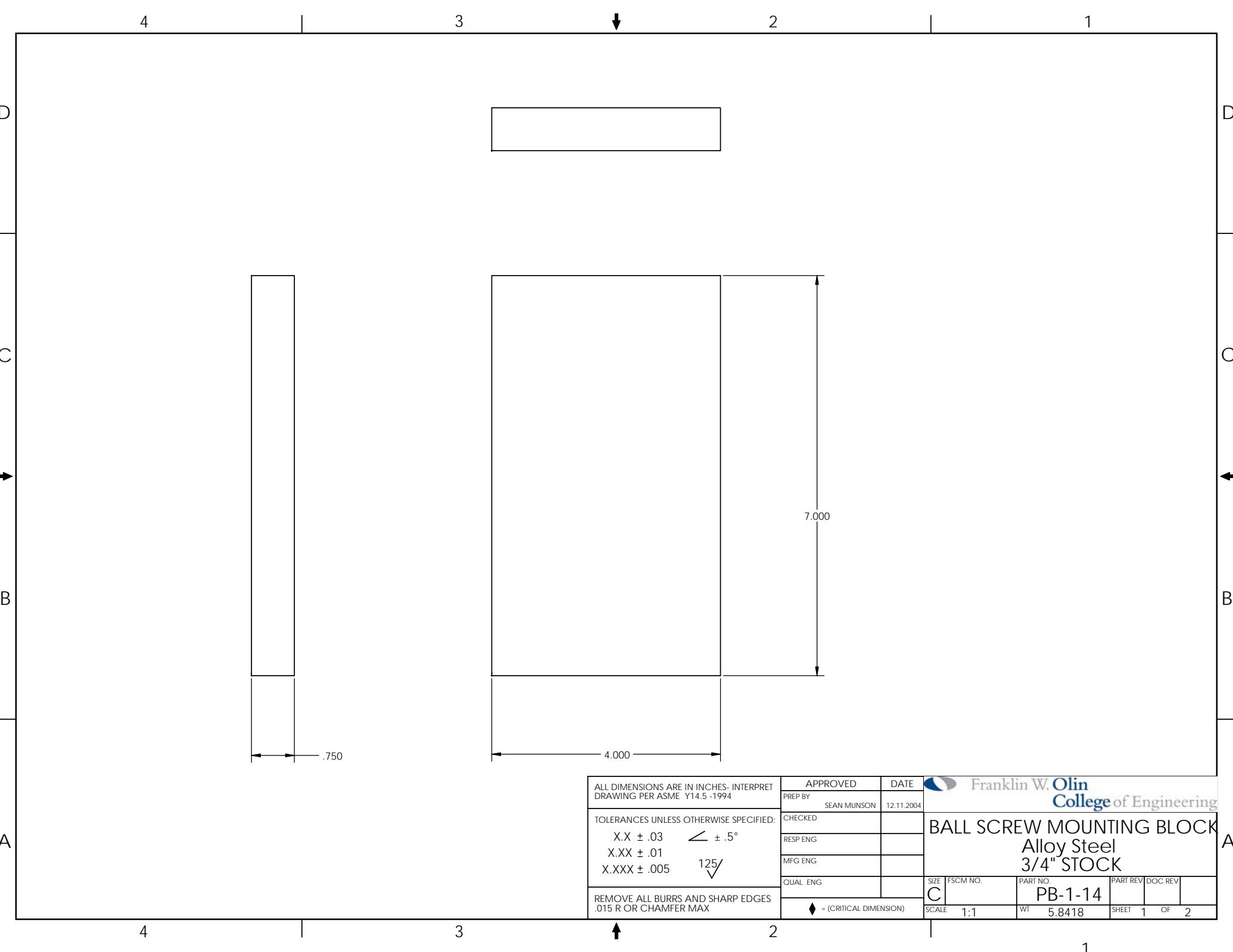


.375

10.000

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ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994	APPROVED	DATE					
	PREP BY SEAN MUNSON	12.13.2004					
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√	CHECKED		TOP PLATE XAXIS GRIPS Plain Carbon Steel 3/8" STOCK				
	RESP ENG						
	MFG ENG						
	QUAL ENG						
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	◆ = (CRITICAL DIMENSION)	SCALE 1:2	SIZE C	FSCM NO.	PART NO. PB-1-15	PART REV	DOC REV
				WT	SHEET 1 OF 2		



ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01 125/
 X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY SEAN MUNSON	12.11.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	

BALL SCREW MOUNTING BLOCK Alloy Steel 3/4" STOCK				
SIZE C	FSCM NO.	PART NO. PB-1-14	PART REV	DOC REV
SCALE 1:1	WT 5.8418	SHEET 1	OF 2	

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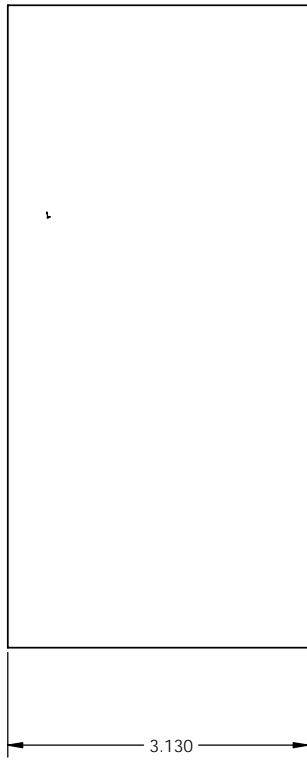
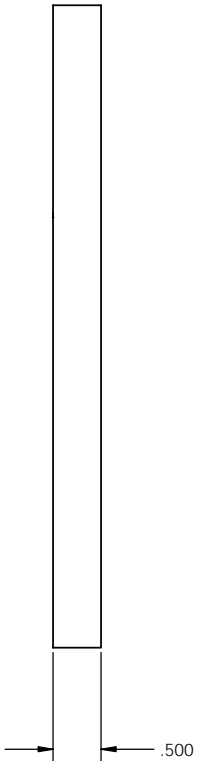
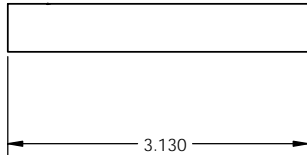
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ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994	APPROVED	DATE					
	PREP BY SEAN MUNSON	12.11.2004					
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√	CHECKED		CARTBOX INSERT Alloy Steel 1/2" STOCK				
	RESP ENG						
	MFG ENG						
	QUAL ENG						
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	◆ = (CRITICAL DIMENSION)	SCALE 1:1	SIZE C	FSCM NO.	PART NO. PB-1-13	PART REV	DOC REV
			WT	SHEET 1 OF 2			

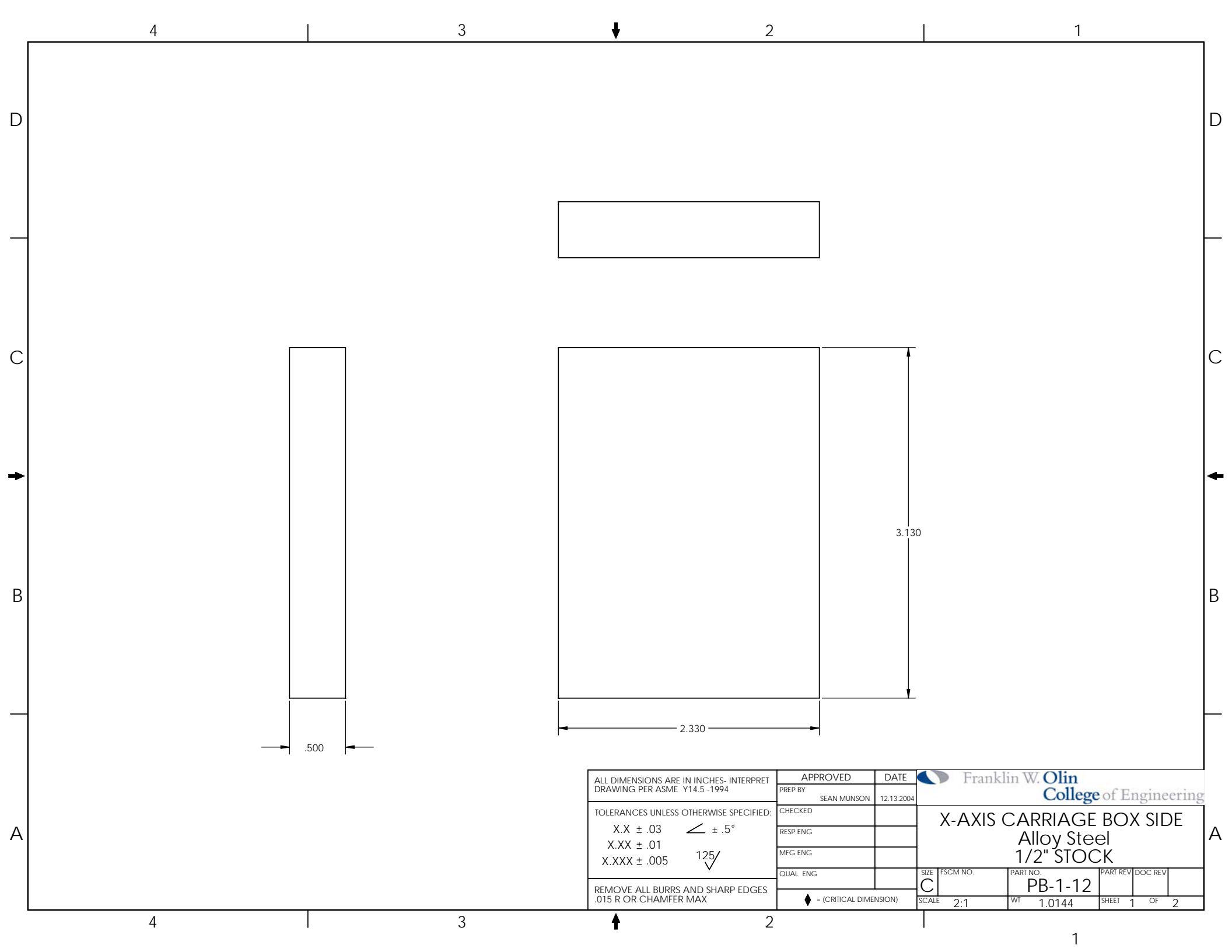
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ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01
 X.XXX ± .005 125/

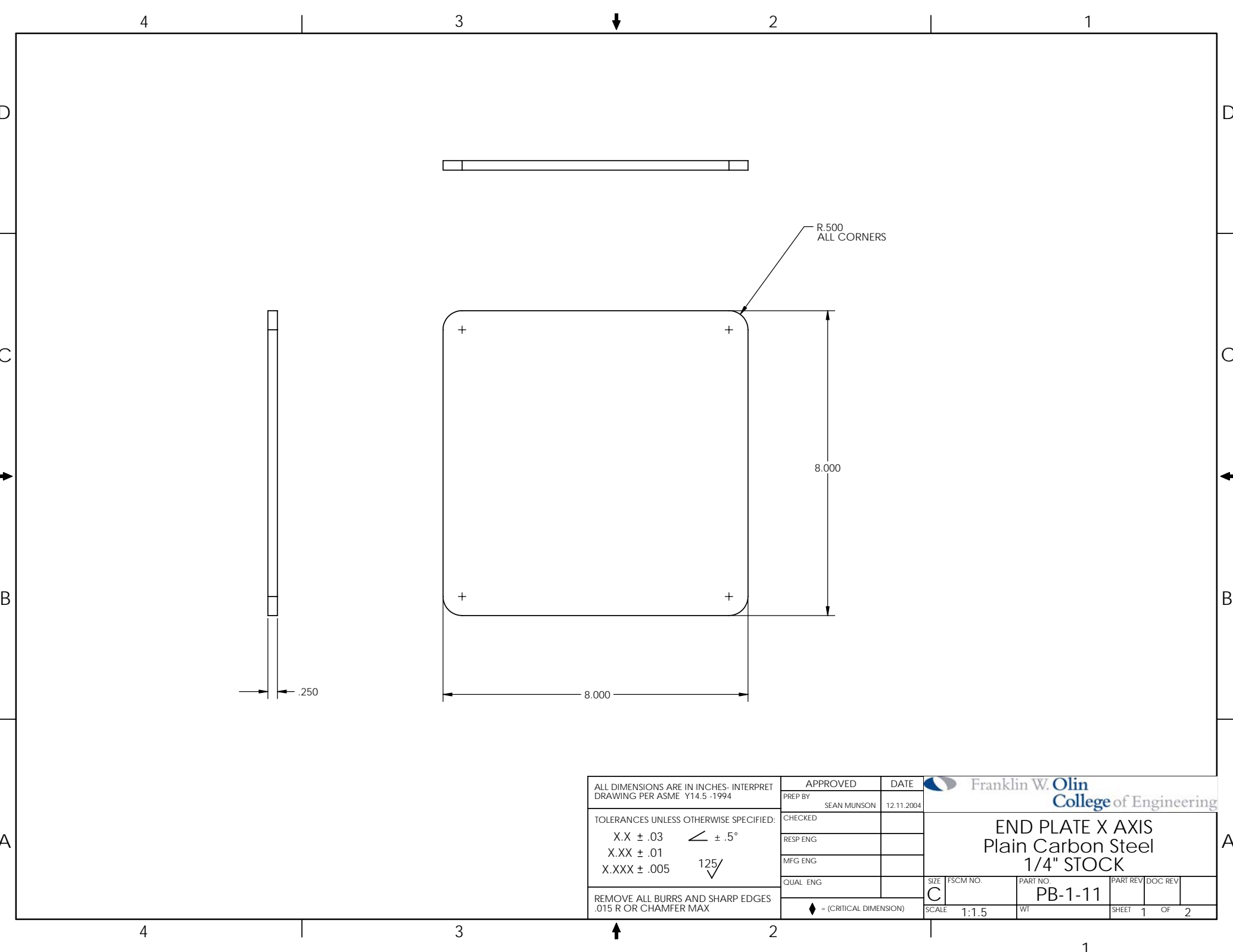
REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY SEAN MUNSON	12.13.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



X-AXIS CARRIAGE BOX SIDE
Alloy Steel
1/2" STOCK

SIZE C	FSCM NO.	PART NO. PB-1-12	PART REV	DOC REV
SCALE 2:1	WT 1.0144	SHEET 1	OF 2	



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994	APPROVED	DATE						
	PREP BY SEAN MUNSON	12.11.2004						
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√	CHECKED		END PLATE X AXIS Plain Carbon Steel 1/4" STOCK					
	RESP ENG							
	MFG ENG							
	QUAL ENG							
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	SIZE C	FSCM NO.	PART NO. PB-1-11	PART REV	DOC REV	SCALE 1:1.5	WT	SHEET 1 OF 2
	◆ = (CRITICAL DIMENSION)							

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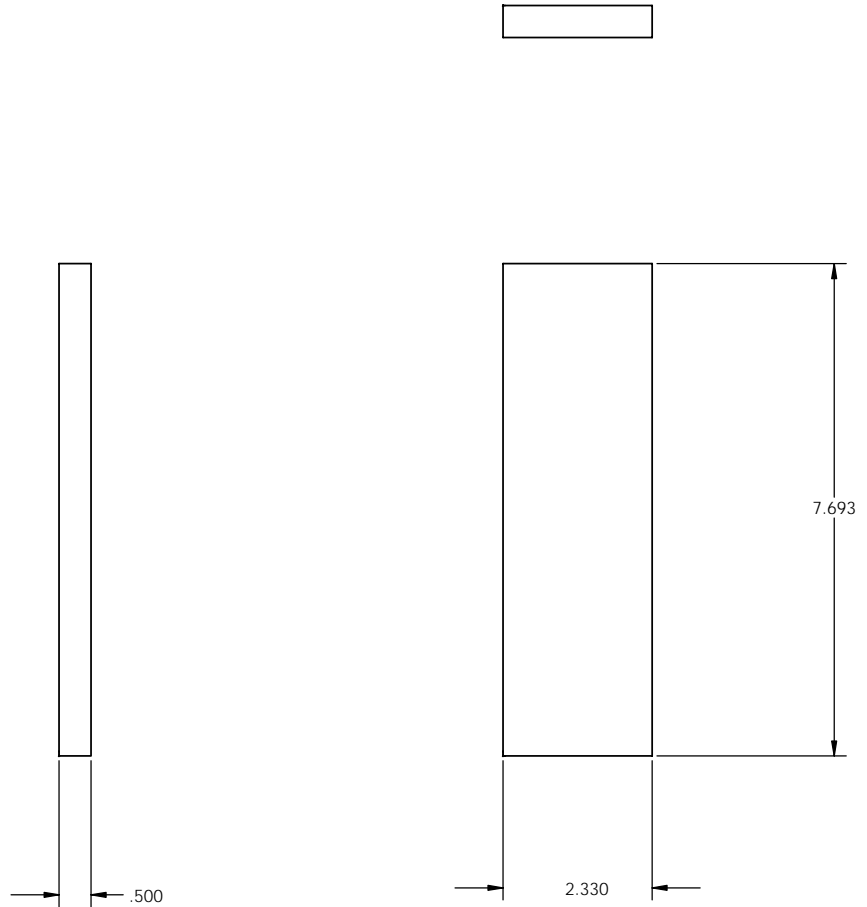
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ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994	APPROVED	DATE				
	PREP BY SEAN MUNSON	12.13.2004				
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√	CHECKED		CARRIAGE HOLDER TOP/BOT Alloy Steel 1/2" STOCK			
	RESP ENG					
	MFG ENG					
	QUAL ENG					
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	◆ = (CRITICAL DIMENSION)	SIZE C	FSCM NO.	PART NO. PB-1-10	PART REV	DOC REV
		SCALE 1:1.5	WT 2.4931	SHEET 1	OF 2	

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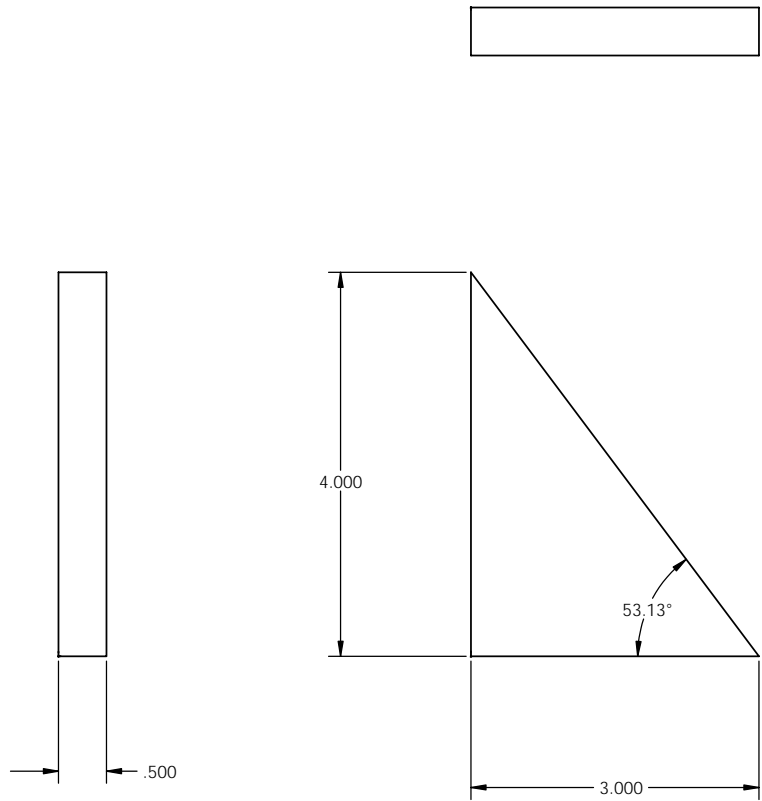
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ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√ REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	APPROVED	DATE					
	PREP BY SEAN MUNSON	12.13.2004					
	CHECKED		GUSSET FOR UPRIGHTS Plain Carbon Steel 1/2" STOCK				
	RESP ENG						
MFG ENG							
QUAL ENG			SIZE C	FSCM NO.	PART NO. PB-1-09	PART REV	DOC REV
◆ = (CRITICAL DIMENSION)	SCALE 1:1	WT 0.8454	SHEET 1	OF 2			

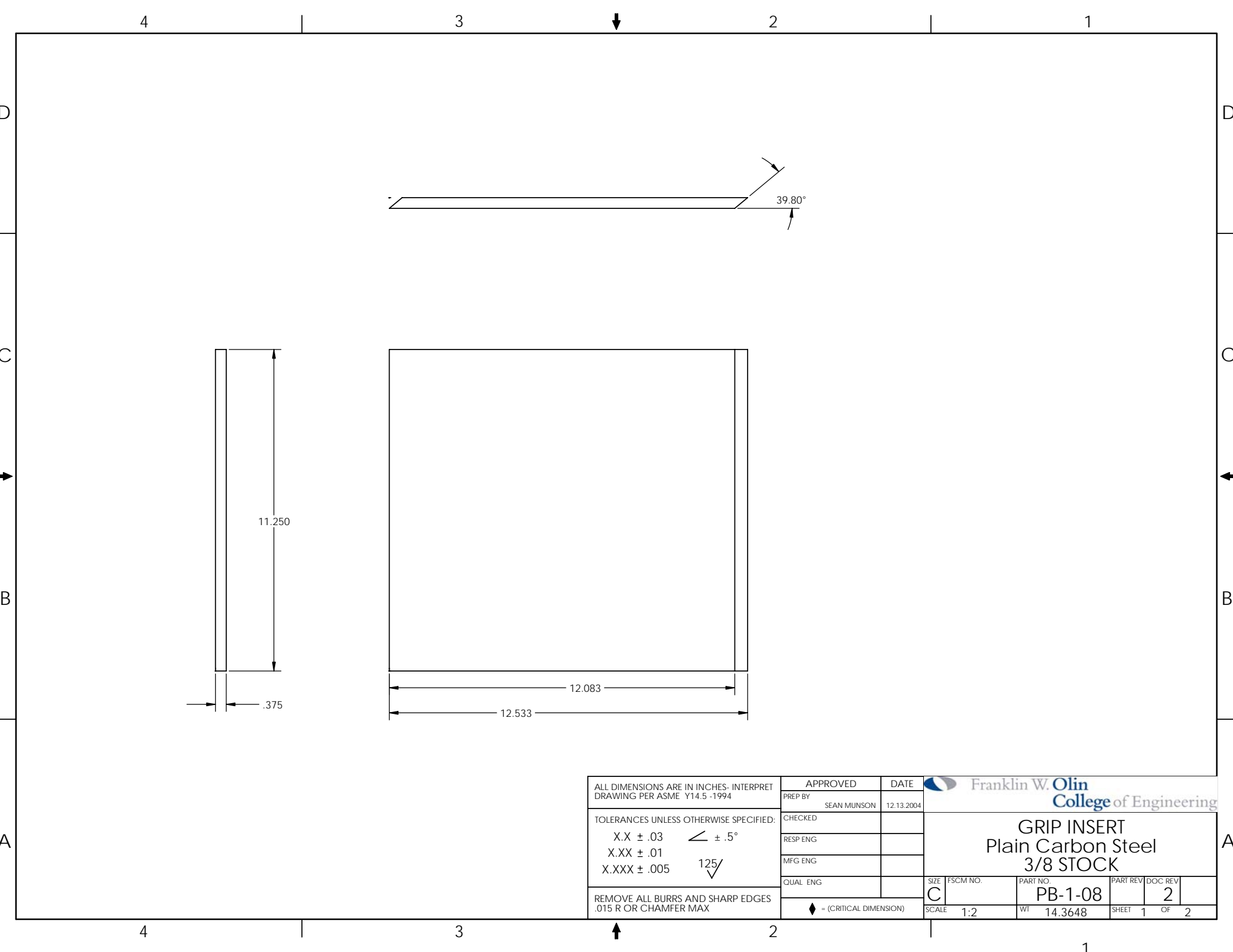
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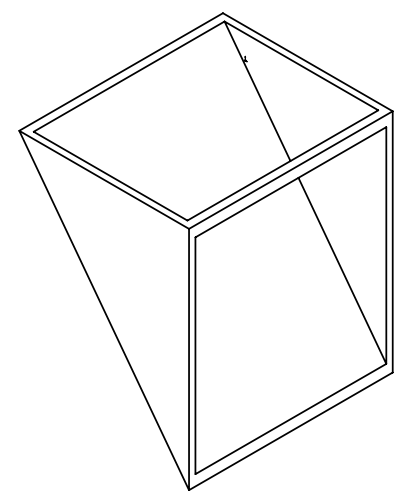
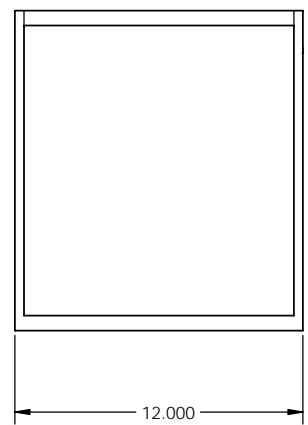
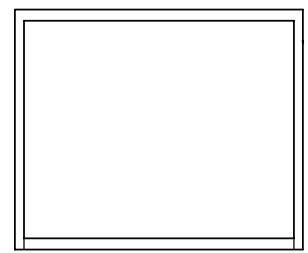
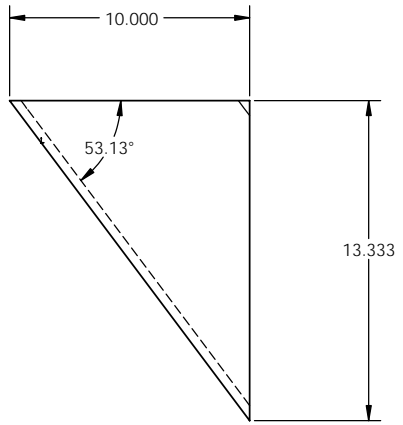
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ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X \pm .03 $\angle \pm .5^\circ$ X.XX \pm .01 $\sqrt{125}$ X.XXX \pm .005 REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	APPROVED	DATE				
	PREP BY SEAN MUNSON	12.13.2004	CHECKED	GRIP INSERT Plain Carbon Steel 3/8 STOCK		
	RESP ENG					
	MFG ENG					
QUAL ENG						
SIZE C SCALE 1:2 \blacklozenge = (CRITICAL DIMENSION)	FSCM NO.	PART NO. PB-1-08	PART REV	DOC REV 2	SHEET 1 OF 2	WT 14.3648



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994		APPROVED	DATE	Franklin W. Olin College of Engineering				
TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 125/ X.XXX ± .005		PREP BY SEAN MUNSON	12.13.2004	UPRIGHT BOTTOM SUPPORT Cast Carbon Steel 10x12x3/8 TUBING				
REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX		CHECKED						
		RESP ENG						
		MFG ENG						
		QUAL ENG		SIZE C	FSCM NO.	PART NO. PB-1-07	PART REV	DOC REV
		◆ = (CRITICAL DIMENSION)		SCALE 1:4	WT 33.9032	SHEET 1	OF 2	

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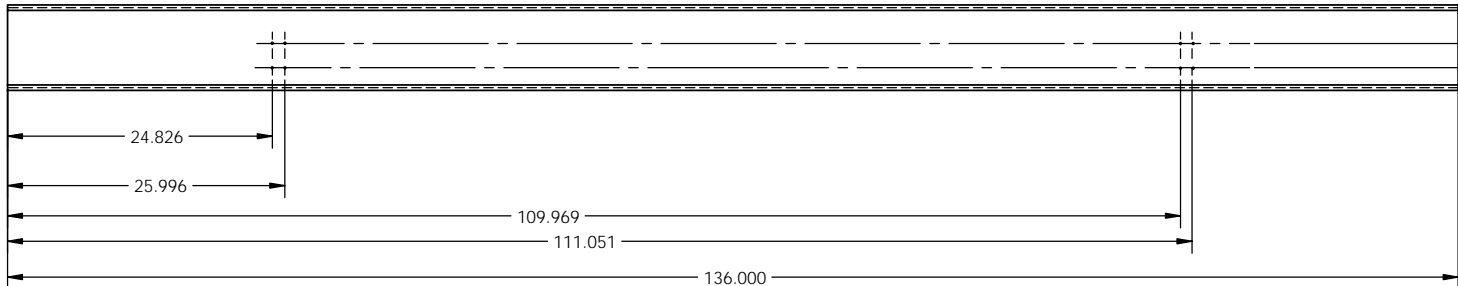
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1

NOTES, UNLESS OTHERWISE SPECIFIED

- 1. ONLY MODIFIED DIMENSIONS INDICATED
- 2. HOLES # 10-32 TAPPED



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994 TOLERANCES UNLESS OTHERWISE SPECIFIED: X.X ± .03 ∠ ± .5° X.XX ± .01 X.XXX ± .005 125/√ REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX	APPROVED	DATE					
	PREP BY SEAN MUNSON	12.11.2004					CHECKED
			RESP ENG				
			MFG ENG				
		QUAL ENG					
	◆ = (CRITICAL DIMENSION)	SCALE 1:9	SIZE C	FSCM NO.	PART NO. PB-1-06	PART REV	DOC REV
			WT	SHEET 1 OF 2			

4

3

2

1

D

D

C

C

B

B

A

A

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3

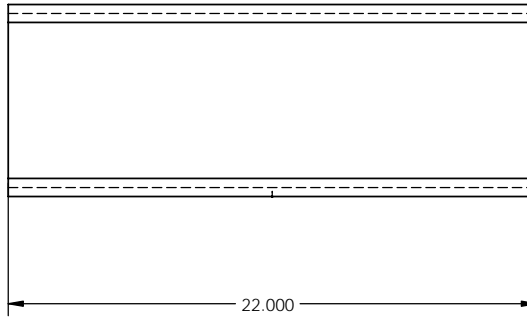
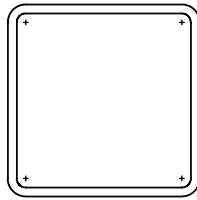


2

1

NOTES, UNLESS OTHERWISE SPECIFIED

1. ONLY MODIFIED DIMENSIONS INDICATED



ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 $\angle \pm .5^\circ$
 X.XX ± .01
 X.XXX ± .005 125°

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY SEAN MUNSON	12.11.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



UPRIGHT TUBING
CAST CARBON STEEL
STOCK 8"x8"x1/4"

SIZE C	FSCM NO.	PART NO. PB-1-05	PART REV	DOC REV
SCALE 1:4	WT	SHEET 1	OF 2	

4

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C

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A

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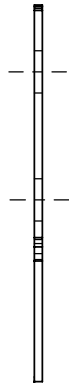
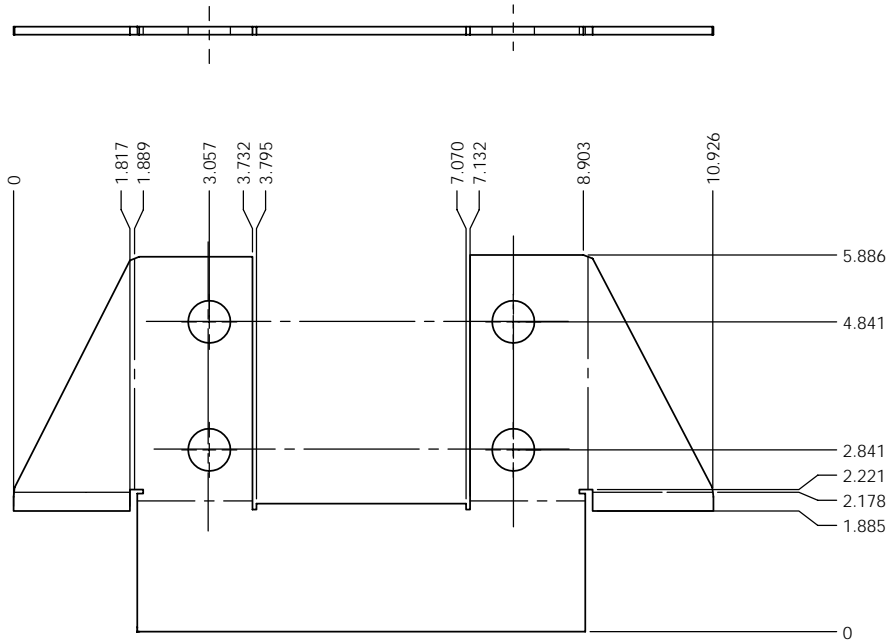
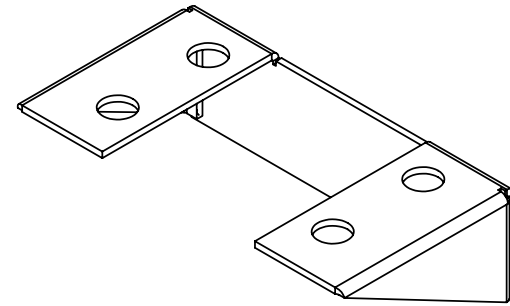


2

1

NOTES, UNLESS OTHERWISE SPECIFIED

1. HOLES 0.660 DIA THRU



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
X.X ± .03 $\angle \pm .5^\circ$
X.XX ± .01
X.XXX ± .005 125°

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY SEAN MUNSON	12.13.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	

Franklin W. Olin College of Engineering		NOOK MOUNT (Y-AXIS) ALLOY STEEL .125"			
SIZE C	FSCM NO.	PART NO. PB-1-03	PART REV	DOC REV	
SCALE 1:1.5	WT 1.2265	SHEET 1	OF 2		

4

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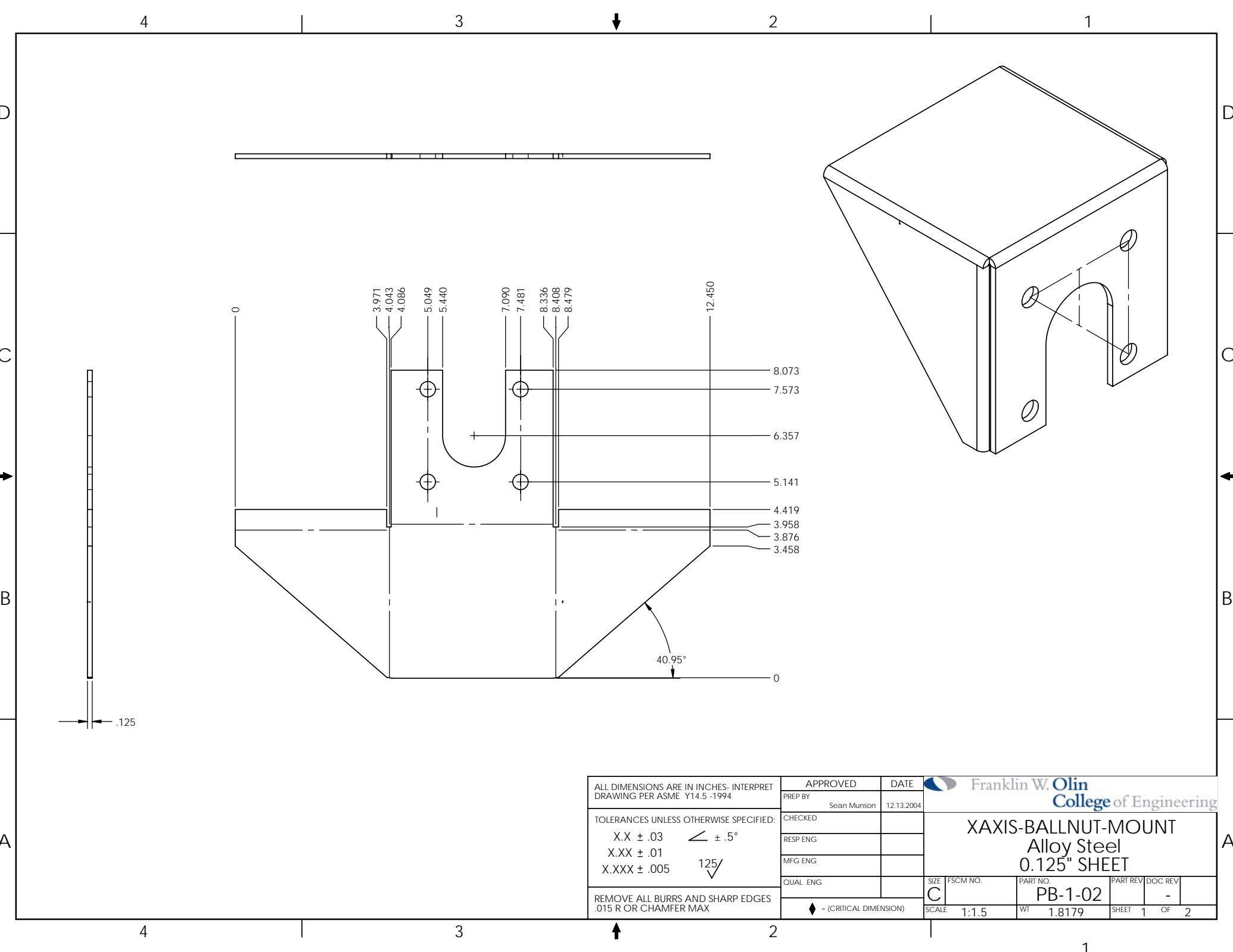
C

B

B

A

A



ALL DIMENSIONS ARE IN INCHES- INTERPRET
DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:
 X.X ± .03 ∠ ± .5°
 X.XX ± .01 125/
 X.XXX ± .005

REMOVE ALL BURRS AND SHARP EDGES
.015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY Sean Munson	12.13.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	

Franklin W. Olin College of Engineering		XAXIS-BALLNUT-MOUNT Alloy Steel 0.125" SHEET			
SIZE C	FSCM NO.				
SCALE 1:1.5	WT 1.8179	SHEET 1	OF 2		

4

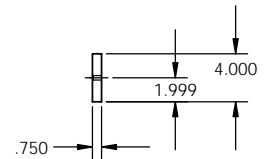
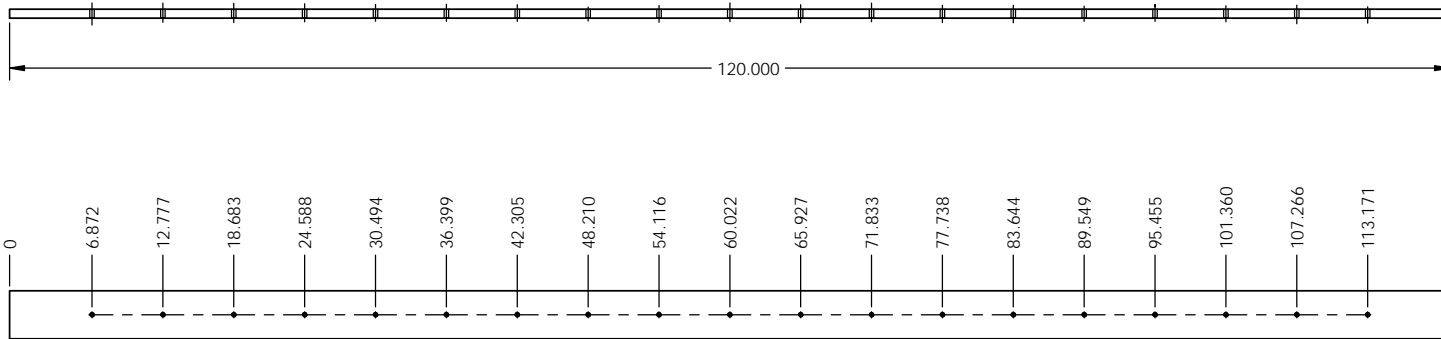
3

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NOTES, UNLESS OTHERWISE SPECIFIED

1. HOLES 3/8-16 TAPPED



ALL DIMENSIONS ARE IN INCHES- INTERPRET DRAWING PER ASME Y14.5 -1994

TOLERANCES UNLESS OTHERWISE SPECIFIED:

X.X ± .03 $\angle \pm .5^\circ$

X.XX ± .01

X.XXX ± .005 $\sqrt{125}$

REMOVE ALL BURRS AND SHARP EDGES .015 R OR CHAMFER MAX

APPROVED	DATE
PREP BY Sean Munson	12.13.2004
CHECKED	
RESP ENG	
MFG ENG	
QUAL ENG	
◆ = (CRITICAL DIMENSION)	



UTILITRACK-MOUNT (Y-AXIS)
PLAIN CARBON STEEL
3/4"x4" STOCK

SIZE C	FSCM NO.	PART NO. PB-1-01	PART REV	DOC REV
SCALE 1:8	WT	SHEET 1	OF 2	

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