

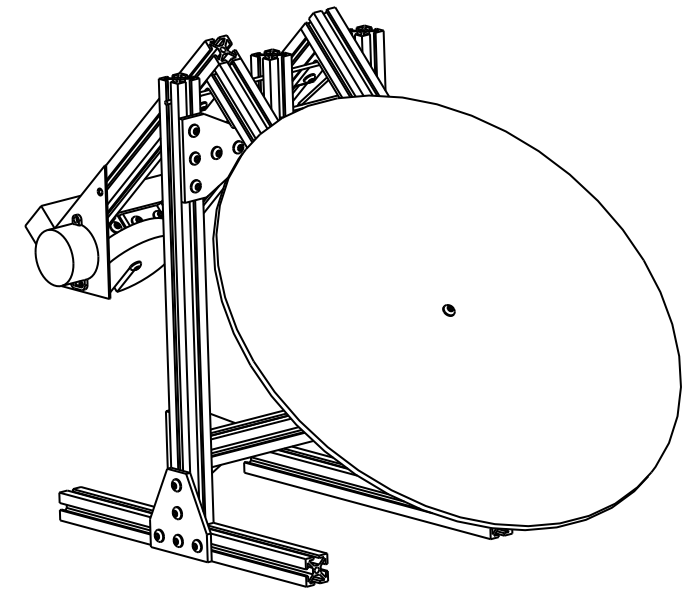
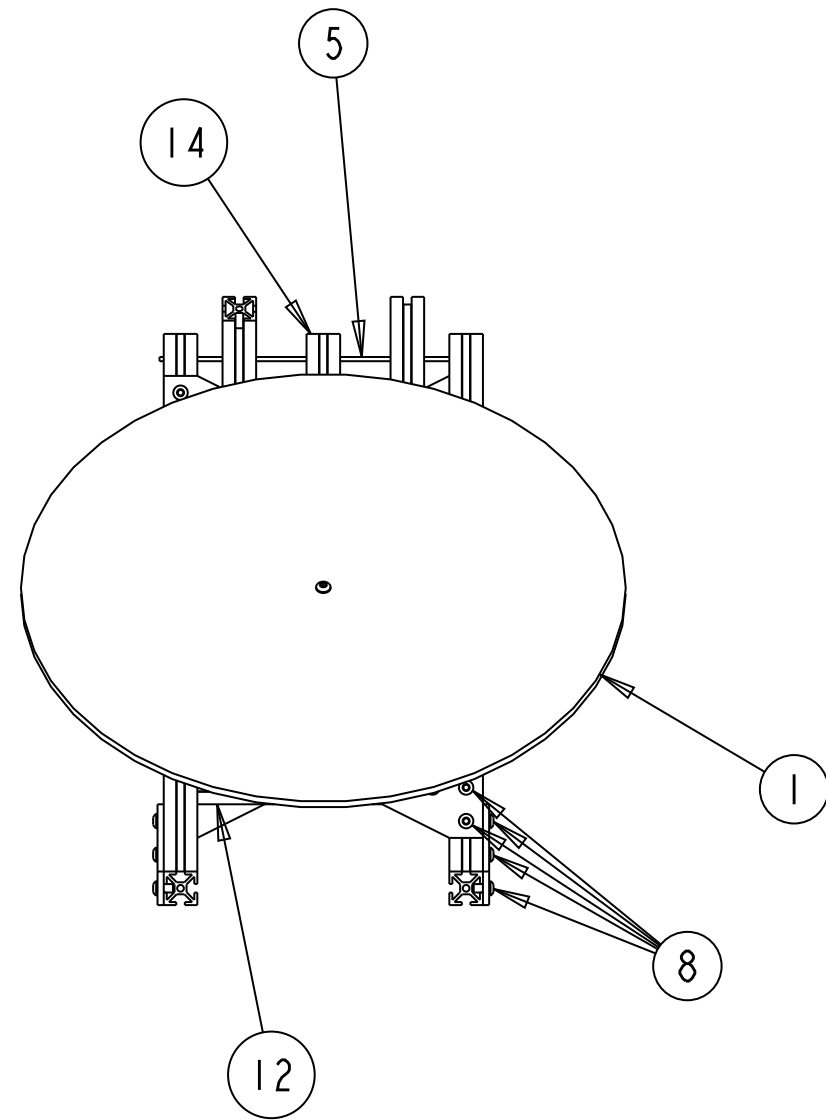
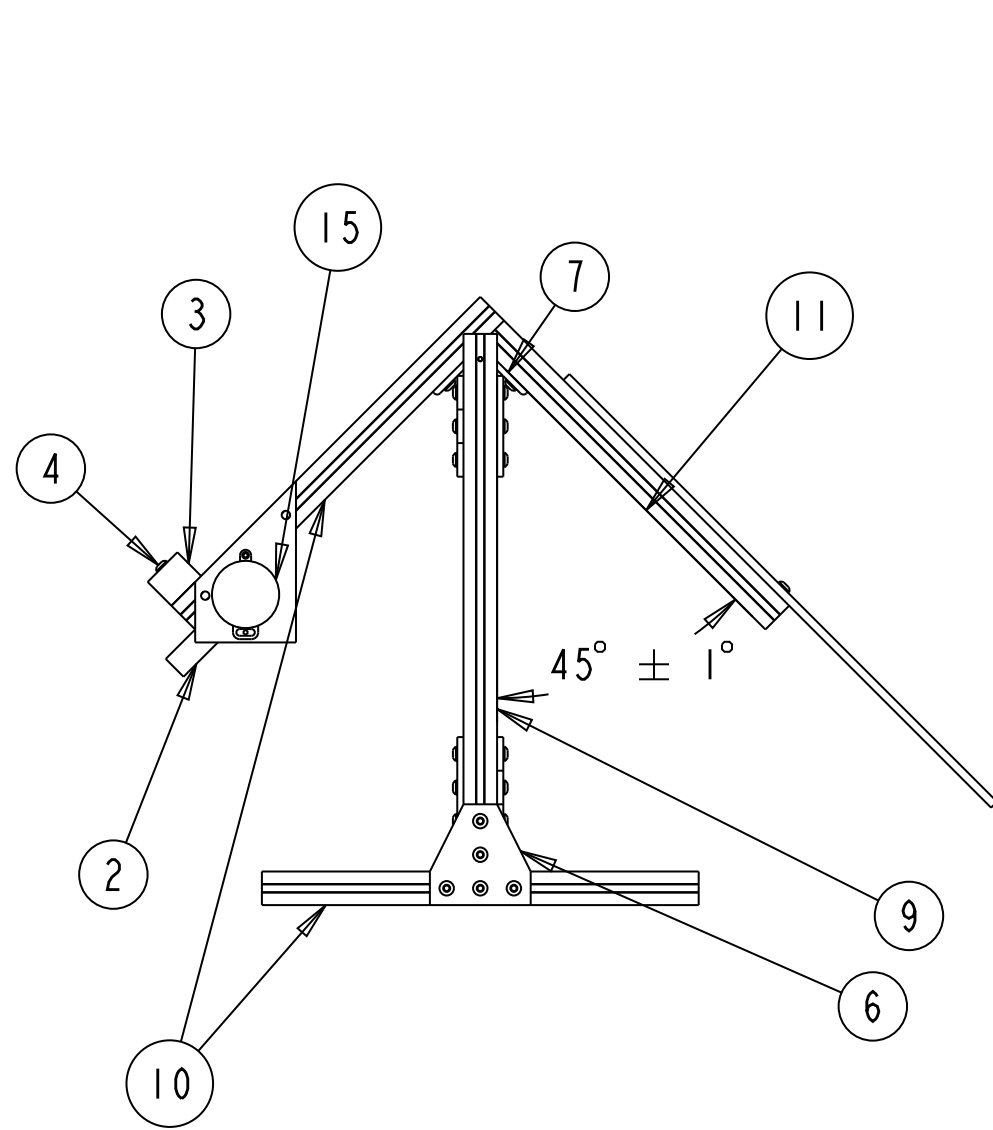
## Detailed Drawings for the Force Balance Test Apparatus

Drawings courtesy of Mike Miller, Alsons Corporation

The American Society of Mechanical Engineers (ASME)/Canadian Standards Association (CSA) Joint Harmonization Task Force on water-efficient showerheads used the force balance test apparatus shown in these drawings during its research and development of the force requirements outlined in the WaterSense® Specification for Showerheads. For more information on this apparatus please contact Mike Miller at 517-439-2145 or [mmiller@alsons.com](mailto:mmiller@alsons.com).

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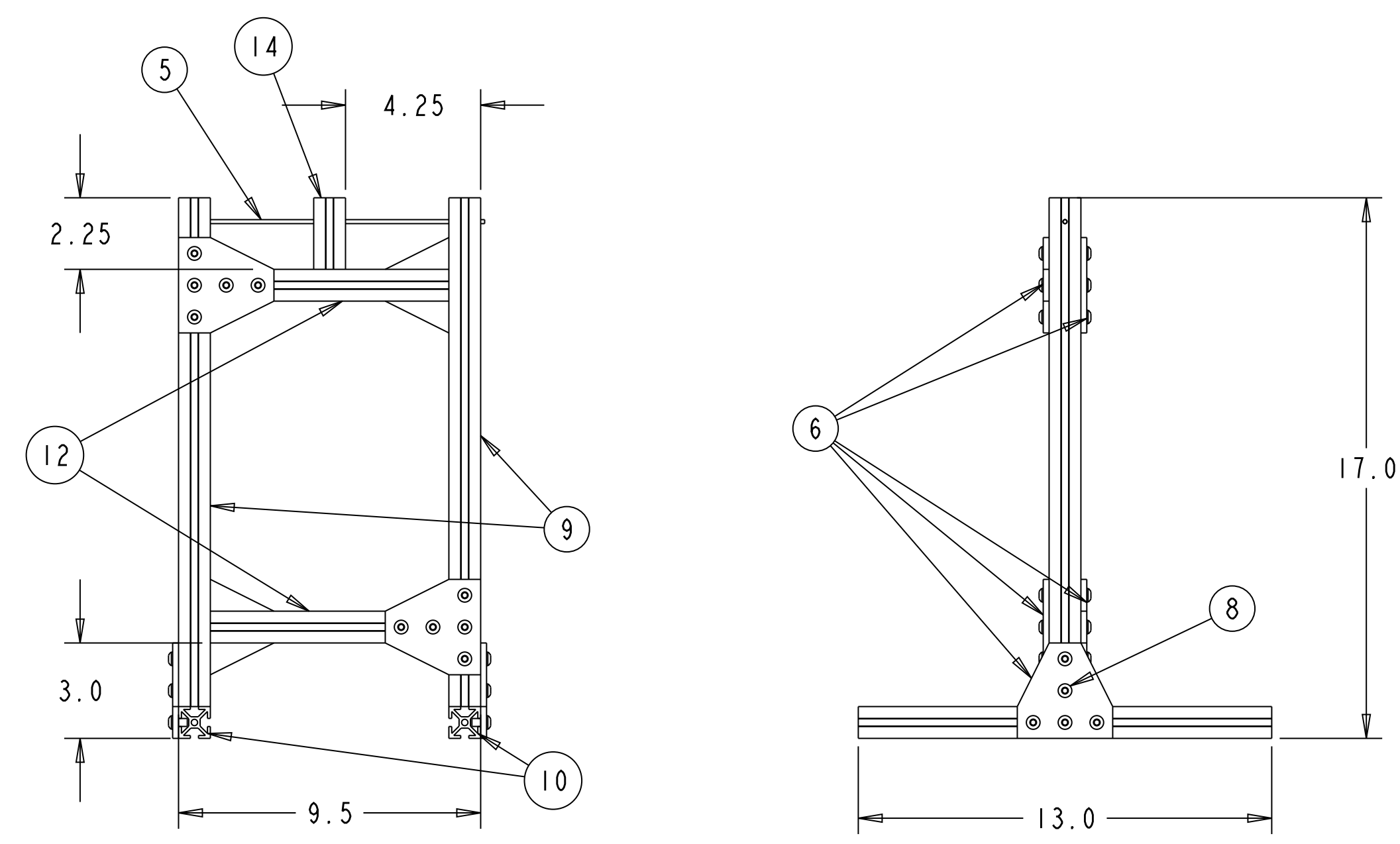
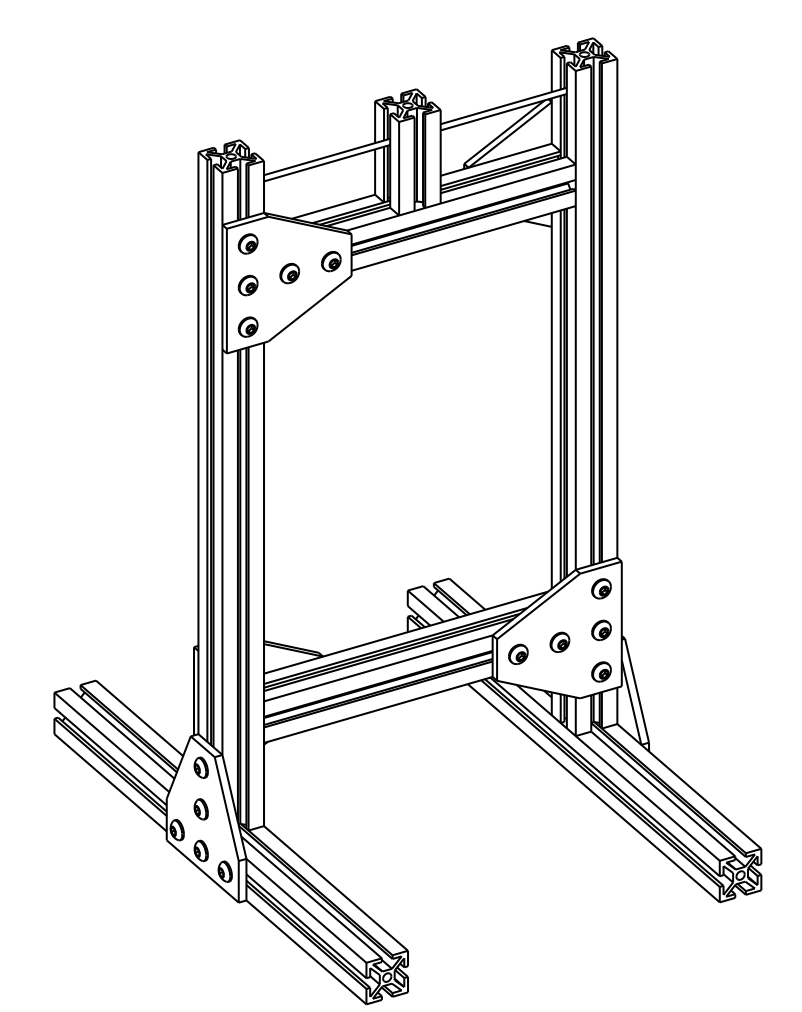
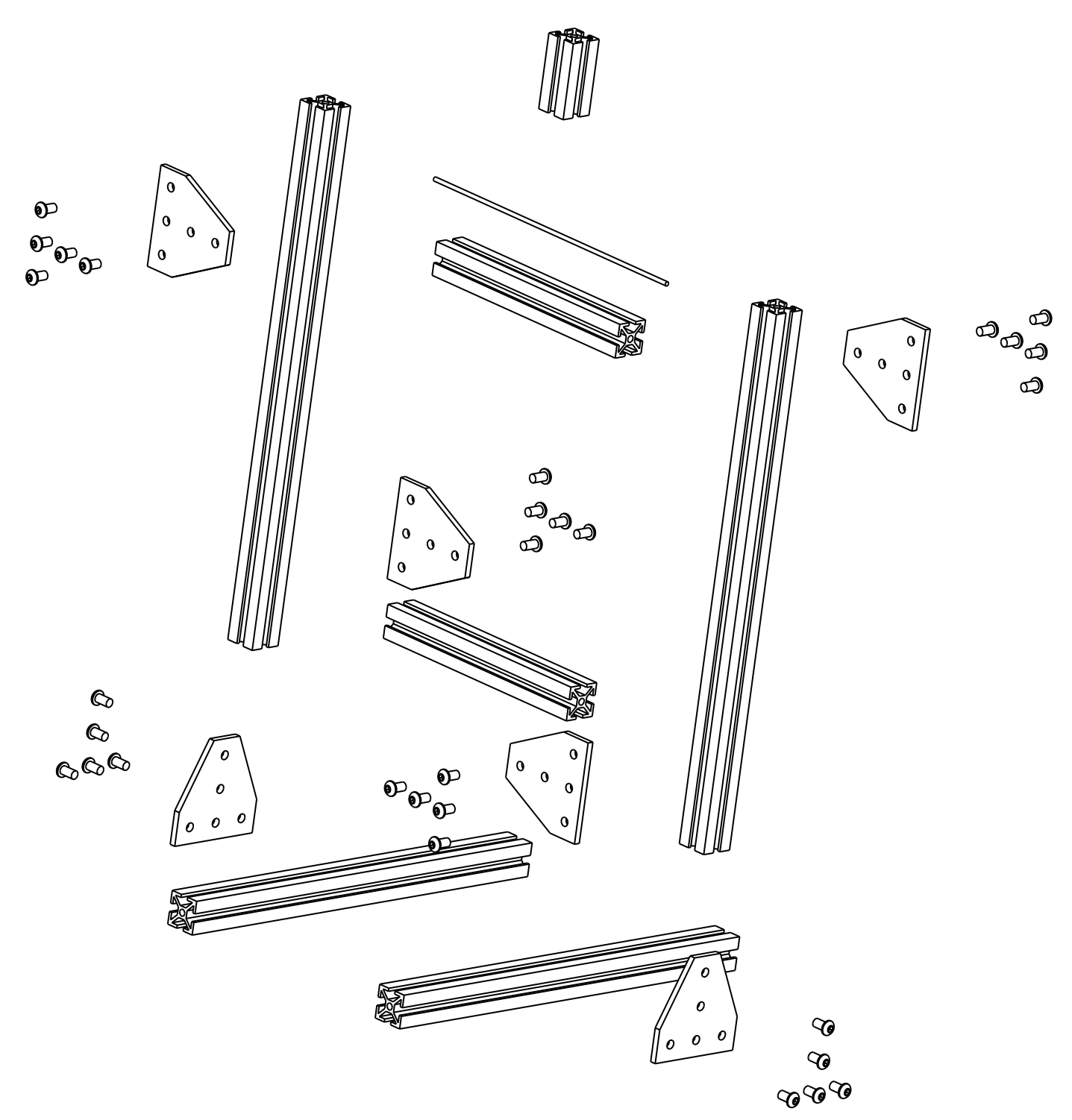
15	ANGLE INDICATOR	1	MCMASTER NUMBER 21955A68
14	2.25" T-SLOTTED ALUMINUM	1	ALUMINUM
13	4" T-SLOTTED ALUMINUM	2	ALUMINUM
12	7.5" T-SLOTTED ALUMINUM	2	ALUMINUM
11	12" T-SLOTTED ALUMINUM	2	ALUMINUM
10	13" T-SLOTTED ALUMINUM	4	ALUMINUM
9	16" T-SLOTTED ALUMINUM	2	ALUMINUM
8	SCREW	51	POWDER COATED STEEL
7	CORNER CONNECTOR	6	ALUMINUM
6	TEE CONNECTOR	6	ALUMINUM
5	PIVOT ROD	1	TYPE 304 STAINLESS STEEL
4	LONG SCREW	3	ALUMINUM
3	WEIGHT HOLDER	1	POLYPROPYLENE
2	COUNTER WEIGHT	1	STAINLESS STEEL
1	TARGET	1	POLYPROPYLENE
NO.	DESCRIPTION	QTY.	MATERIAL/COLOR

For more information, contact  
 Michael Miller. (517) 439-2145 or  
 mmiller@alsons.com

NOTE:  
 THE SYSTEM MUST BALANCE AT  $45 \pm 1^\circ$

DO NOT SCALE PRINT		TITLE	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ± .1 DECIMAL .XX ± .01 DECIMAL .XXX ± .005 ANGULAR ±30'		FORCE BALANCE	
DRAWN BY	DATE	SIZE	APPROVED BY
	8/17/09	B	
MATERIAL	SCALE	PART NO.	SHEET
SEE TABLE	N/A		1 OF 17

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020



NO.	DESCRIPTION	QTY.	MATERIAL/COLOR
15	ANGLE INDICATOR	0	MCMASTER NUMBER 21955A68
14	2.25" T-SLOTTED ALUMINUM	1	ALUMINUM
13	4" T-SLOTTED ALUMINUM	0	ALUMINUM
12	7.5" T-SLOTTED ALUMINUM	2	ALUMINUM
11	12" T-SLOTTED ALUMINUM	0	ALUMINUM
10	13" T-SLOTTED ALUMINUM	2	ALUMINUM
9	16" T-SLOTTED ALUMINUM	2	ALUMINUM
8	SCREW	30	POWDER COATED STEEL
7	CORNER CONNECTOR	0	ALUMINUM
6	TEE CONNECTOR	6	ALUMINUM
5	PIVOT ROD	1	TYPE 304 STAINLESS STEEL
4	LONG SCREW	0	ALUMINUM
3	WEIGHT HOLDER	0	POLYPROPYLENE
2	COUNTER WEIGHT	0	STAINLESS STEEL
1	TARGET	0	POLYPROPYLENE
NO.	DESCRIPTION	QTY.	MATERIAL/COLOR

**DO NOT SCALE PRINT**  
 UNLESS OTHERWISE SPECIFIED  
 ALL DIMENSIONS ARE IN INCHES  
 TOLERANCES  
 DECIMAL .X ± .1  
 DECIMAL .XX ± .01  
 DECIMAL .XXX ± .005  
 ANGULAR ±30°

TITLE: **STAND**

DRAWN BY	DATE	SIZE	APPROVED BY	DWG. NO.	REV.
	8/17/09	C			REL
MATERIAL	SCALE		PART NO.	SHEET	
SEE TABLE		N/A		2 OF 17	

For more information, contact  
 Michael Miller. (517) 439-2145 or  
 mmiller@alsons.com

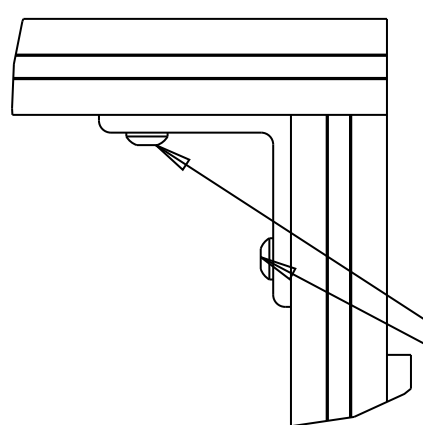
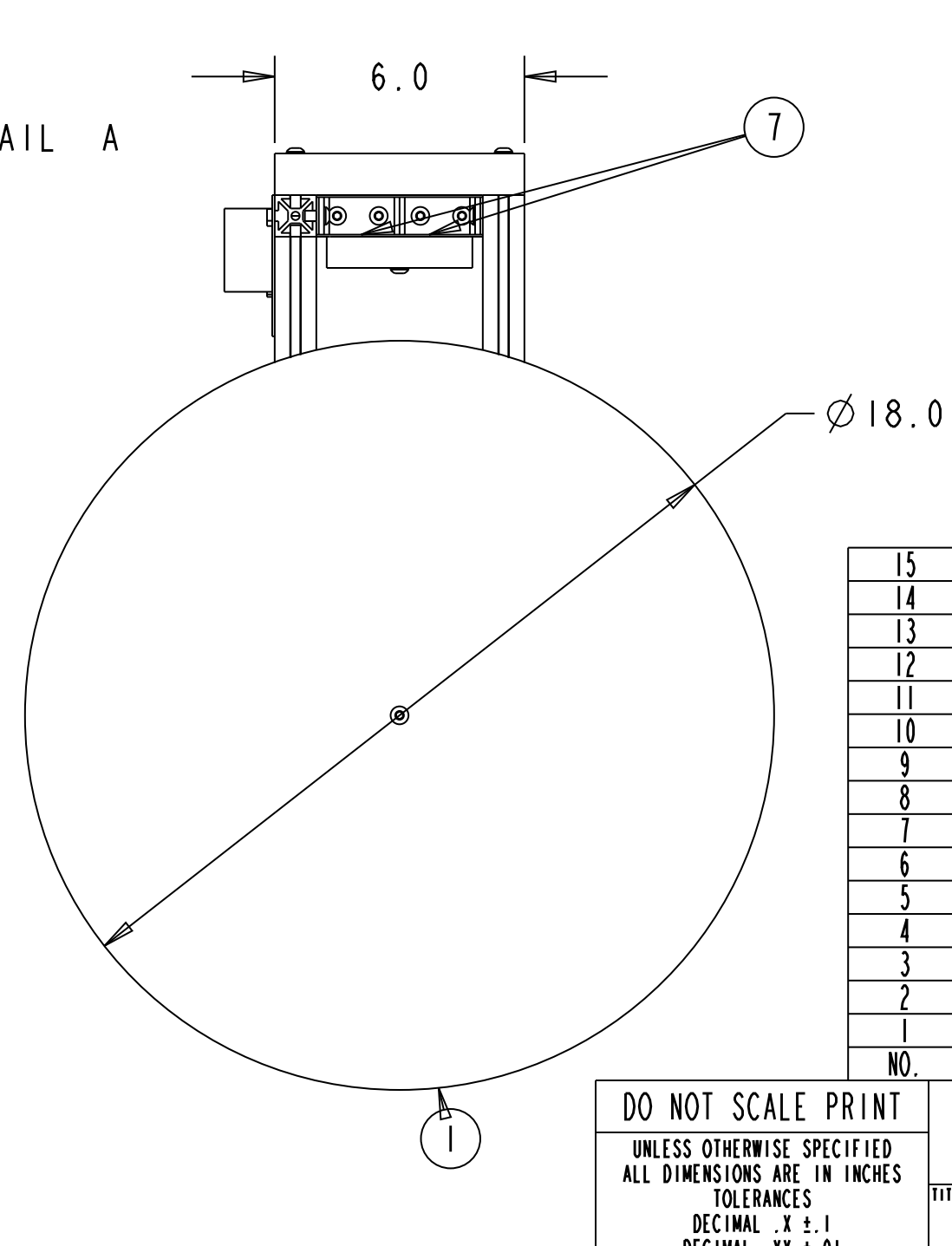
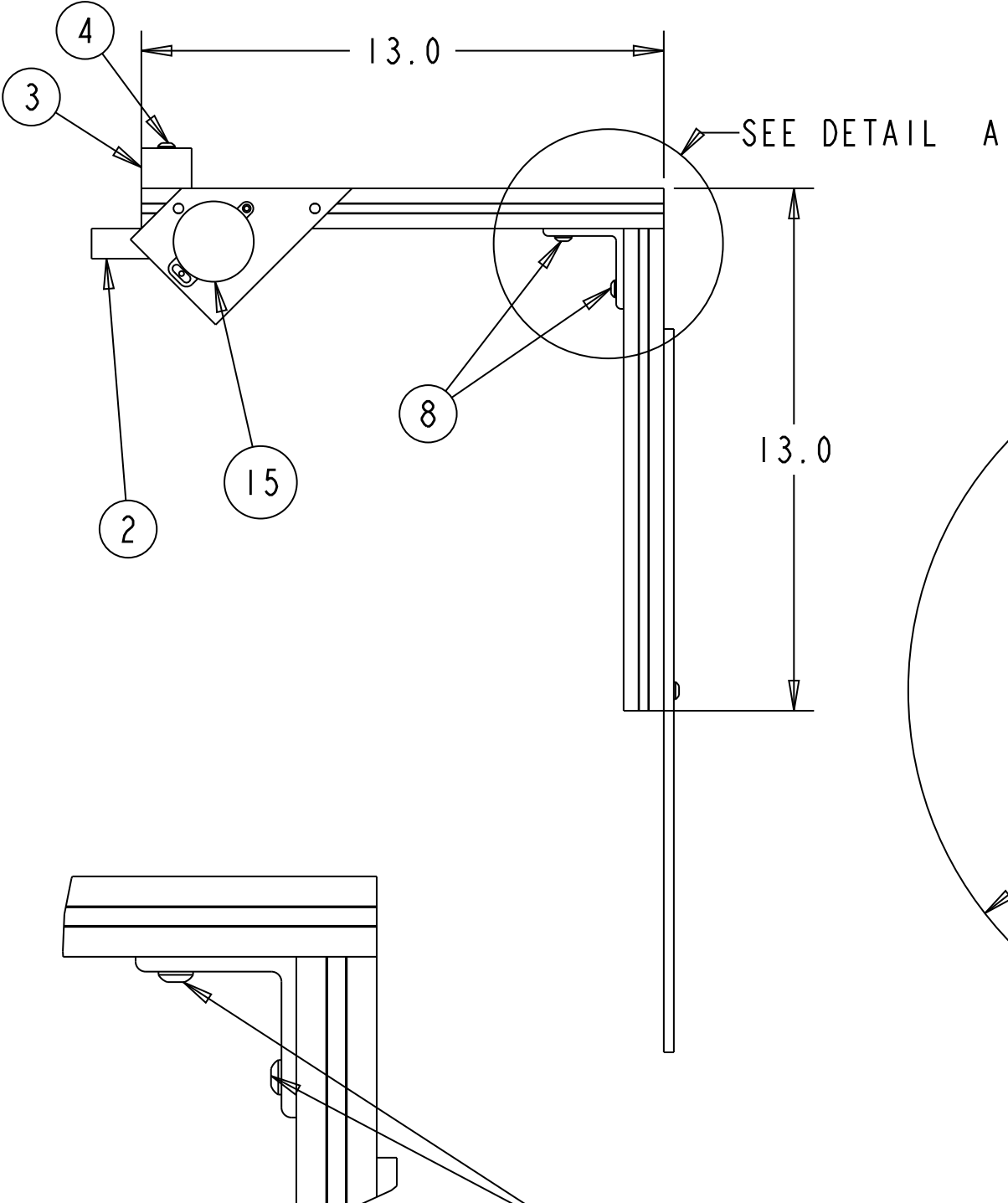
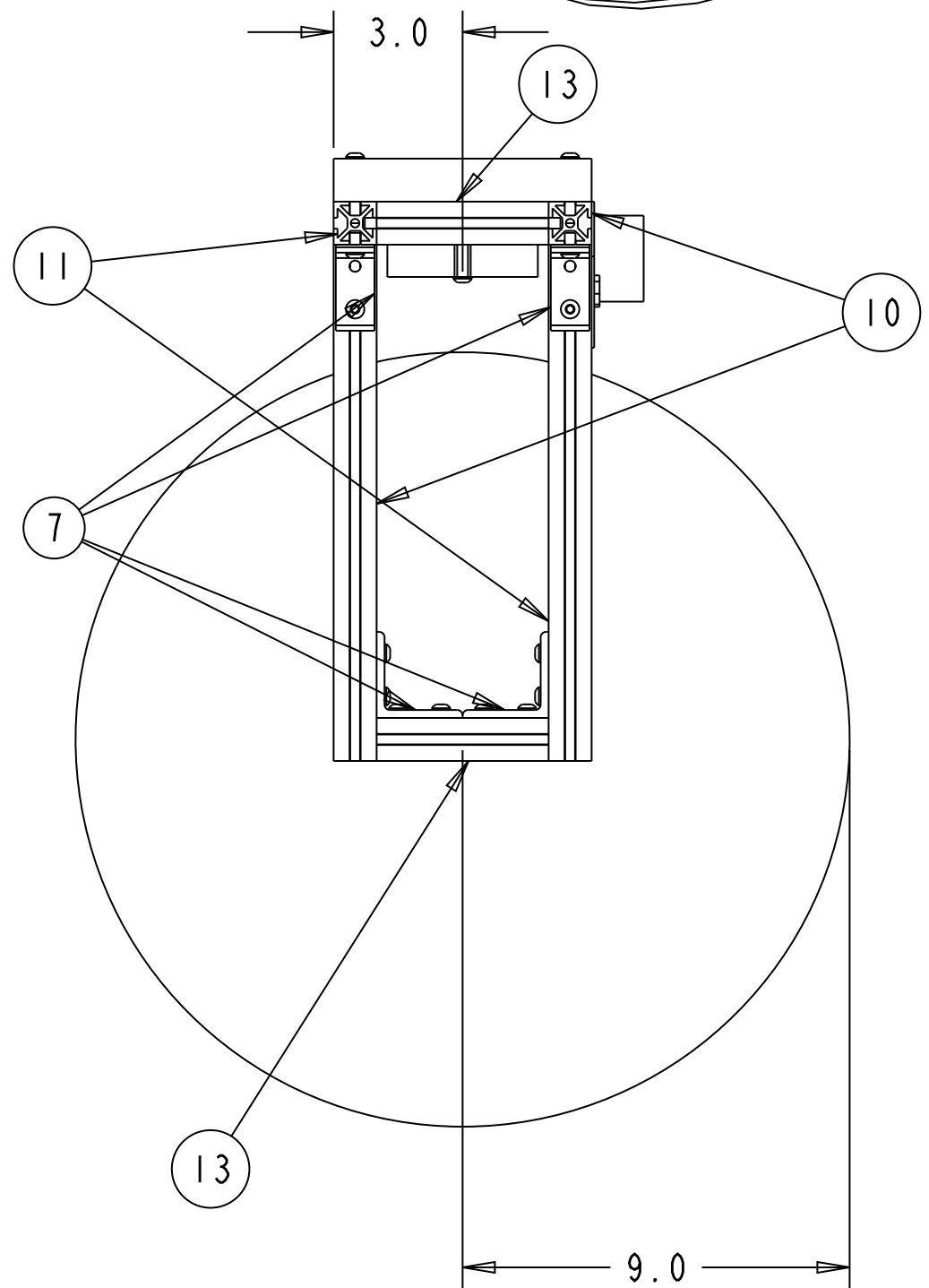
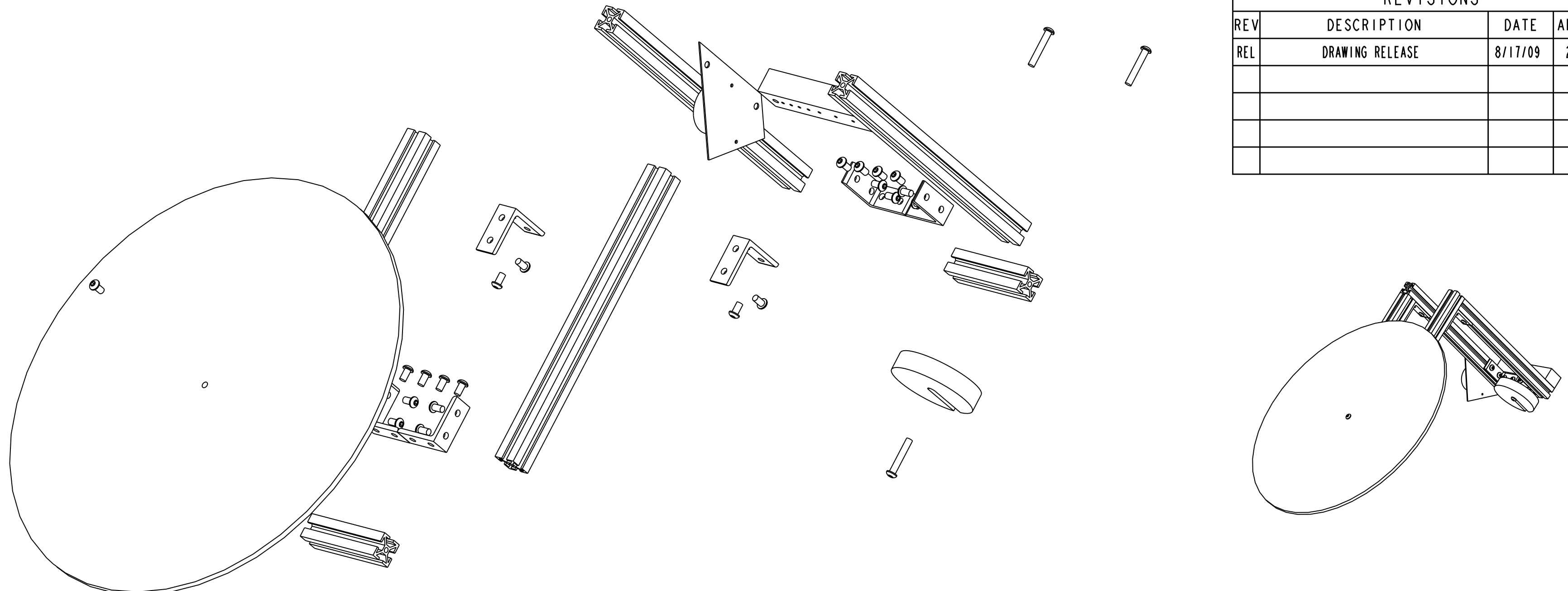
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REVISIONS			
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DETAIL A

ONLY TWO SCREWS USED TO SECURE BRACKET MUST BE THE TWO OUTSIDE SCREWS

NO.	DESCRIPTION	QTY.	MATERIAL/COLOR
15	ANGLE INDICATOR	1	MCMASTER NUMBER 21955A68
14	2.25" T-SLOTTED ALUMINUM	0	ALUMINUM
13	4" T-SLOTTED ALUMINUM	2	ALUMINUM
12	7.5" T-SLOTTED ALUMINUM	0	ALUMINUM
11	12" T-SLOTTED ALUMINUM	2	ALUMINUM
10	13" T-SLOTTED ALUMINUM	2	ALUMINUM
9	16" T-SLOTTED ALUMINUM	0	ALUMINUM
8	SCREW	21	POWDER COATED STEEL
7	CORNER CONNECTOR	6	ALUMINUM
6	TEE CONNECTOR	0	ALUMINUM
5	PIVOT ROD	0	TYPE 304 STAINLESS STEEL
4	LONG SCREW	3	ALUMINUM
3	WEIGHT HOLDER	1	POLYPROPYLENE
2	COUNTER WEIGHT	1	STAINLESS STEEL
1	TARGET	1	POLYPROPYLENE

DO NOT SCALE PRINT  
 UNLESS OTHERWISE SPECIFIED  
 ALL DIMENSIONS ARE IN INCHES  
 TOLERANCES  
 DECIMAL .X ± .1  
 DECIMAL .XX ± .01  
 DECIMAL .XXX ± .005  
 ANGULAR ±30°

TITLE		BALANCE	
DRAWN BY	DATE	APPROVED BY	DWG. NO.
MATERIAL	SCALE	PART NO.	SHEET
	SEE TABLE	N/A	3 OF 17

For more information, contact  
 Michael Miller. (517) 439-2145 or  
 mmiller@alsons.com

4

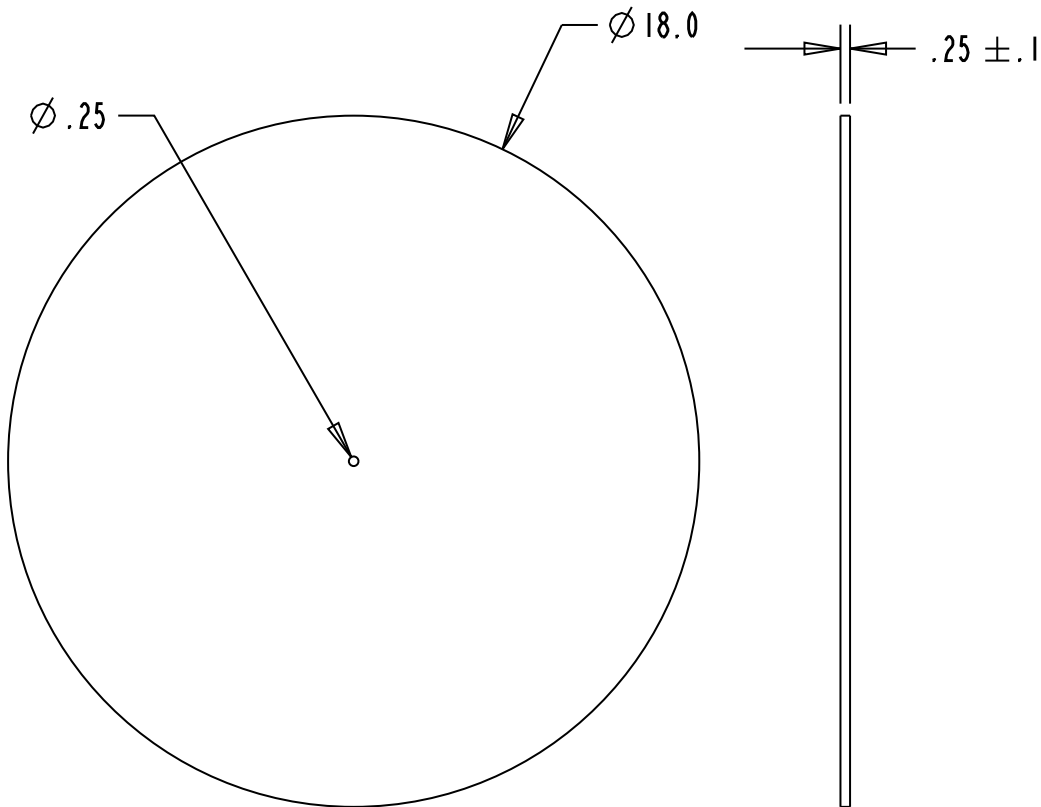
3

2

1

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**NOTES:**

1. CUT FROM MCMASTER-CARR PART NUMBER 8742K435 POLYPROPYLENE SHEET 1/4" THICK, 24" X 24", TRANSLUCENT WHITE
2. DISK MUST BE FLAT AND LEVEL WITHIN 0.25"
3. SURFACE MUST BE FREE OF CUTS AND GROOVES THAT MAY COLLECT WATER

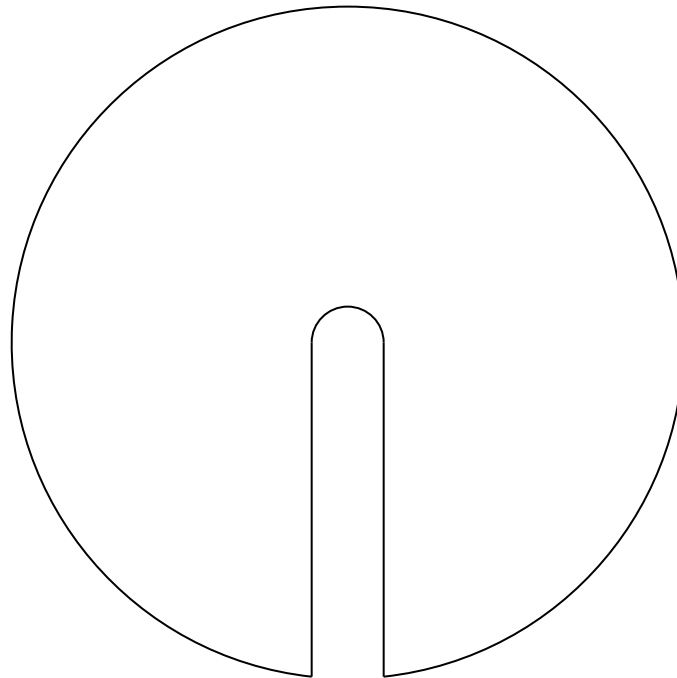
UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN INCHES  
TOLERANCES  
DECIMAL .X  $\pm .1$   
DECIMAL .XX  $\pm .01$   
DECIMAL .XXX  $\pm .005$   
ANGULAR  $\pm 30'$

TITLE

TARGET

For more information, contact  
Michael Miller. (517) 439-2145 or  
mmiller@alsons.com

DRAWN BY	DATE	SIZE	APPROVED BY	DWG NO.	REV
	8/17/09	A			REL
MATERIAL	SCALE		PART NO.	SHEET	
POLYPROPYLENE	1:5			4 OF 17	

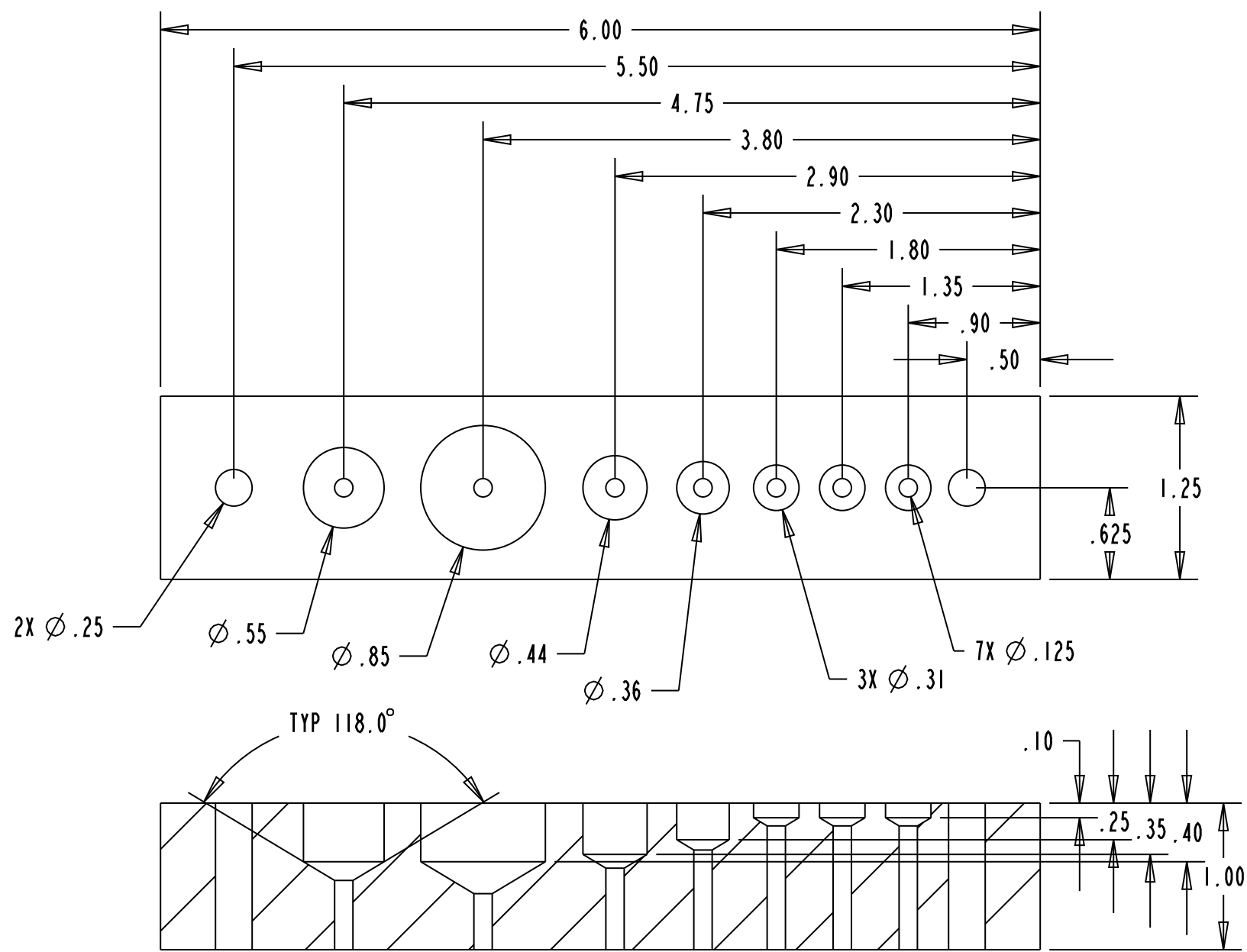


REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
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- NOTES:
1. SIZE AND WEIGHT WILL VARY
  2. MUST COUNTER BALANCE POLYPROPYLENE DISK SO THAT THE SYSTEM BALANCES AT  $45 \pm 1^\circ$

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X $\pm$ .1 DECIMAL .XX $\pm$ .01 DECIMAL .XXX $\pm$ .005 ANGULAR $\pm$ 30'		TITLE  COUNTER WEIGHT			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL		SCALE	PART NO.	SHEET	5 OF 17

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Michael Miller. (517) 439-2145 or  
mmiller@alsons.com



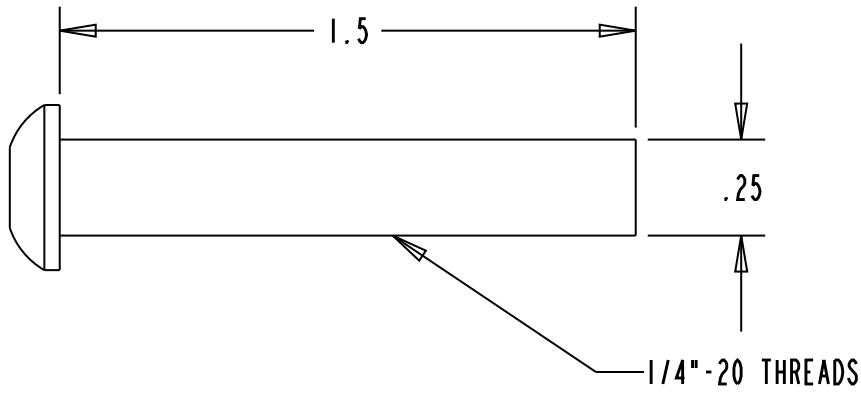
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE		

NOTES:  
 $\phi .31$  FOR 2 g WEIGHT MCMASTER PART NUMBER 1777T44  
 $\phi .36$  FOR 5 g WEIGHT MCMASTE PART NUMBER 1777T45  
 $\phi .44$  FOR 10 g WEIGHT MCASTER PART NUMBER 1777T46  
 $\phi .55$  FOR 1/2 oz WEIGHT MCMASTER PART NUMBER 1908T23  
 $\phi .85$  FOR 2 oz WEIGHT MCMASTER PART NUMBER 1908T21

For more information, contact  
 Michael Miller. (517) 439-2145 or  
 mmiller@alsons.com

DO NOT SCALE PRINT					
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .XX $\pm .01$ DECIMAL .XXX $\pm .005$ ANGULAR $\pm 30'$		TITLE  WEIGHT HOLDER			
DRAWN BY	DATE 9/3/09	SIZE B	APPROVED BY	DWG NO.	REV REL
MATERIAL POLYPROPYLENE	SCALE 1:1	PART NO.	SHEET 6 OF 17		

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020



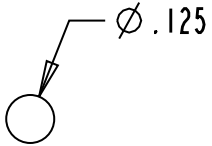
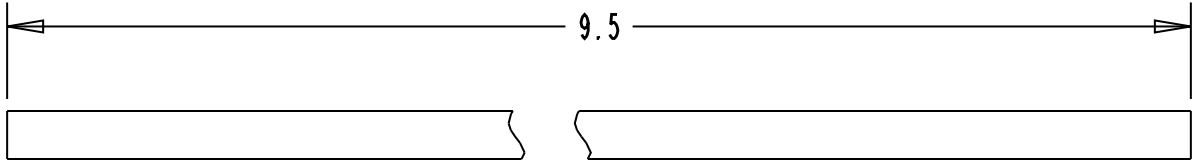
NOTE: MCMaster-CARR PART NUMBER 98164A222  
SOCKET CAP SCREW

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  LONG SCREW			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL STAINLESS STEEL		SCALE 2:1	PART NO.		SHEET 7 OF 17

For more information, contact  
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mmiller@alsons.com



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020



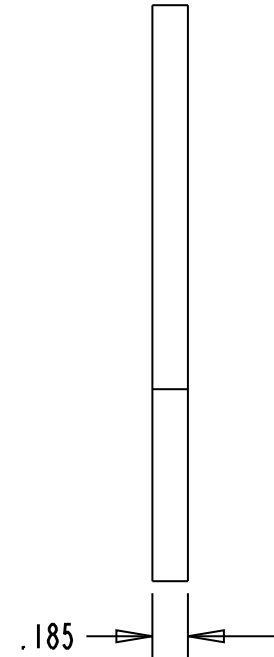
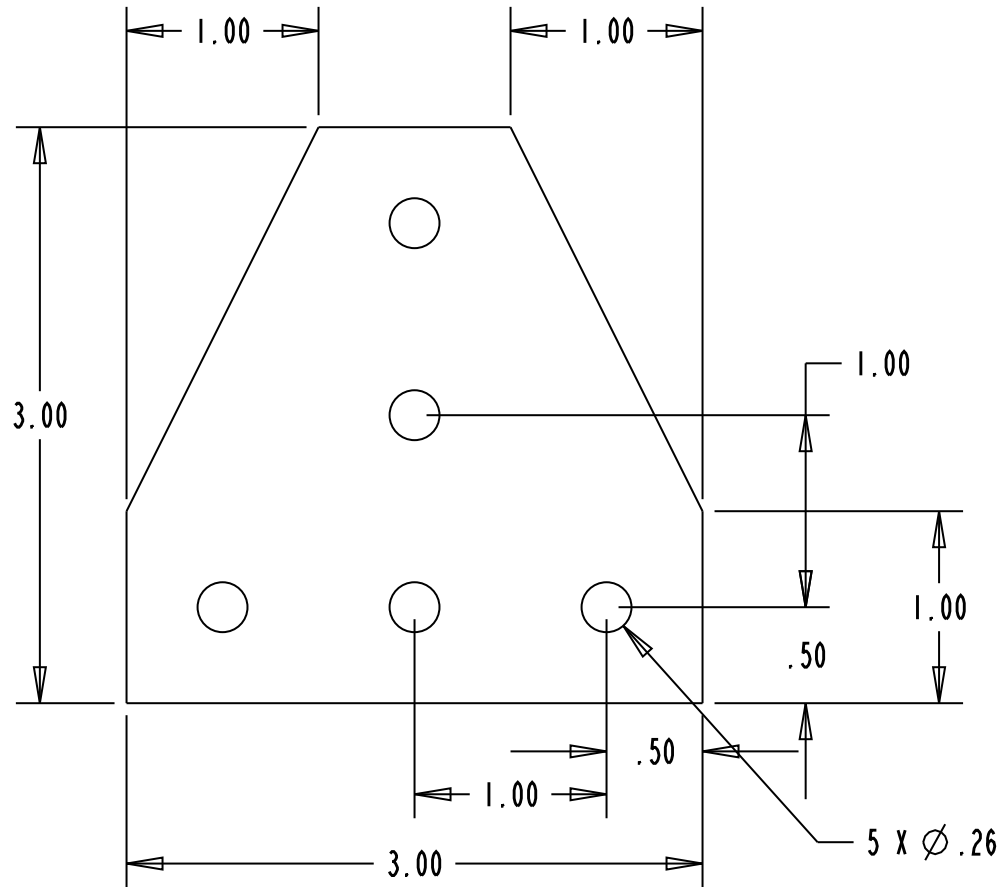
NOTE:  
PRECISION GROUND FINISH, FREE FROM BURRS

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  PIVOT ROD			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL TYPE 304 STAINLESS STEEL	SCALE 2:1	PART NO.		SHEET 8 OF 17	

For more information, contact  
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NOTE: MCMaster-CARR PART NUMBER 47065T182  
TEE CONNECTOR

UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN INCHES  
TOLERANCES  
DECIMAL .X ±.1  
DECIMAL .XX ±.01  
DECIMAL .XXX ±.005  
ANGULAR ±30°

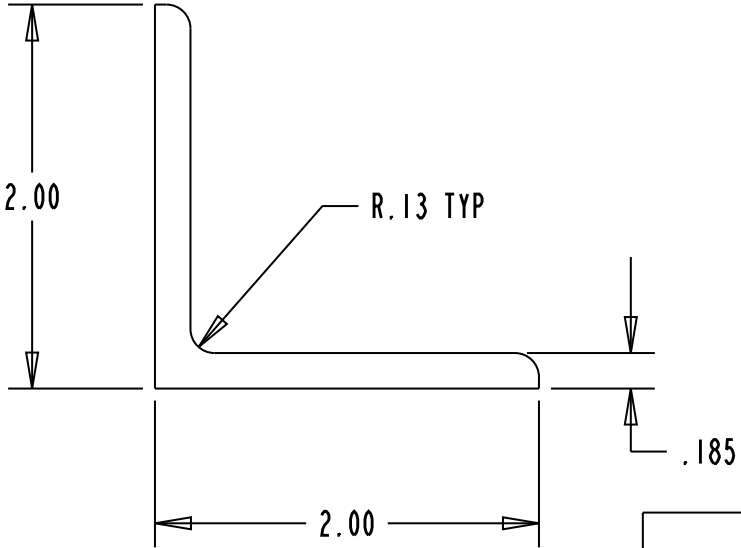
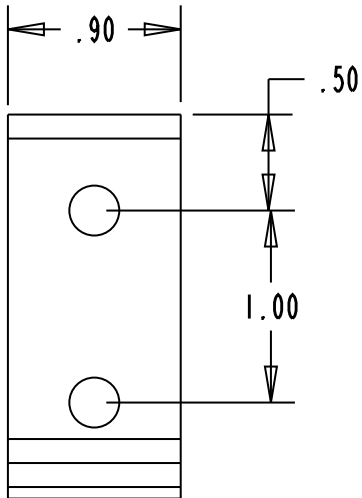
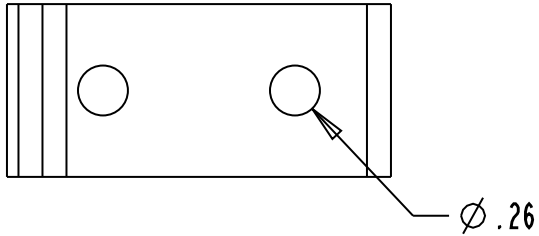
TITLE

TEE CONNECTOR

For more information, contact  
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mmiller@alsons.com

DRAWN BY	DATE	SIZE	APPROVED BY	DWG NO.	REV
	8/17/09	A			REL
MATERIAL	SCALE		PART NO.	SHEET	
ALUMINUM	1:1			9 OF 17	

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020

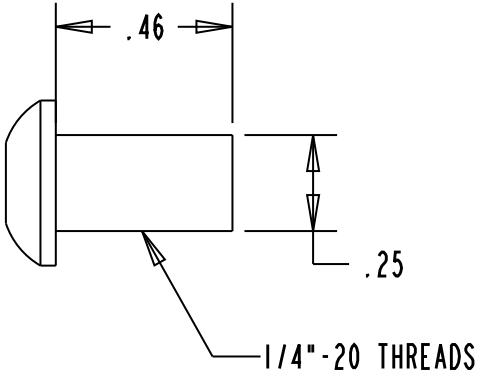


NOTE: MCMaster-CARR PART NUMBER 47065T175  
CORNER CONNECTOR

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X $\pm .1$ DECIMAL .XX $\pm .01$ DECIMAL .XXX $\pm .005$ ANGULAR $\pm 30'$		TITLE <b>CORNER CONNECTOR</b>			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL ALUMINUM	SCALE 1:1	PART NO.	SHEET 10 OF 17		

For more information, contact  
Michael Miller. (517) 439-2145 or  
mmiller@alsons.com

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020

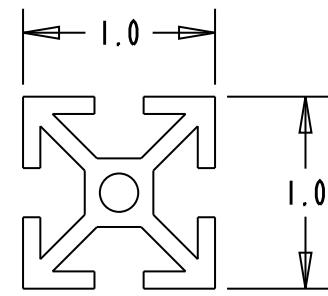
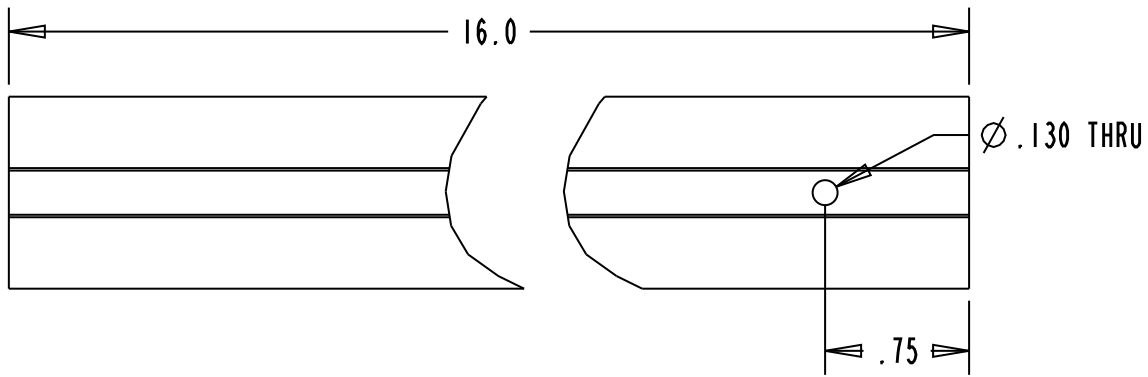


NOTE: MCMaster-CARR PART NUMBER 47065T139  
T-NUT WITH BUTTON-HEAD CAP SCREW

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  SCREW			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL POWDER COATED STEEL	SCALE 2:1	PART NO.		SHEET 11 OF 17	

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REL	DRAWING RELEASE	8/17/09	2008020

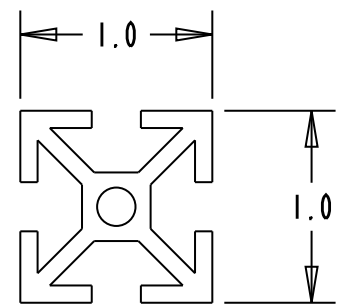
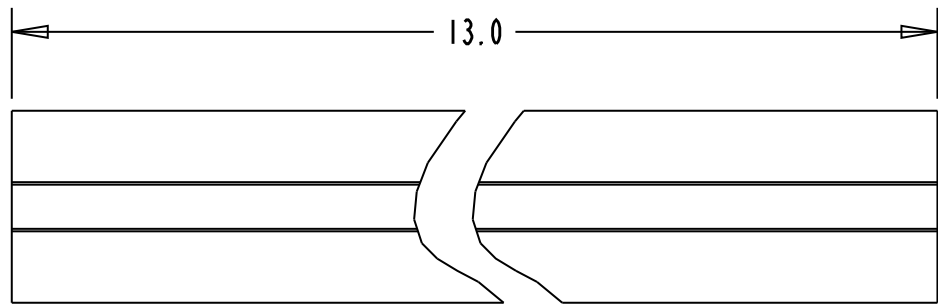


NOTE: CUT FROM MCMASTER-CARR PART NUMBER 47065T123  
 FRACTIONAL T-SLOTTED FRAMING SYSTEM 1" X 1" SQUARE  
 EXTRUSION, 8' LENGTH

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  16 INCH BAR			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL ALUMINUM	SCALE 1:1	PART NO.	SHEET 12 OF 17		

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 Michael Miller. (517) 439-2145 or  
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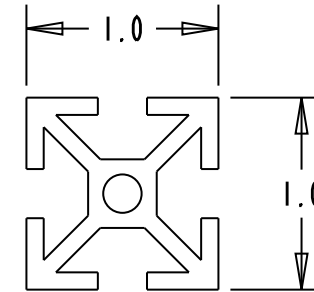
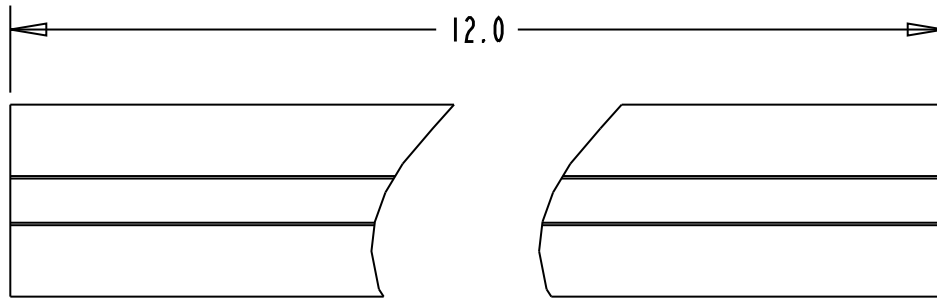


NOTE: CUT FROM MCMASTER-CARR PART NUMBER 47065T123  
 FRACTIONAL T-SLOTTED FRAMING SYSTEM 1" X 1" SQUARE  
 EXTRUSION, 8' LENGTH

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  13 INCH BAR			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL ALUMINUM	SCALE 1:1	PART NO.		SHEET 13 OF 17	

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REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
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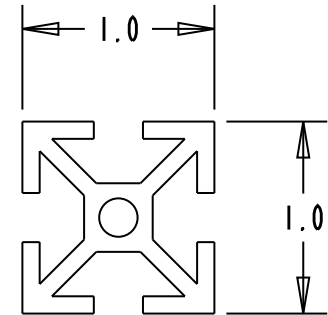
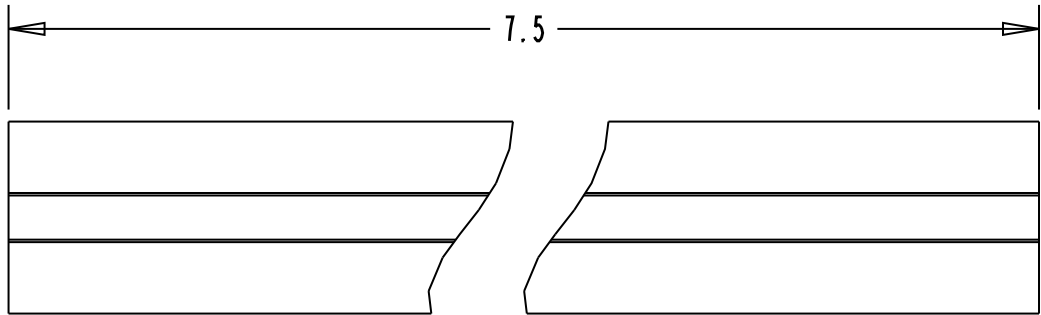


NOTE: CUT FROM MCMASTER-CARR PART NUMBER 47065T123  
 FRACTIONAL T-SLOTTED FRAMING SYSTEM 1" X 1" SQUARE  
 EXTRUSION, 8' LENGTH

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  12 INCH BAR			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL ALUMINUM	SCALE 1:1	PART NO.	SHEET 14 OF 17		

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REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020



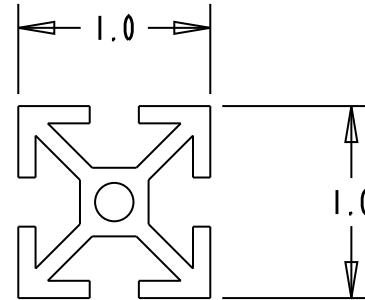
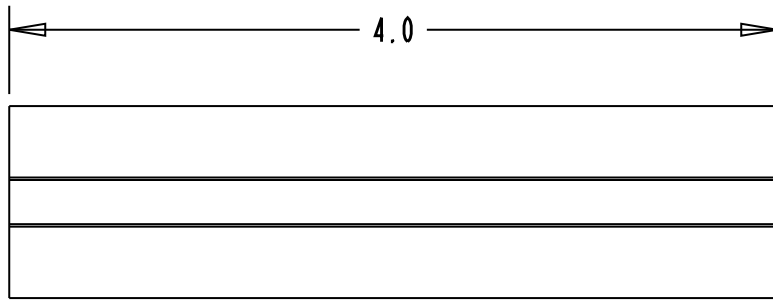
NOTE: CUT FROM MCMASTER-CARR PART NUMBER 47065T123  
 FRACTIONAL T-SLOTTED FRAMING SYSTEM 1" X 1" SQUARE  
 EXTRUSION, 8' LENGTH

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  7.5 INCH BAR		
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.
MATERIAL ALUMINUM	SCALE 1:1	PART NO.	SHEET 15 OF 17	REV REL

For more information, contact  
 Michael Miller. (517) 439-2145 or  
 mmiller@alsons.com



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020

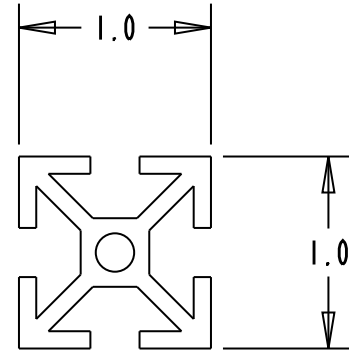
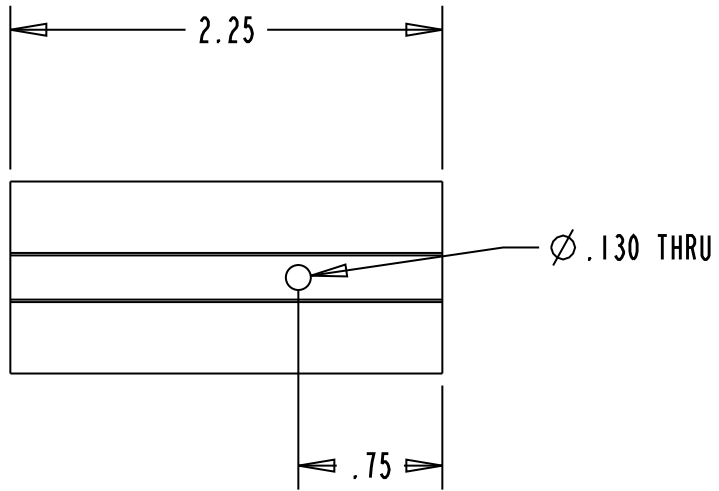


NOTE: CUT FROM MCMASTER-CARR PART NUMBER 47065T123  
 FRACTIONAL T-SLOTTED FRAMING SYSTEM 1" X 1" SQUARE  
 EXTRUSION, 8' LENGTH

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X ±.1 DECIMAL .XX ±.01 DECIMAL .XXX ±.005 ANGULAR ±30'		TITLE  4 INCH BAR			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL ALUMINUM	SCALE 1:1	PART NO.		SHEET 16 OF 17	

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 mmiller@alsons.com

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REV	DESCRIPTION	DATE	APPROVED
REL	DRAWING RELEASE	8/17/09	2008020



NOTE: CUT FROM MCMASTER-CARR PART NUMBER 47065T123  
 FRACTIONAL T-SLOTTED FRAMING SYSTEM 1" X 1" SQUARE  
 EXTRUSION, 8' LENGTH

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL .X $\pm$ .1 DECIMAL .XX $\pm$ .01 DECIMAL .XXX $\pm$ .005 ANGULAR $\pm$ 30'		TITLE  2.25 INCH BAR			
DRAWN BY	DATE 8/17/09	SIZE A	APPROVED BY	DWG NO.	REV REL
MATERIAL ALUMINUM	SCALE 1:1	PART NO.		SHEET 17 OF 17	

For more information, contact  
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