Spring | 14

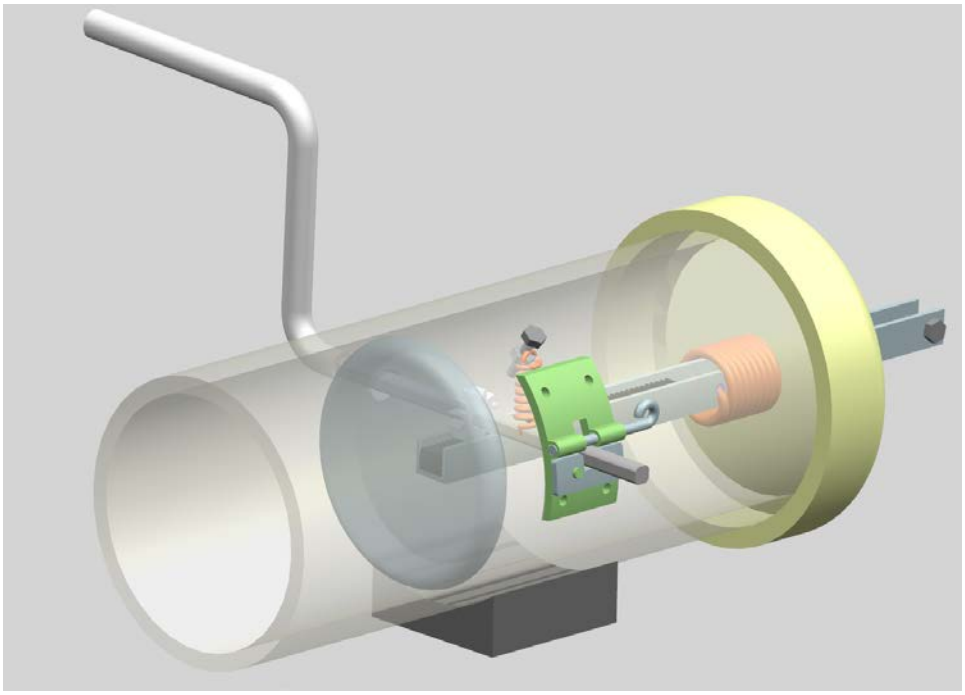
BLAM Project

Group 12

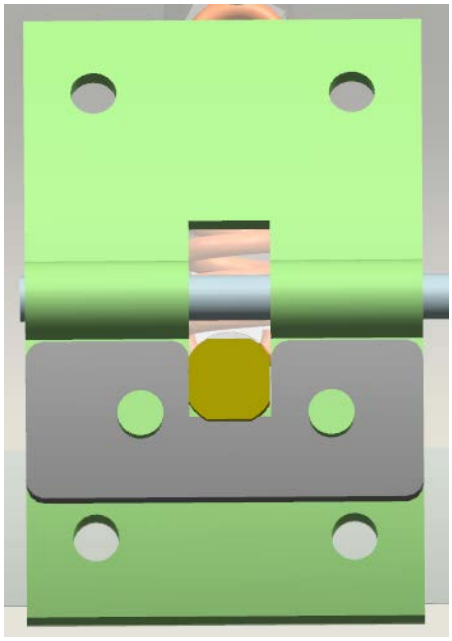
Matt Ledesma, Richard Misawa, Samuel Ojogbo, Zachary Cox

Ball Launcher Mechanism Description

The ball launcher machine (BLAM) made by Group 12 consists of 17 parts including a tripod. The mechanism uses two energy storing components (springs) and makes use of a gear and rack to enable deployment.



The Ball Launching Mechanism depicted above was designed to launch a tennis ball at a precise location six feet from a defined enclosure of 1'x2'x2'. The design makes use of a compression spring to force a piston (pushing the tennis ball) through PVC piping. The spring is compressed by means of winding a rack and pinion set. The pinion is driven by means of a hand powered crank.



The crankshaft is designed as a rounded square extrusion. This shape allows the shaft to rotate freely in a circular hole, but also allows locking of the shaft when it is inserted into a sufficiently small rectangular enclosure. When the spring is partially compressed, the crankshaft is locked in place by inserting a rectangular cap over the pictured protrusions.

To release the mechanism, a pin is pulled from the release bracket. This allows the crankshaft (prevented from rotating axially) to be pulled upward by a spring, which disengages the pinion from the rack, allowing the compression spring to decompress, launching the tennis ball. A tripod (not pictured) is used to freely adjust the trajectory of the launched tennis ball. The tripod used will be a stock purchase and the mount pictured is designed to attach to it.

Table 1: Bill Of Materials & Manufacturing Plan

Item numbers refer to “PC NO” in “BLAM” assembly drawing. Component names in parenthesis are the names used in report document.

Item Number	Part Number	Name of Component	Quantity	Price	Build method / Purchase Location
1	48925K97	Standard-Wall White PVC Unthreaded Pipe (Outer Shaft)	1	(Provided)	McMaster-Carr http://www.mcmaster.com/#48925k97/=r61iix
2	4880K57	Standard-Wall White PVC Pipe Fitting (Outer Shaft cover)	1	(Provided)	McMaster-Carr http://www.mcmaster.com/?error_redirect=true#4880k57/=r6j3yk
3	MT-F50C	Crankshaft	1	(Provided)	Metal supplied by team
4	PL-F20C	Crank Handle	1	(Provided)	3D Printed
5	WD-F10C	Ramrod	1	(Provided)	Wood
6	57655K32	Molded Nylon 14-1/2 Degree Angle Spur Gear (Gear)	1	$3.84	McMaster-Carr http://www.mcmaster.com/#57655k32/=r61ghk
7	PL-F30C	Ramrod Plate	1	(Provided)	3D Printed
8	AC-F70C	Lock Bolt (Key)	1	(Provided)	Acrylic
9	PL-F50C	Release bracket	1	(Provided)	3D printed
10	MT-F60C	Locking Cap	1	(Provided)	Metal supplied by team
11	SH4MS10	M4 x 0.7 Cap Screw &	2	(Provided)	Thor Labs http://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=248&pn=HW-KIT1
12	SH4MS10	M4 Nut	2	(Provided)	Thor Labs http://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=248&pn=HW-KIT1
13	PL-F40C	Mounting Plate	1	(Provided)	3D Printed
14	9657K423	Compression Spring 2.5” length 0.72” Diameter 34.6lbs./inch Spring Constant	1	$7.82	McMaster-Carr http://www.mcmaster.com/#compression-springs/=r6limp
15	57655K62	Molded Nylon 14-1/2 Degree Angle Spur Gear (Rack)	1	$5.33	McMaster-Carr http://www.mcmaster.com/#57655k62/=r60uao
16	9654K947	Tension Spring 1.121” Length (extend) 1.29 lbs./inch Spring Constant	1	$7.22	McMaster-Carr http://www.mcmaster.com/#extension-springs/=r6lki7
N/A	620-250	Sunpak 12.2" Mini-Pro Plus Tripod with 3-Way Panhead	1	$13.92	Amazon http://www.amazon.com/SUNPAK-620-250-MINI-PRO-TRIPOD-PANHEAD/dp/B00012BYXO

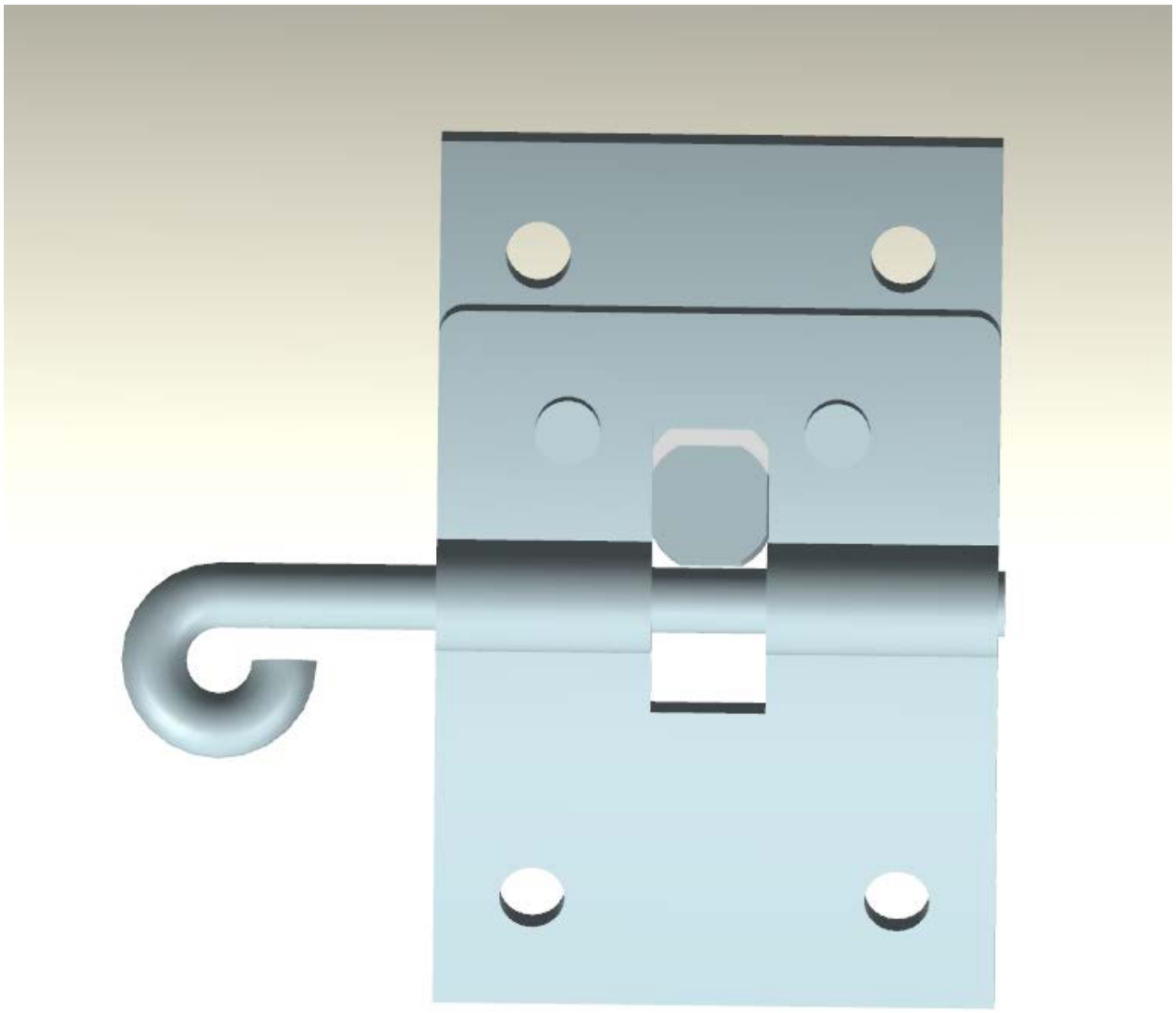


Figure 1: Lock Bolt, Release Bracket and Locking Cap Emphasized.

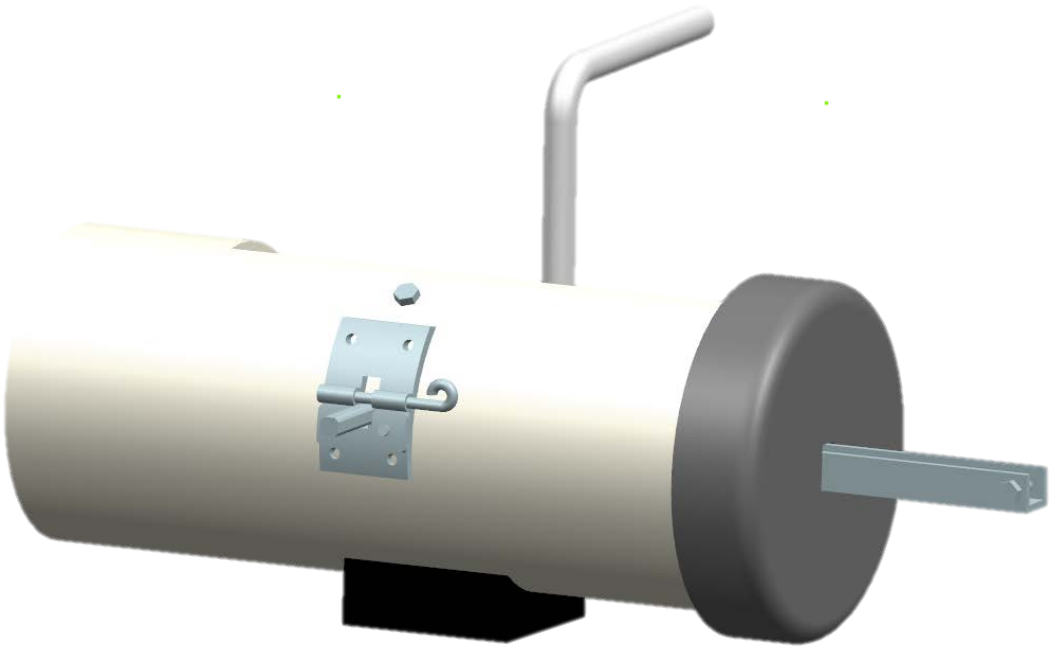


Figure 2: Back View of BLAM

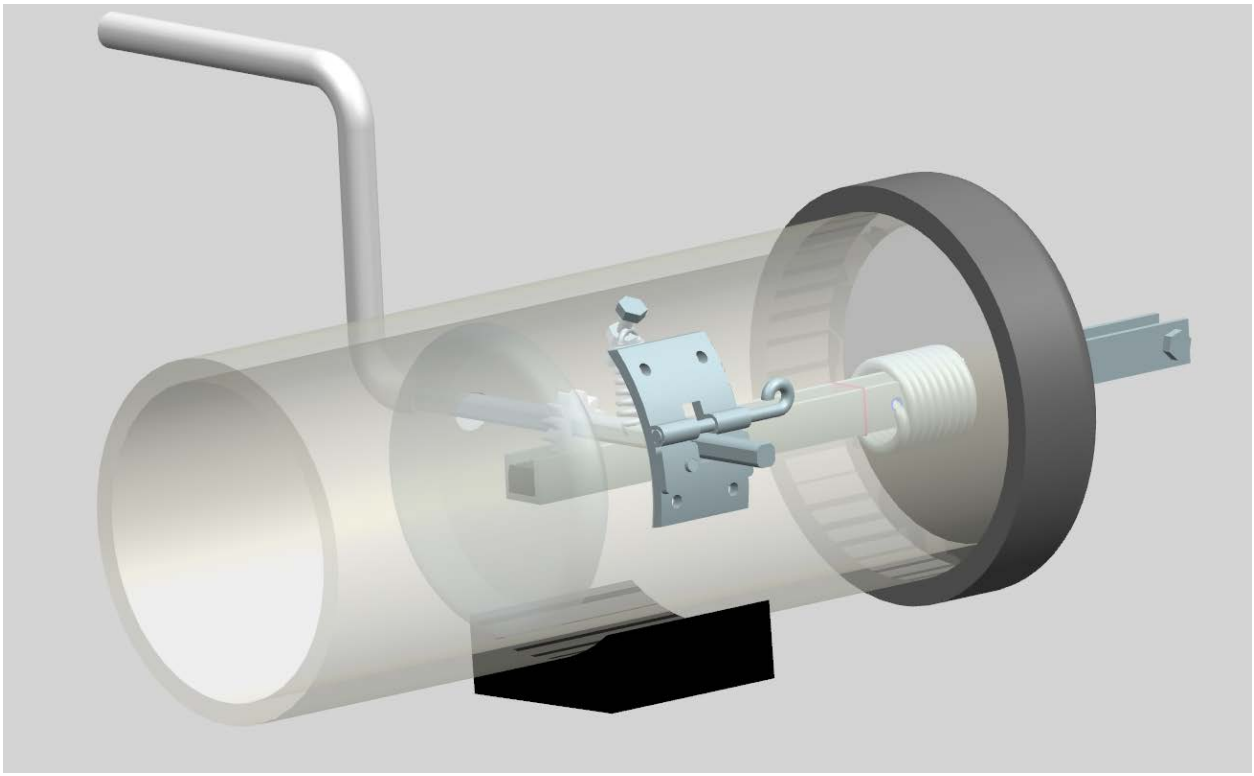
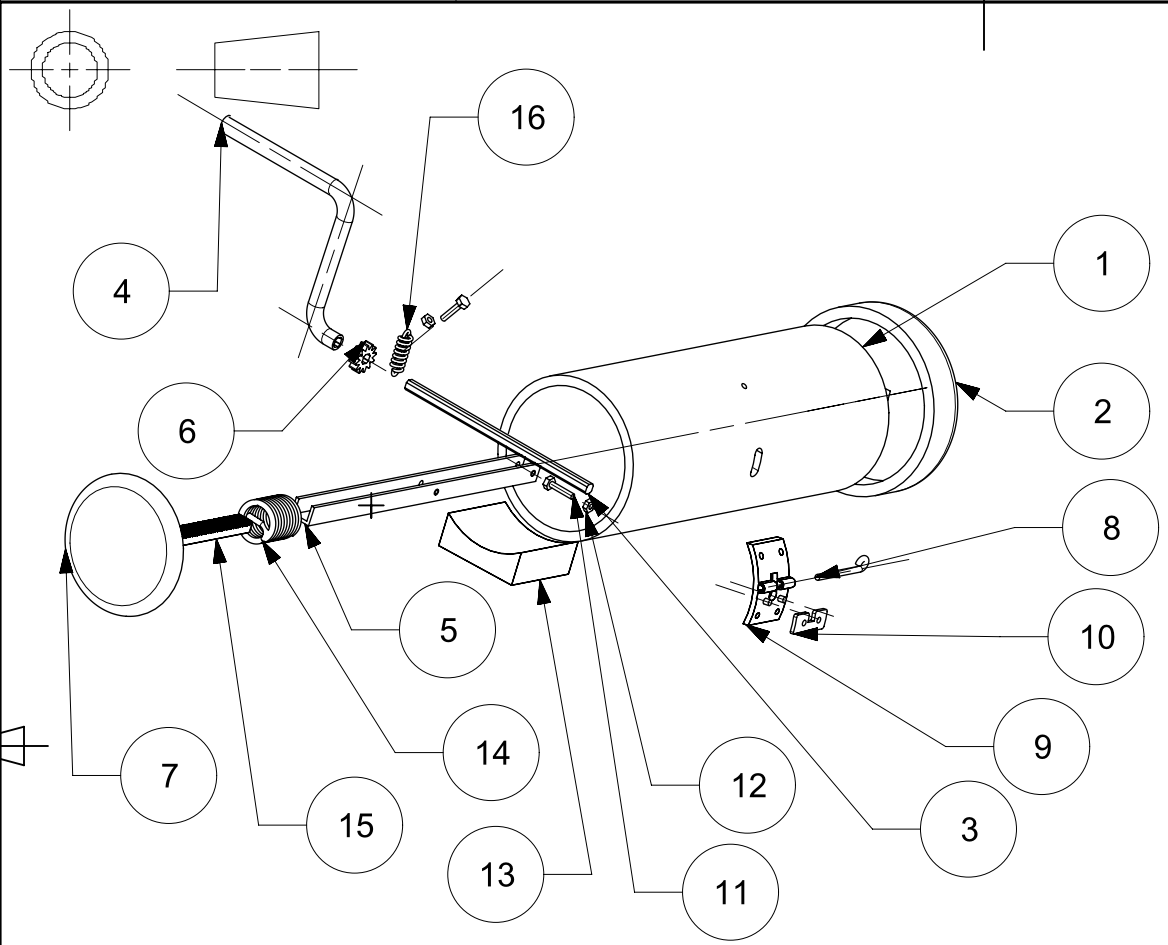
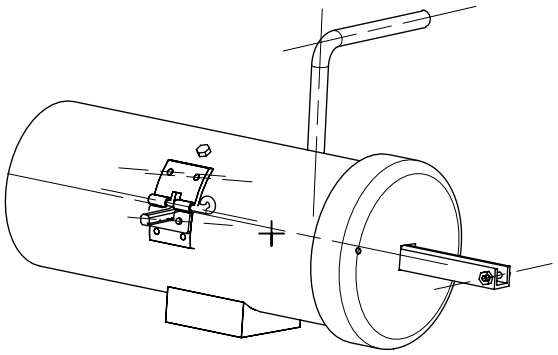


Figure 3: Assembly Photo of BLAM Without Tripod



PC NO	PART NAME	QTY
16	SPRING_2	1
15	RAIL	1
14	SPRING_1	1
13	MOUNTING_PLATE	1
12	NUT	2
11	BOLT	2
10	LOCKING_CAP	1
9	RELEASE_BRACKET	1
8	PIN	1
7	PISTON_HEAD	1
6	GEAR	1
5	RAMROD	1
4	CRANK	1
3	CRANK_SHAFT	1
2	CAP	1
1	OUTER_SHAFT	1



ALL DIMENSIONS IN INCHES

SIEMENS

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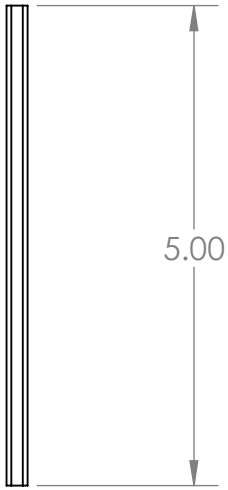
FIRST ISSUED	
DRAWN BY	Group 12
CHECKED BY	
APPROVED BY	

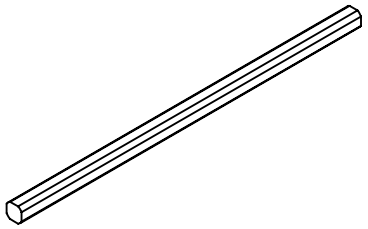
TITLE

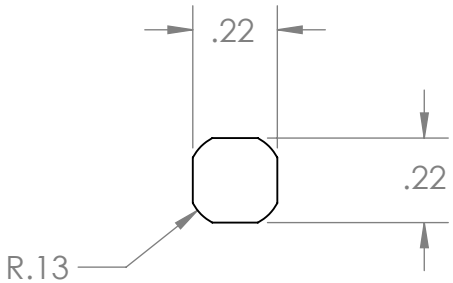
BLAM

SIZE	DRG NO.	SHEET REV
A	BLAM	A

SCALE 1:1 | SHEET 1 OF 1







SCALE: 2:1

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		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL Metal	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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TITLE:

Crank Shaft

SIZE	DWG. NO.	REV
A		

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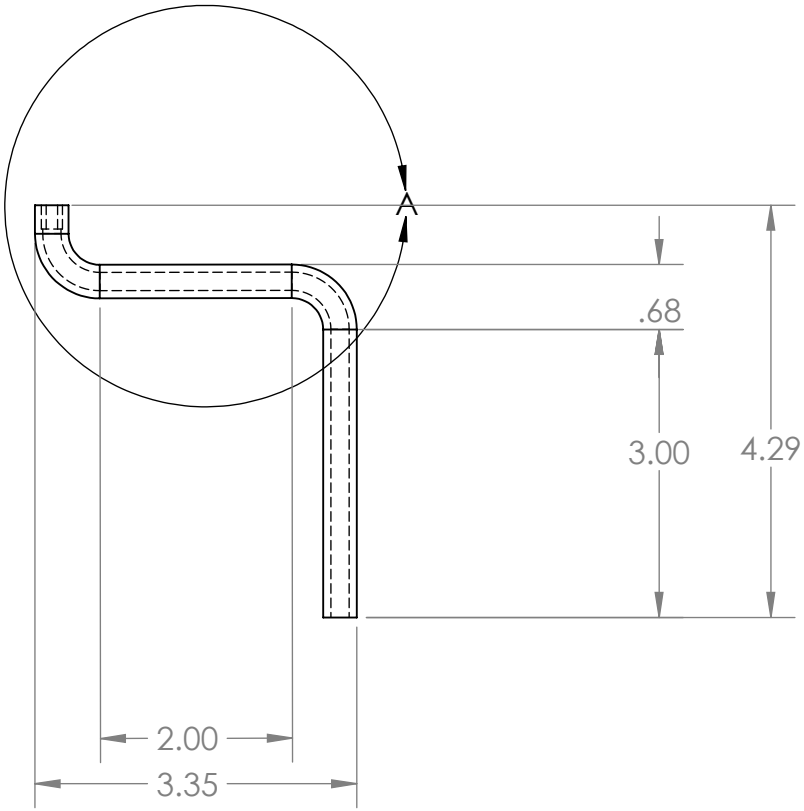
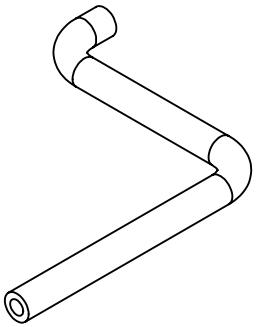
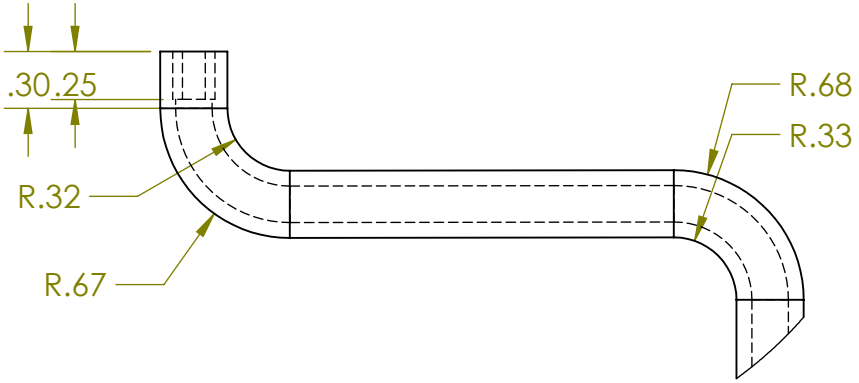
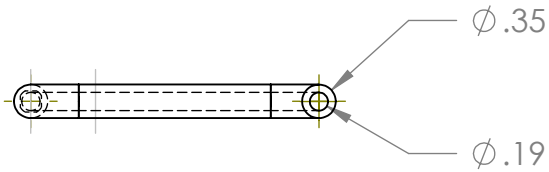
5 4 3 2 1









DETAIL A
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TITLE:

Crank Handle

SIZE	DWG. NO.	REV
A		

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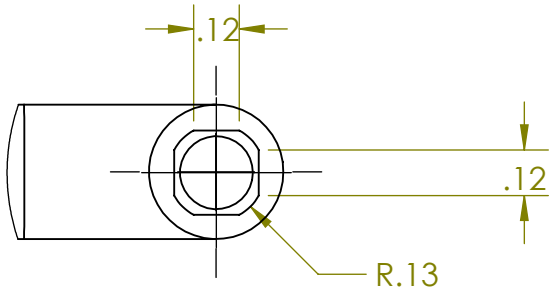

DETAIL B
SCALE 2 : 1

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APPLICATION		DO NOT SCALE DRAWING			

TITLE:

Crank Handle

SIZE	DWG. NO.	REV
A		

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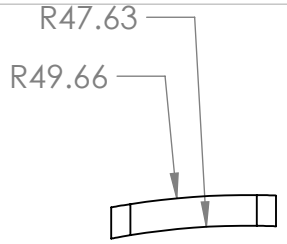

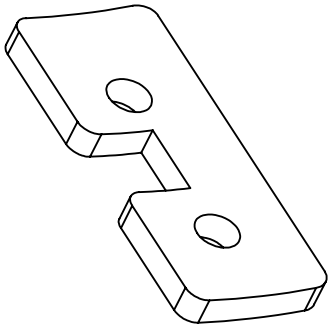

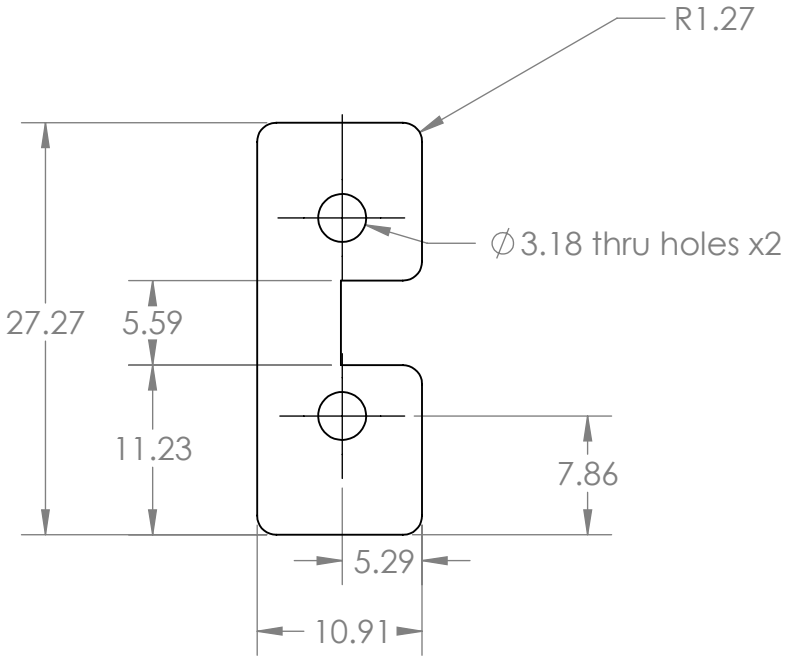

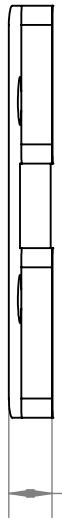

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TITLE:

Locking Cap

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A		

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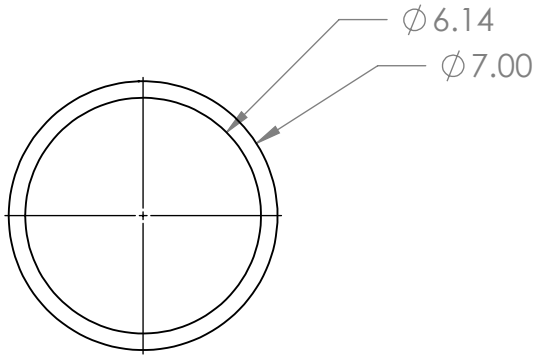
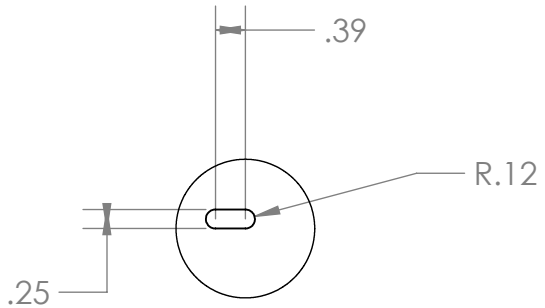
5 4 3 2 1





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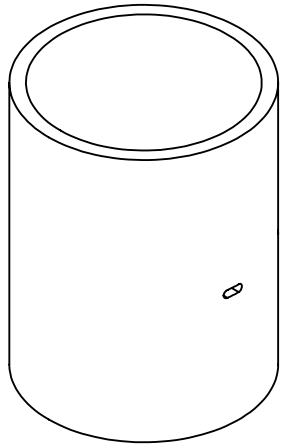

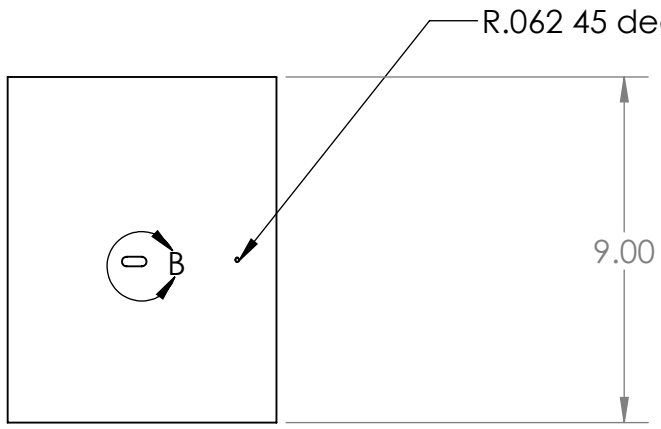

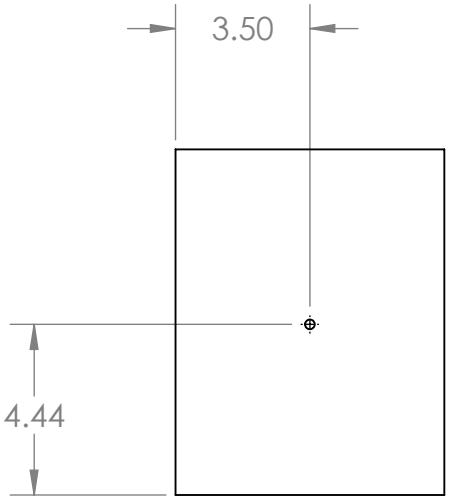

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		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL PVC	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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TITLE:

PVC Outer Shaft

SIZE	DWG. NO.	REV
A		

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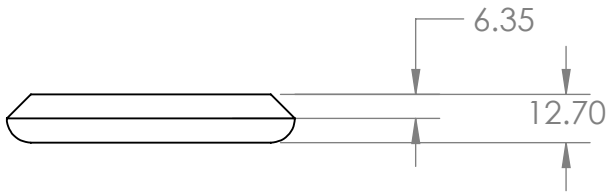
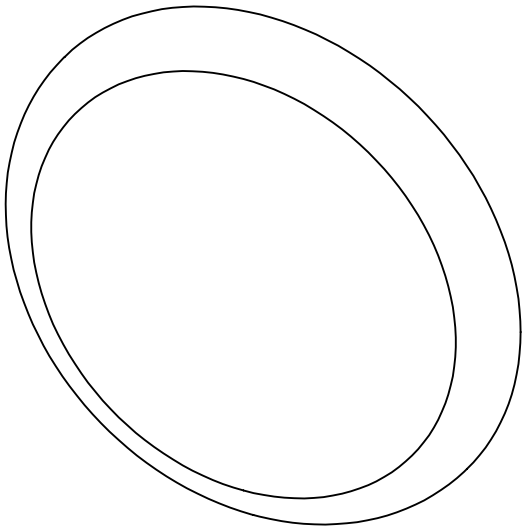
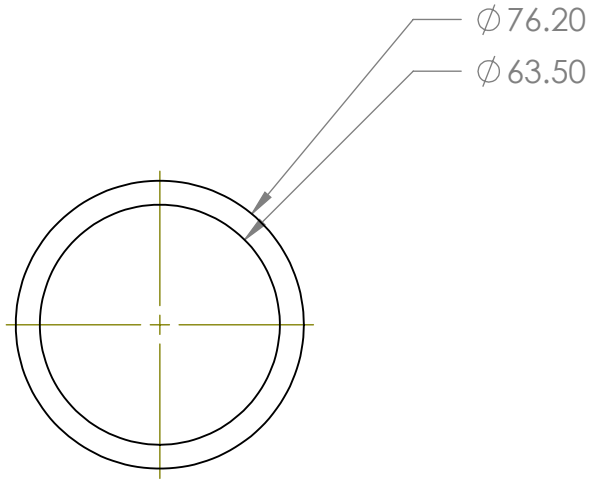
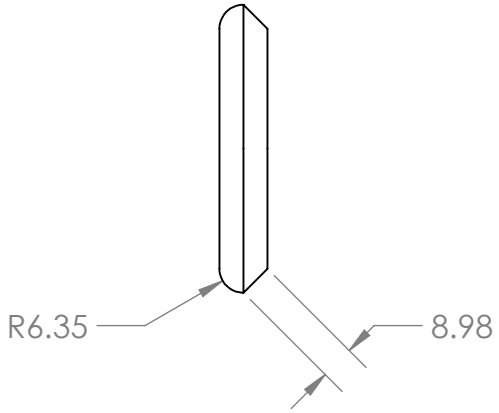
5 4 3 2 1









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			CHECKED		
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		MATERIAL Acrylic	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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TITLE:

Ramrod Plate

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A		

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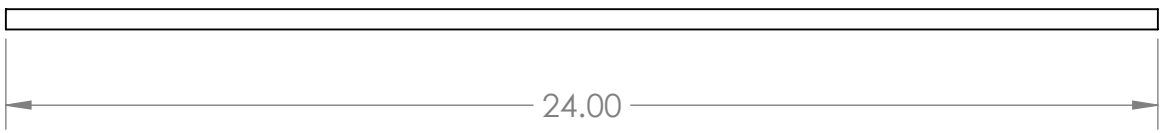
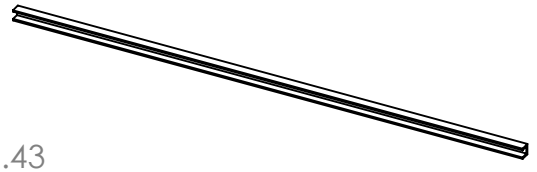
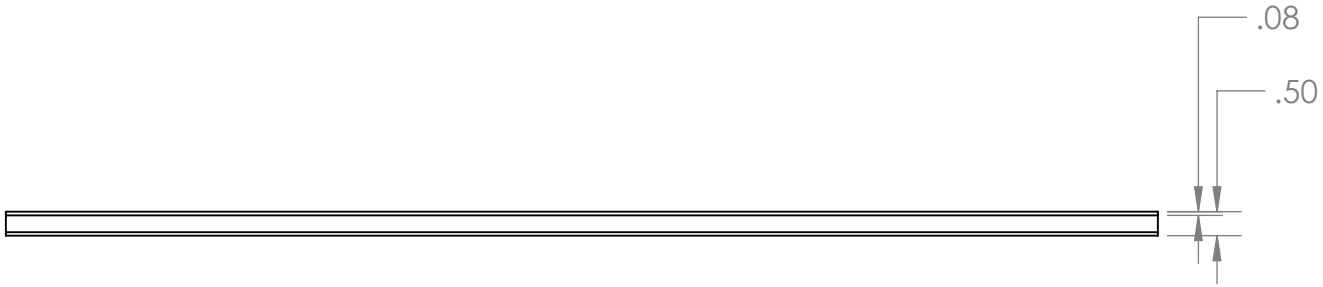
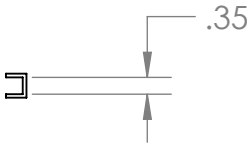




Scale 1:8





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		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL wood			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

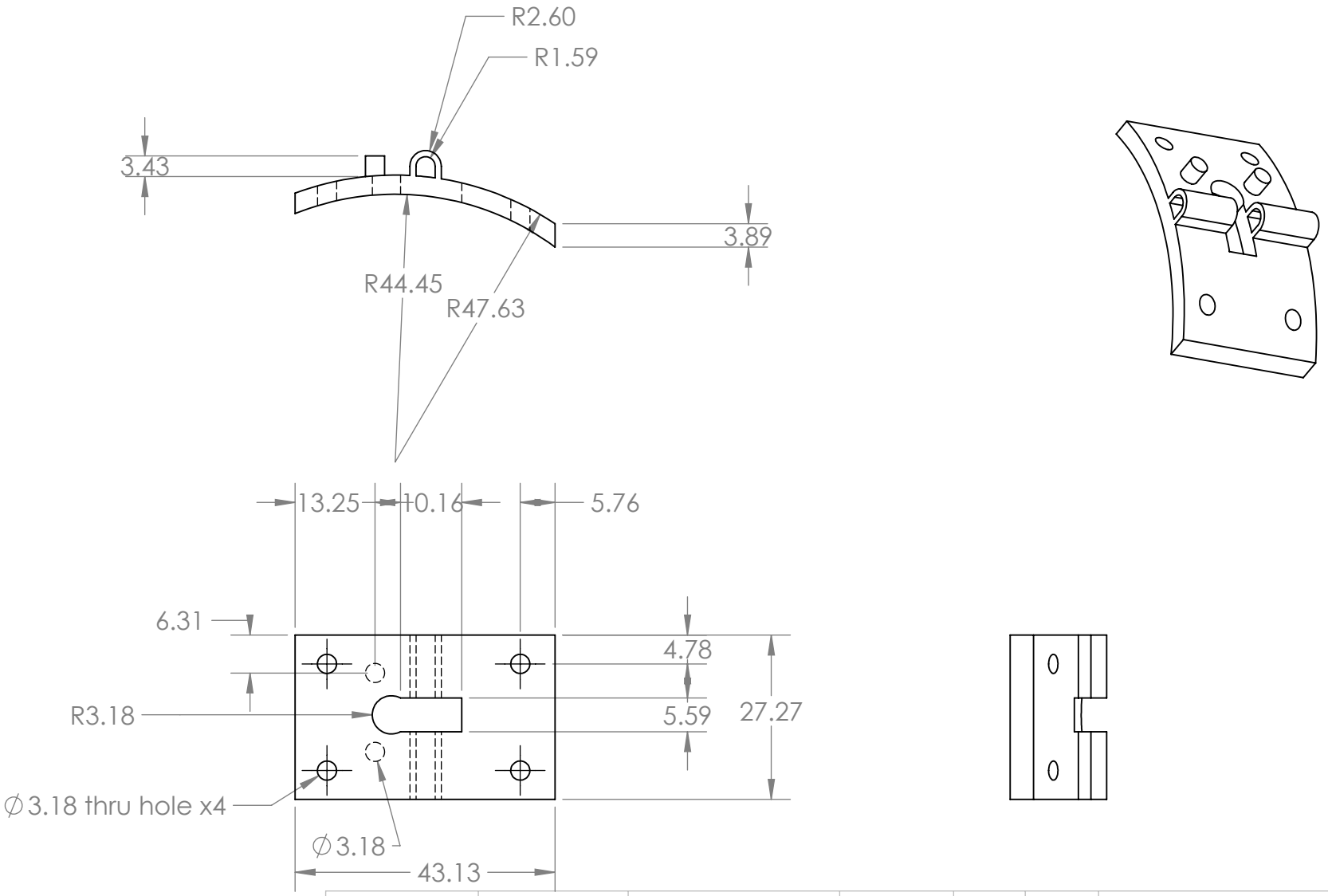
TITLE:

Ramrod

SIZE	DWG. NO.	REV
A		

SCALE: 1:4	WEIGHT:	SHEET 1 OF 1

5 4 3 2 1



		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 3D printed	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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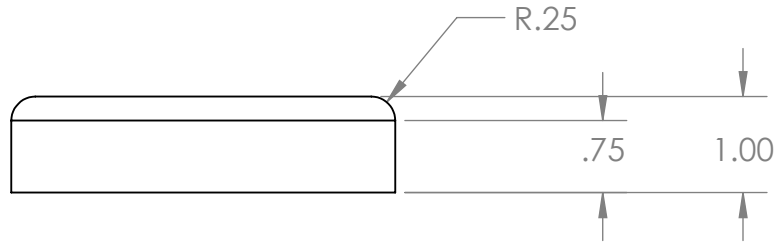
TITLE:

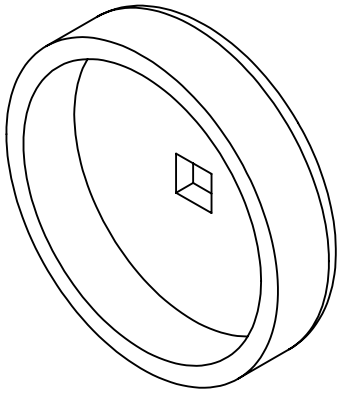
Release Bracket

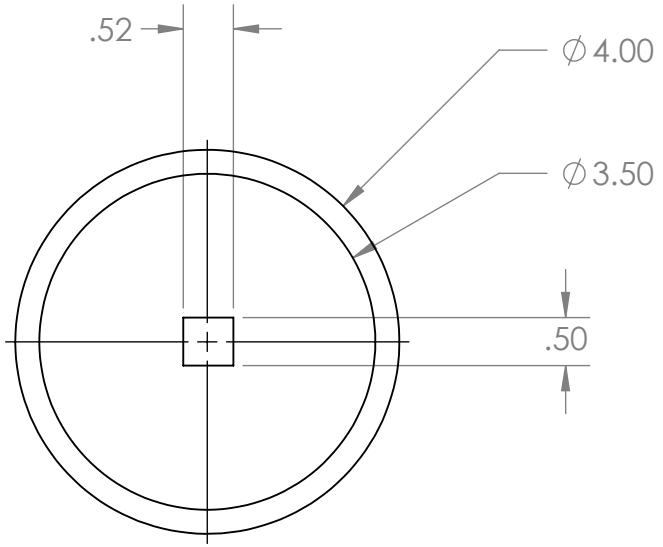
SIZE	DWG. NO.	REV
A		

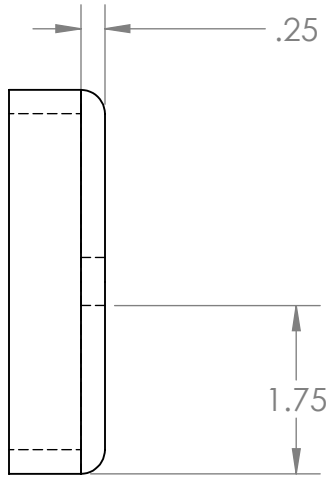
SCALE: 2:1	WEIGHT:	SHEET 1 OF 1

5 4 3 2 1









		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL PVC Pipe	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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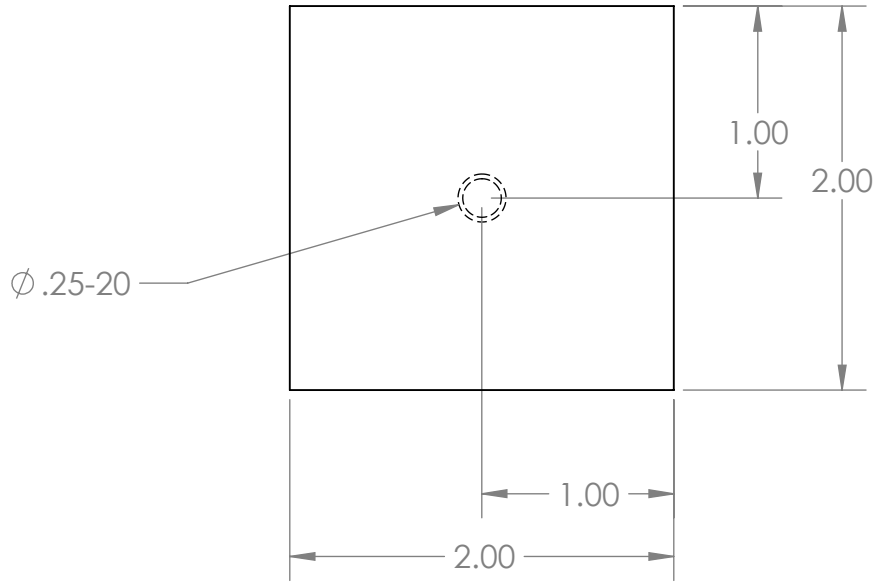
TITLE:

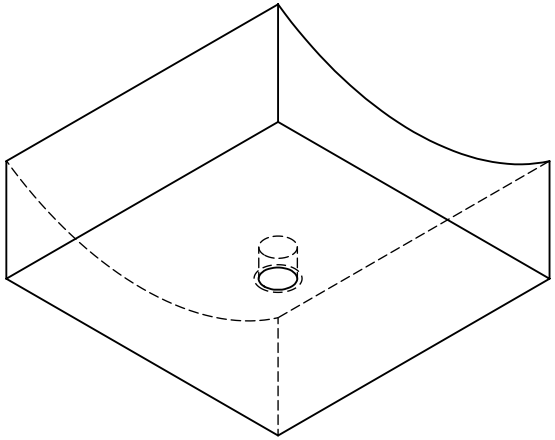
Pipe Cap

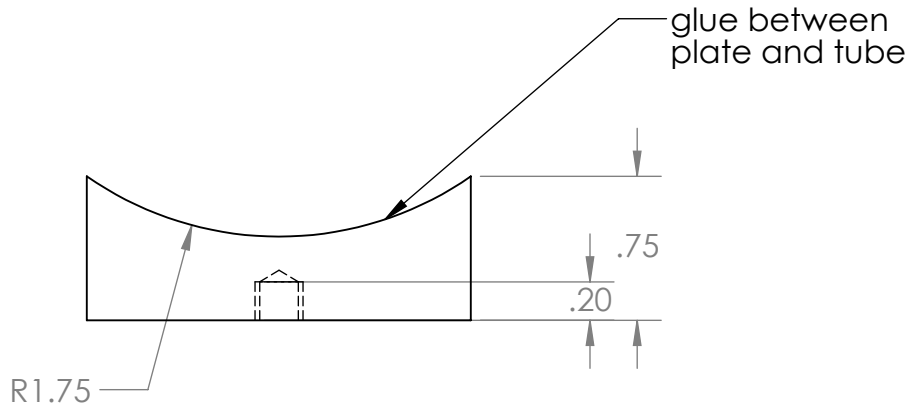
SIZE	DWG. NO.	REV
A		

SCALE: 1:2	WEIGHT:	SHEET 1 OF 1

5 4 3 2 1







		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 3D printed	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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TITLE: Mounting Plate

SIZE	DWG. NO.	REV
A		

SCALE: 1:1	WEIGHT:	SHEET 1 OF 1

5 4 3 2 1