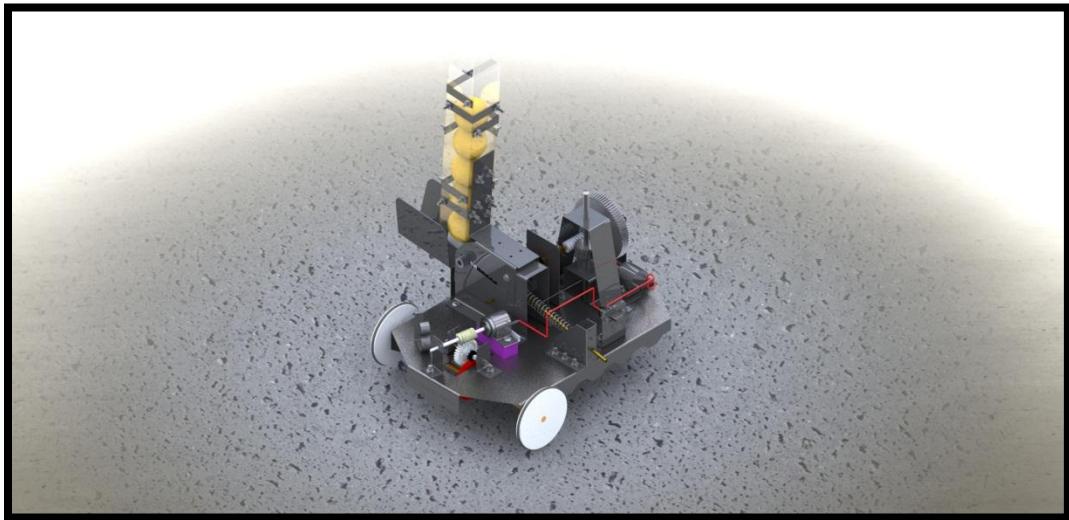


BIATHLON OF THE MACHINES

DRAWING PACKAGE



**Mec E 265 ENGINEERING GRAPHICS and CAD &
Mec E 260 – MECHANICAL DESIGN I**

Prepared For

Dr. K. Duke & Dr. P. Mertiny

April 5th, 2014

GROUP 13
TEAM OLE EINAR BJØRNDALEN

Drew Gingras 1354827

Boston Maris 1269706

Ruby Nicholls 1351597

Kevin O'Rourke 1364052

Alexandre Sauve 1371644

Winter 2014

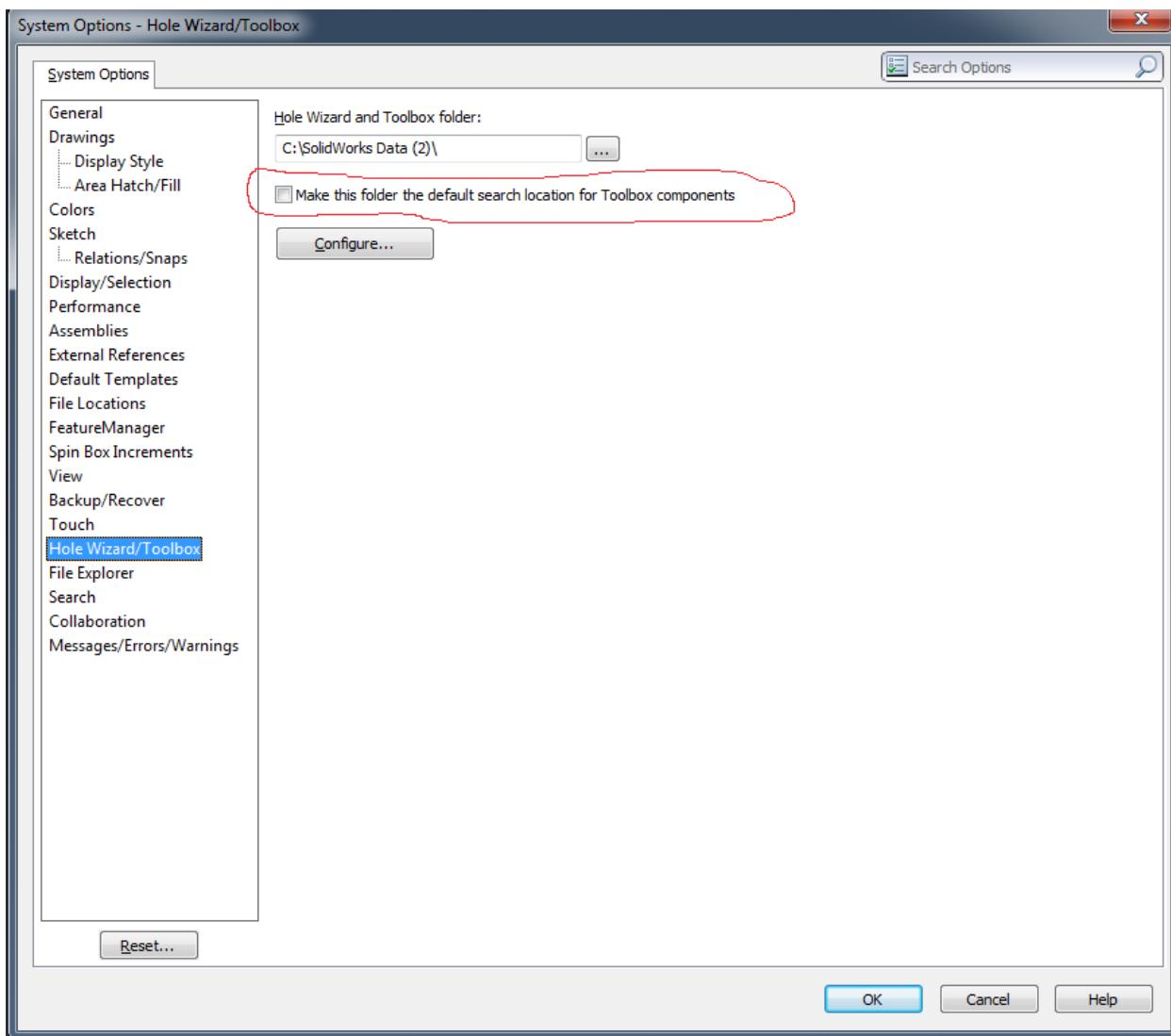
**DEPARTMENT OF MECHANICAL ENGINEERING
UNIVERSITY OF ALBERTA**

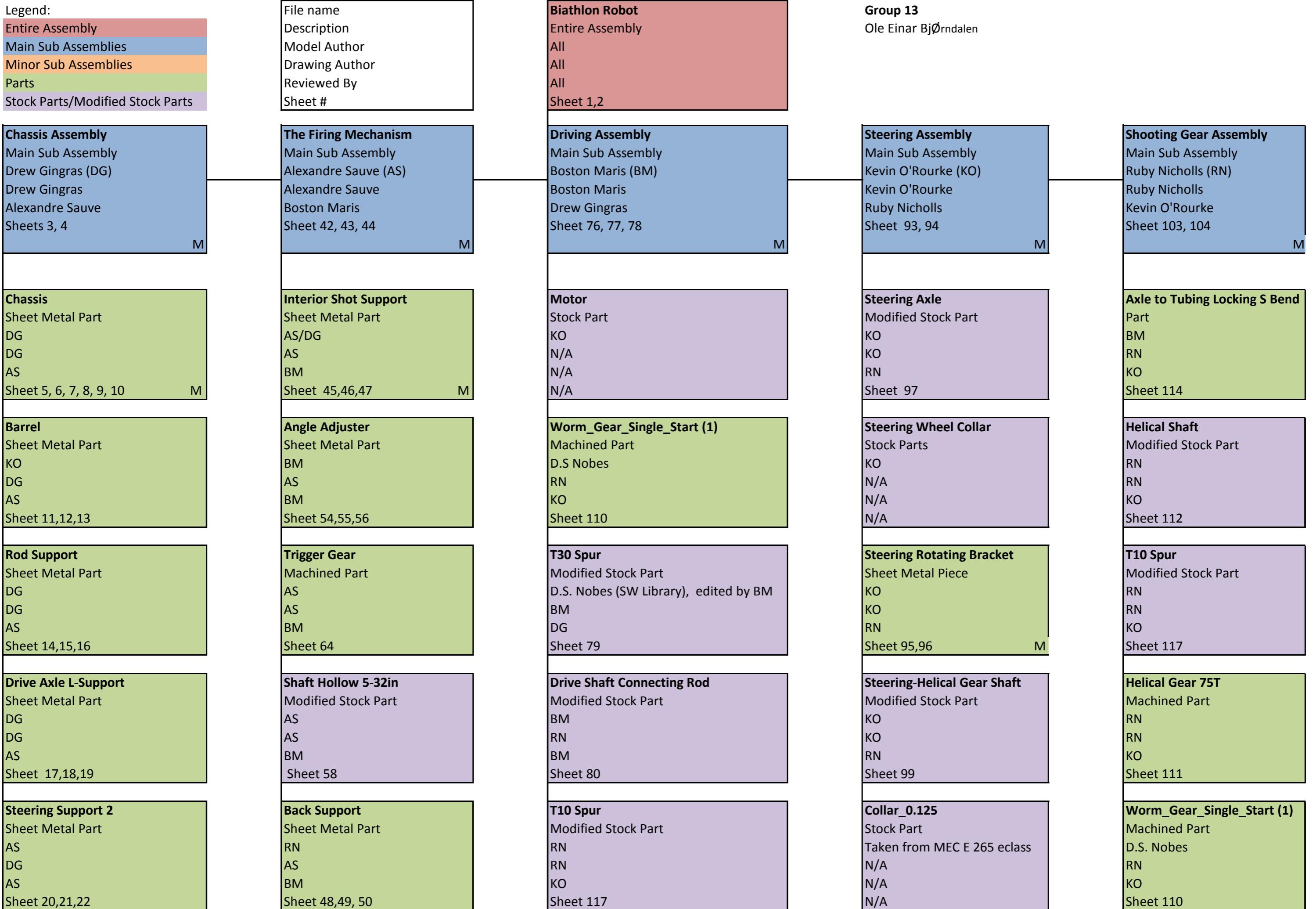
Important!!!

Due to the fact that we used modified Solidworks toolbox components (various gears) in our model there will be rebuild errors when it is first opened. To fix these errors simply follow the following directions:

1. Open up the options menu in solidworks
2. Select the section titled: "Hole Wizard/Toolbox"
3. Uncheck the box that reads: "Make this folder the default search location for Toolbox Components"
4. Close any opened parts and make sure not to save them! When you re-open them they should be error free.

The unchecked box will look like this:





motor 1 spacer Modified Stock Part DG DG AS Sheet 23	Tube segment 5-32 square Modified Stock Part AS AS BM Sheet 60	T50 Spur_ver3 Modified Stock Part G. Gearloose (Edited by BM) BM DG Sheet 81	Nylon Spacer_0.125 Stock Part KO N/A N/A N/A	Motor Stock Part KO N/A N/A N/A
Gear System Support Sheet Metal Part DG DG AS Sheet 24,25,26	Spring Stock Part Taken from MEC E 265 eclass N/A N/A N/A	Drive Shaft Modified Stock Part BM BM DG Sheet 82	Nylon Spacer_0.250 Stock Part KO N/A N/A N/A	Motor 2 Bracket Sheet Metal Part RN RN KO Sheet 107, 108 M
Motor 1 Worm Support Sheet Metal Part DG DG AS Sheet 27,28,29	Trigger Rack Pin 5_32in hollow Modified Stock Part AS AS BM Sheet 57	Axle to Tubing Locking S Bend Part BM RN KO Sheet 114	Nylon Spacer_0.5_0.250 Modified Stock Part KO KO RN Sheet 102	Motor 2 Backing Sheet Metal Part RN RN KO Sheet 105, 106
Gear System Support 2 Sheet Metal Part DG DG AS Sheet 30,31,32	Collar 1-4in Stock Part AS N/A N/A N/A	Motor 1 Bracket Sheet Metal Part BM BM DG Sheet 83, 84, 85 M	Helical Gear 20T - Metric Machined Part RN RN KO Sheet 98	Motor 2 step shaft Machined Part BM RN KO Sheet 109
Motor 2 Worm Support Sheet Metal Part DG DG AS Sheet 33, 34 ,35	Shaft Solid 4mm Modified Stock Part AS AS BM Sheet 59	Motor 1 Bracket Bottom Sheet Metal Part BM BM DG Sheet 86, 87, 88	Steering Wheel Sub-Assembly Minor Sub Assembly KO KO RN Sheet 100	Worm Gear_Double_Start Machined Part G. Gearloose/RN RN KO Sheet 115
9-Pin Bracket Support Sheet Metal Part DG DG AS Sheet 36,37,38	Axle to Tubing Locking S Bend Part BM RN KO Sheet 114	Motor 1 Step Shaft Machined Part RN BM DG Sheet 89	Steering Wheels Stock Parts KO N/A N/A N/A	Square tubing-long Modified Stock Part RN RN KO Sheet 113
GROUP 13! - The 13 Sheet Metal Part AS DG AS Sheet 39,40,41	L-bracket Sheet Metal Part AS AS BM Sheet 51,52,53	Collar_0.125 Stock Part Taken from MEC E 265 eclass N/A N/A N/A	Steering Wheel Rubber Ring Stock Parts KO KO RN Sheet 101	Square tubing-short Modified Stock Part RN RN KO Sheet 116

Electrical Hookup Stock Part KO N/A N/A N/A	Square tubing - big Modified Stock Part RN AS BM Sheet 61	Drive Shaft Connecting Square Tubing Modified Stock Part BM BM DG Sheet 90	Heat Shrink Wrap Stock Part BM N/A N/A N/A
Heat Shrink Wrap Stock Part BM N/A N/A N/A	T50 Spur_ver2 Modified Stock Part RN RN BM Sheet 62	Heat Shrink Wrap Stock Part BM N/A N/A N/A	Motor 2 Wire 1 Stock Part BM N/A N/A N/A
Screw Stock Part Solidworks Library N/A N/A N/A	Trigger Rack Machined Part AS AS BM Sheet 63	Black Wire Motor 1 Stock Part BM N/A N/A N/A	Motor 2 Wire 2 Stock Part BM N/A N/A N/A
Nut Stock Part Solidworks Library N/A N/A N/A	Hopper Subassembly Minor Sub Assembly AS AS BM Sheet 65, 66, 67	Red Wire Motor 1 Stock Part BM N/A N/A N/A	
	Hopper U Bracket Sheet Metal Part AS AS BM Sheet 74, 75	Driven Wheel Sub-Assembly Minor Sub Assembly AS DG DG Sheet 91	
	Hopper Corner Bracket Sheet Metal Part AS AS BM Sheet 72, 73	Driven Wheels Stock Part KO N/A N/A N/A	
	Acrylic Panel 1 Part AS AS BM Sheet 68	Driven Wheel Rubber Ring Modified Stock Part KO KO DG Sheet 92	

Acrylic Panel 2

Part

AS

AS

BM

Sheet 69

Acrylic Panel 3

Part

AS

AS

BM

Sheet 70

Acrylic Panel 4

Part

AS

AS

BM

Sheet 71

Ping Pong Ball

Stock Part

AS

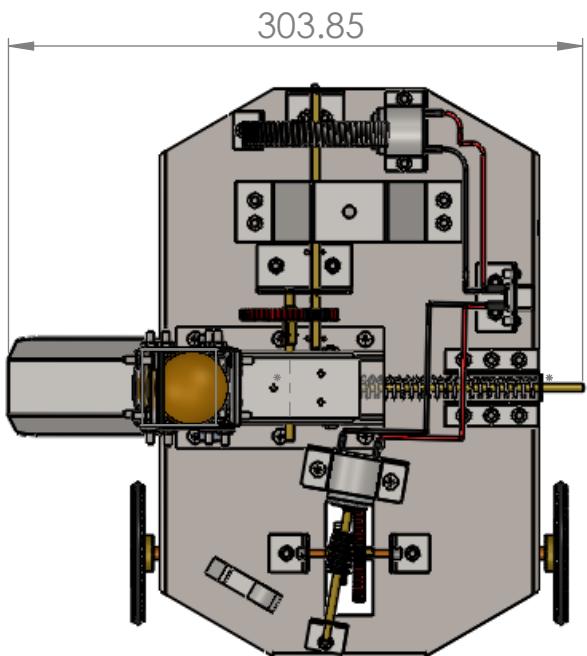
N/A

N/A

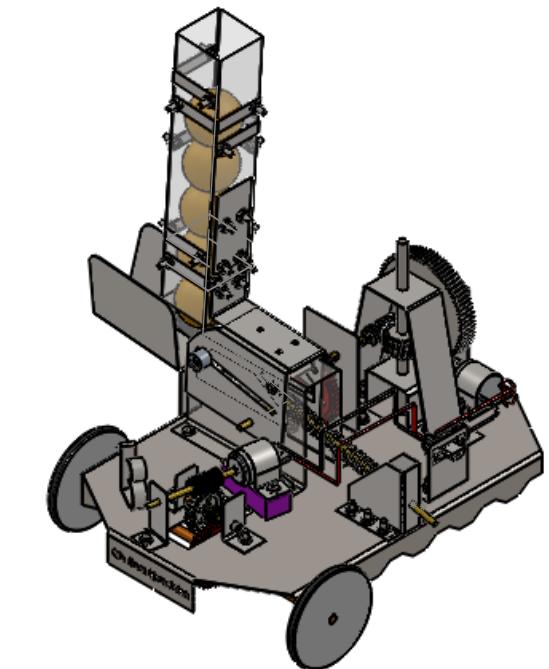
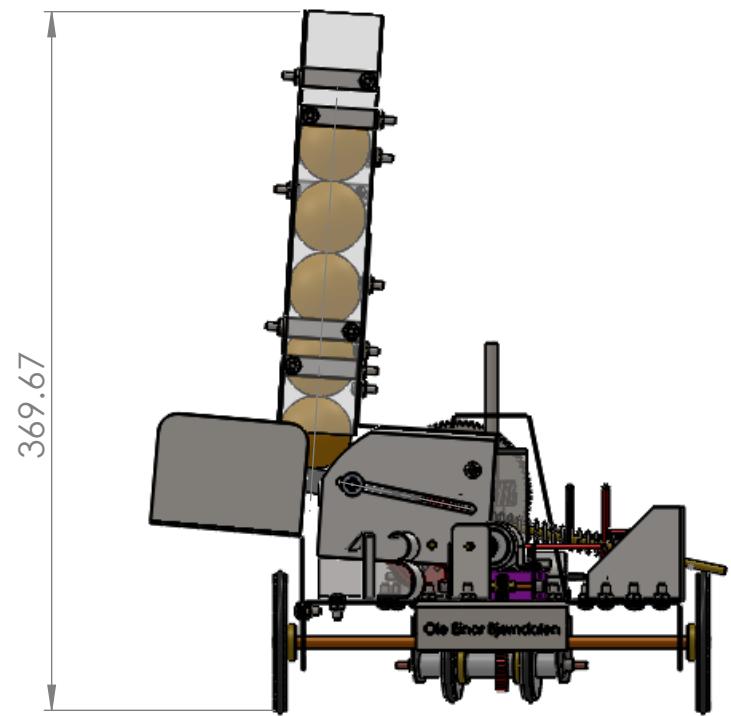
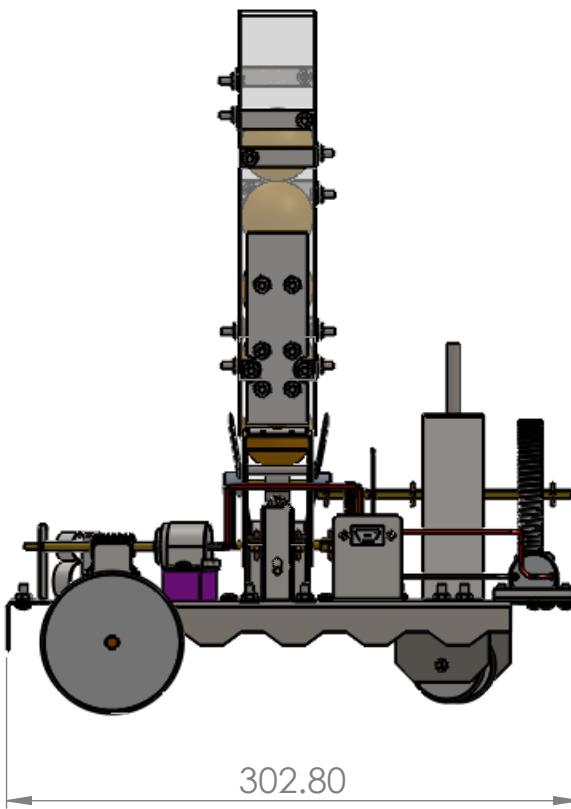
N/A

OOLBOX CREATES REBUILD ERRORS

to fix:
options>Hole Wizard/Toolbox
uncheck "make this folder the default
search location for toolbox components
close drawing, don't save
then re-open drawing pack or assembly

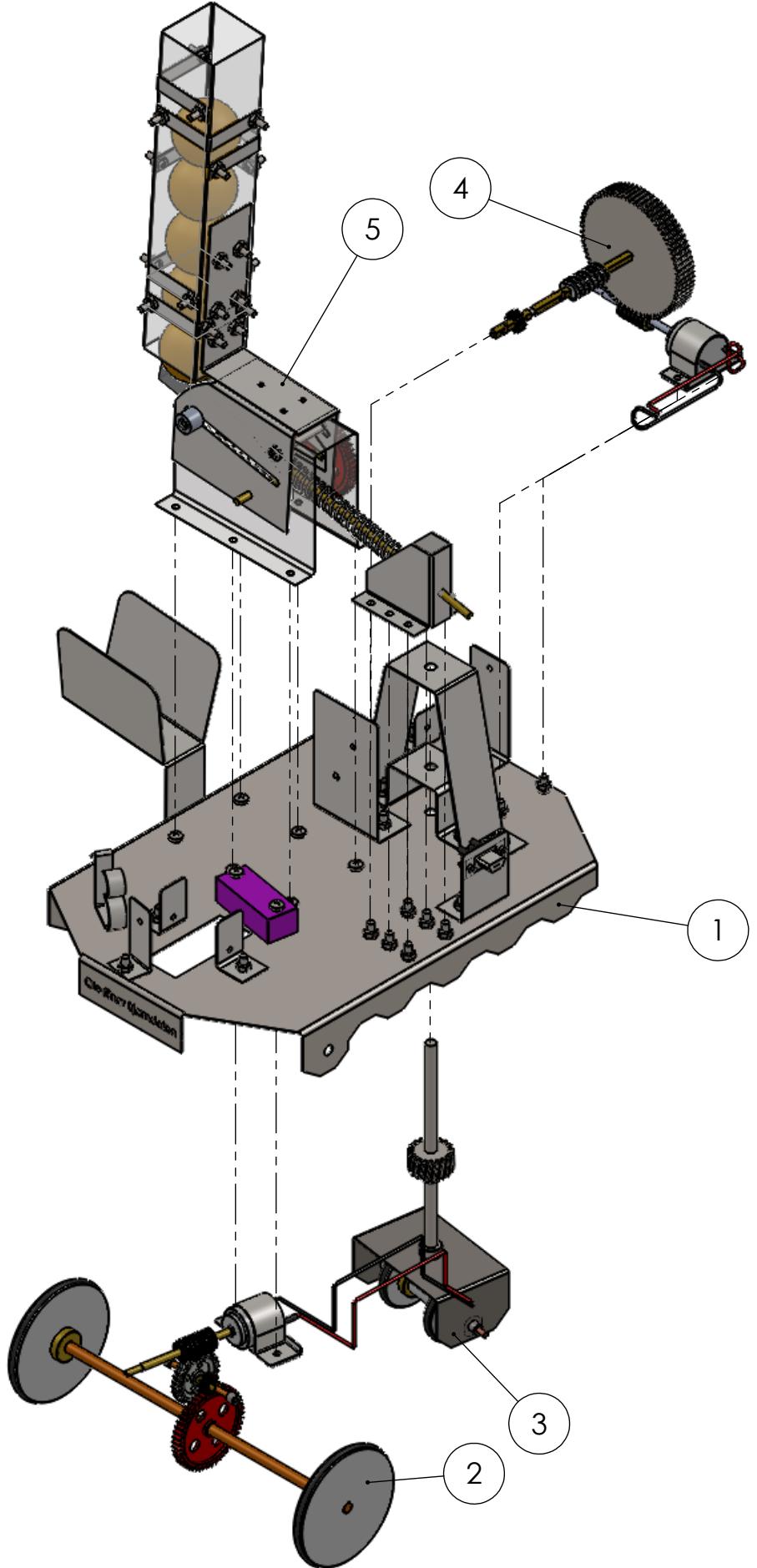


ITEM NO.	PART NUMBER	SW-Author(Author)	Pages	QTY
1	Chassis Assembly	Drew Gingras	3-41	1
2	Driving Assembly	Boston Maris	76-92	1
3	Steering Assembly	Kevin O'Rourke	93-102	1
4	Shooting Gear Assembly	Ruby Nicholls	103-117	1
5	The Firing Mechanism	Alexandre Sauve	42-75	1
6	B18.6.7M - M4 x 0.7 x 10 Type I Cross Recessed PHMS --10N	Solidworks Toolbox	N/A	34
7	B18.6.7M - M4 x 0.7 x 30 Type I Cross Recessed PHMS --30N	Solidworks Toolbox	N/A	2
8	B18.2.4.1M - Hex nut, Style 1, M4 x 0.7 --D-N	Solidworks Toolbox	N/A	36
9	CR-FIMS 0.099-48x0.25x0.25- N	Solidworks Toolbox	N/A	2



Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY: Alexandre Sauve		The Department of Mechanical Engineering UNIVERSITY OF ALBERTA		
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Group name	The Ole Einar Bjørndalen Group	TITLE: Biathlon Machine		
Comments:		SURFACE FINISH μm	Group number	13			
		0.6	SM By	Group 13			
			Reviewed by	Group 13			
 DO NOT SCALE DRAWING		SIZE B		Built By: Group 13		REV A	
MATERIAL: As in B.O.M.		Saturday, April 05, 2014 3:25:36 PM		SCALE: 1:10		Mass: 1638.52	
FILE NAME: Biathlon Machine		Sunday, March 30, 2014 12:32:37 PM		SHEET 1 OF 117			

ITEM NO.	PART NUMBER	SW-Author(Author)	Pages	QTY.
1	Chassis Assembly	Drew Gingras	3-41	1
2	Driving Assembly	Boston Maris	76-92	1
3	Steering Assembly	Kevin O'Rourke	93-102	1
4	Shooting Gear Assembly	Ruby Nicholls	103-117	1
5	The Firing Mechanism	Alexandre Sauve	42-75	1
6	B18.6.7M - M4 x 0.7 x 10 Type I Cross Recessed PHMS --10N	Solidworks Toolbox	N/A	34
7	B18.6.7M - M4 x 0.7 x 30 Type I Cross Recessed PHMS --30N	Solidworks Toolbox	N/A	2
8	B18.2.4.1M - Hex nut, Style 1, M4 x 0.7 --D-N	Solidworks Toolbox	N/A	36
9	CR-FIMS 0.099-48x0.25x0.25- N	Solidworks Toolbox	N/A	2



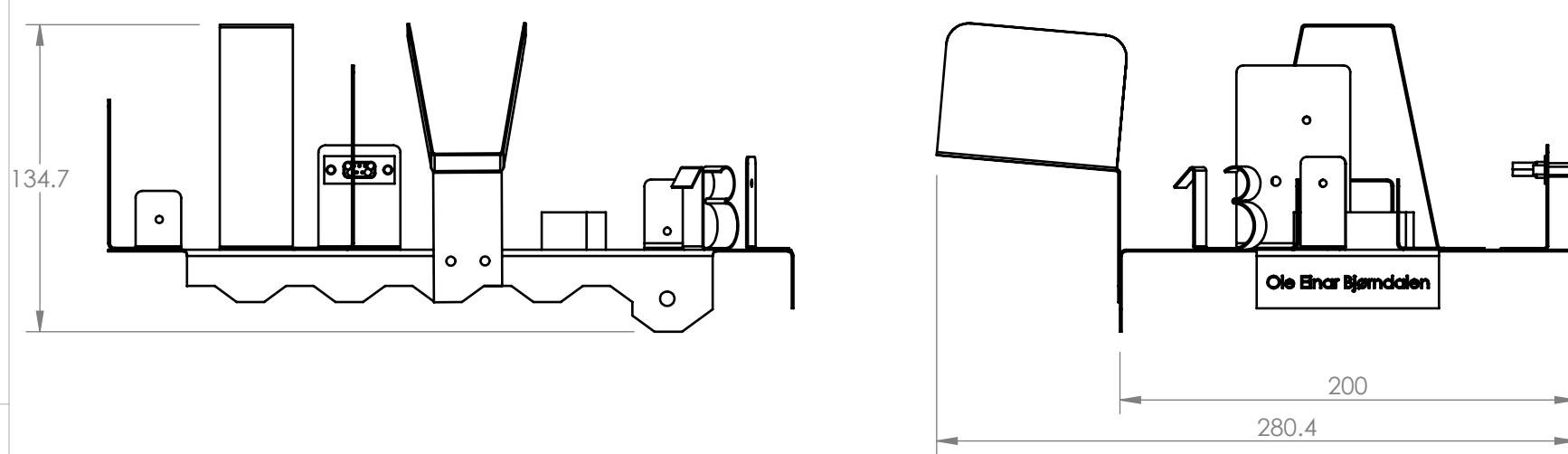
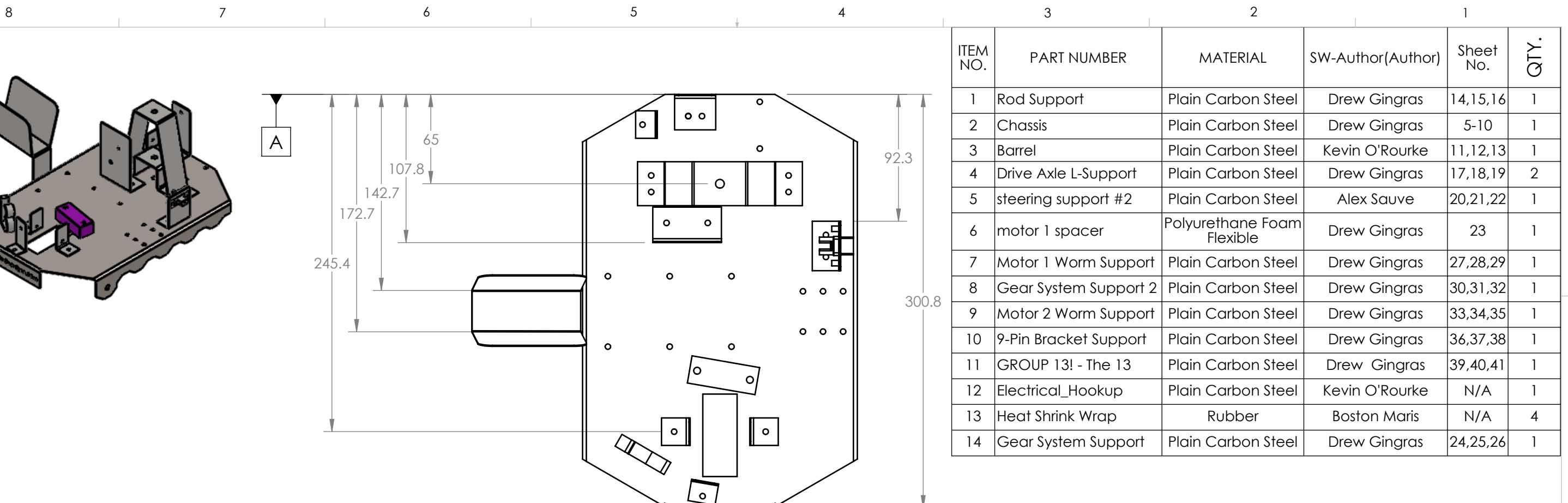
Note: L-bracket and Angle Adjuster
of the Firing Mechanism are attached by 1/8" rivets

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke	Comments: Win. 2014	Group name The Ole Einar Bjørndalen Group	
		Group number 13	
		SM By Group 13	
		Reviewed by Group 13	
FILE NAME: Biathlon Machine		Saturday, April 05, 2014 3:25:36 PM Sunday, March 30, 2014 12:32:37 PM	
SIZE B		Built By: Group 13	
		REV A	
SCALE: 1:1		Mass: 1638.52	
		SHEET 2 OF 117	

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:

Biathlon Machine



Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
Instructors: Dr. Mertiny Dr. Duke	Comments: Win. 2014	Group name Ole Einar Bjørndalen	Group number 13	TITLE: Chassis Assembly	A
		SM By Reviewed by Saturday, April 05, 2014 3:25:36 PM Thursday, March 06, 2014 7:28:51 PM	DO NOT SCALE DRAWING		
				SIZE B	REV B
				Part supplier/manufacturer Group 13	SCALE: 1:5
				Mass: 659.13	SHEET 3 OF 117

**SolidWorks Student Edition.
For Academic Use Only.**

8

7

6

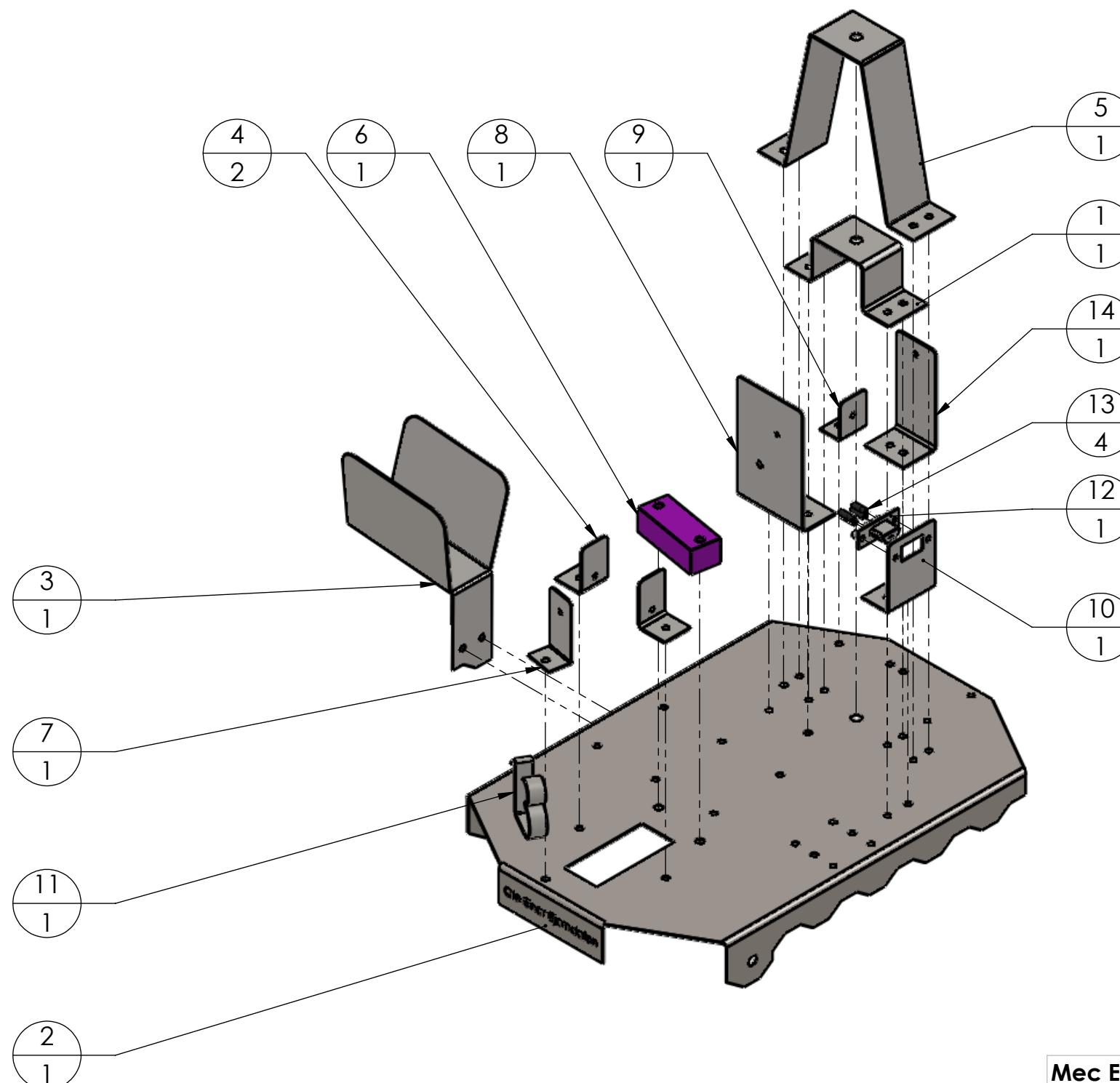
5

4

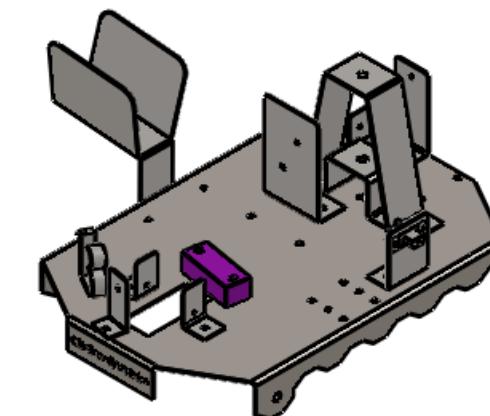
3

2

1



ITEM NO.	PART NUMBER	MATERIAL	SW-Author(Author)	Sheet No.	QTY.
1	Rod Support	Plain Carbon Steel	Drew Gingras	14,15,16	1
2	Chassis	Plain Carbon Steel	Drew Gingras	5-10	1
3	Barrel	Plain Carbon Steel	Kevin O'Rourke	11,12,13	1
4	Drive Axle L-Support	Plain Carbon Steel	Drew Gingras	17,18,19	2
5	steering support #2	Plain Carbon Steel	Alex Sauve	20,21,22	1
6	motor 1 spacer	Polyurethane Foam Flexible	Drew Gingras	23	1
7	Motor 1 Worm Support	Plain Carbon Steel	Drew Gingras	27,28,29	1
8	Gear System Support 2	Plain Carbon Steel	Drew Gingras	30,31,32	1
9	Motor 2 Worm Support	Plain Carbon Steel	Drew Gingras	33,34,35	1
10	9-Pin Bracket Support	Plain Carbon Steel	Drew Gingras	36,37,38	1
11	GROUP 13! - The 13	Plain Carbon Steel	Drew Gingras	39,40,41	1
12	Electrical_Hookup	Plain Carbon Steel	Kevin O'Rourke	N/A	1
13	Heat Shrink Wrap	Rubber	Boston Maris	N/A	4
14	Gear System Support	Plain Carbon Steel	Drew Gingras	24,25,26	1



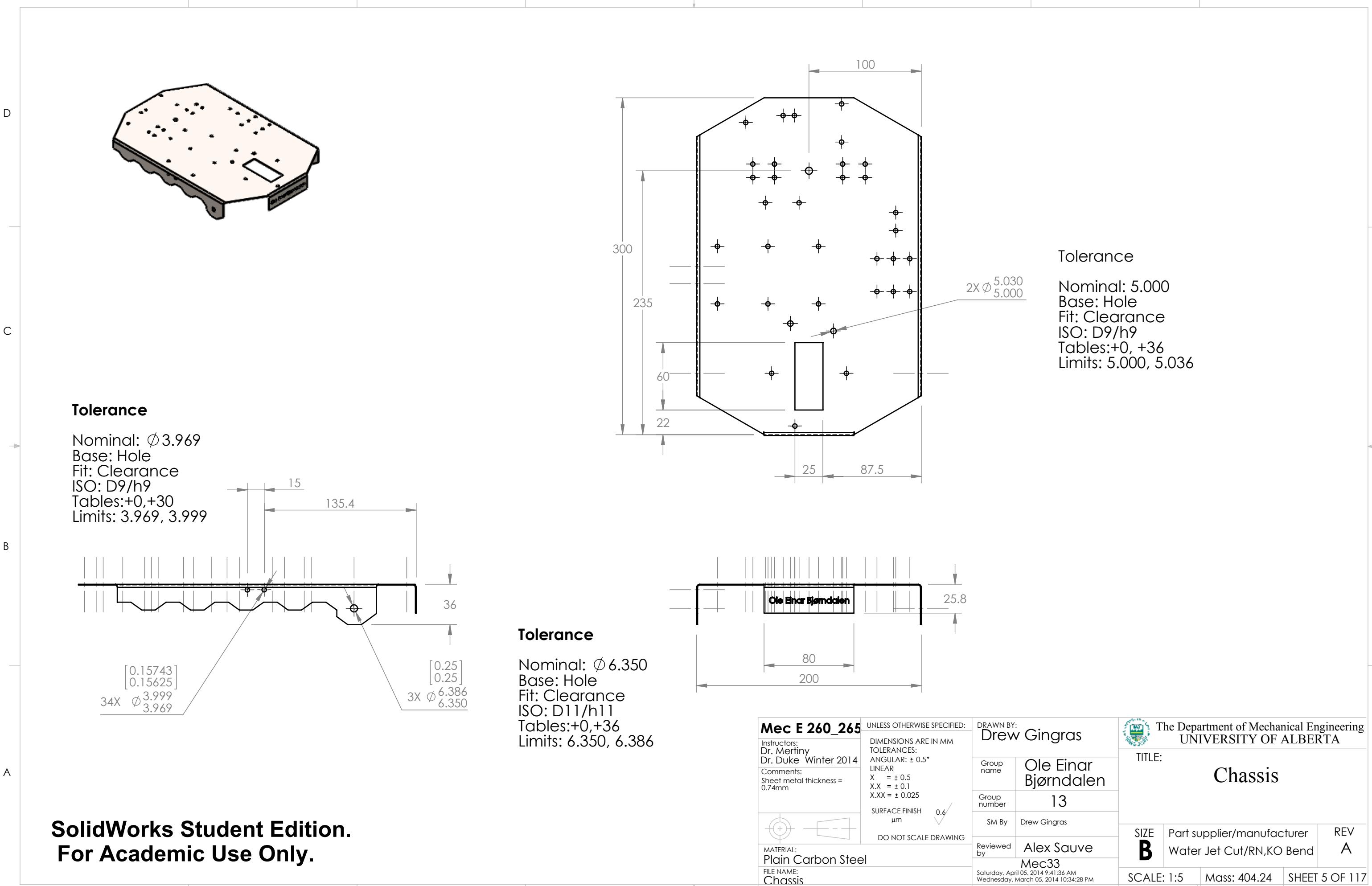
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras
Instructors: Dr. Mertiny Dr. Duke Winter2014	Comments:	Group name Ole Einar Bjørndalen	
		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
MATERIAL: As in B.O.M.		Saturday, April 05, 2014 3:25:36 PM Thursday, March 06, 2014 7:28:51 PM	
FILE NAME: Chassis Assembly		SIZE B Part supplier/manufacturer Group 13 REV B	
SCALE: 1:5		Mass: 659.13 SHEET 4 OF 117	

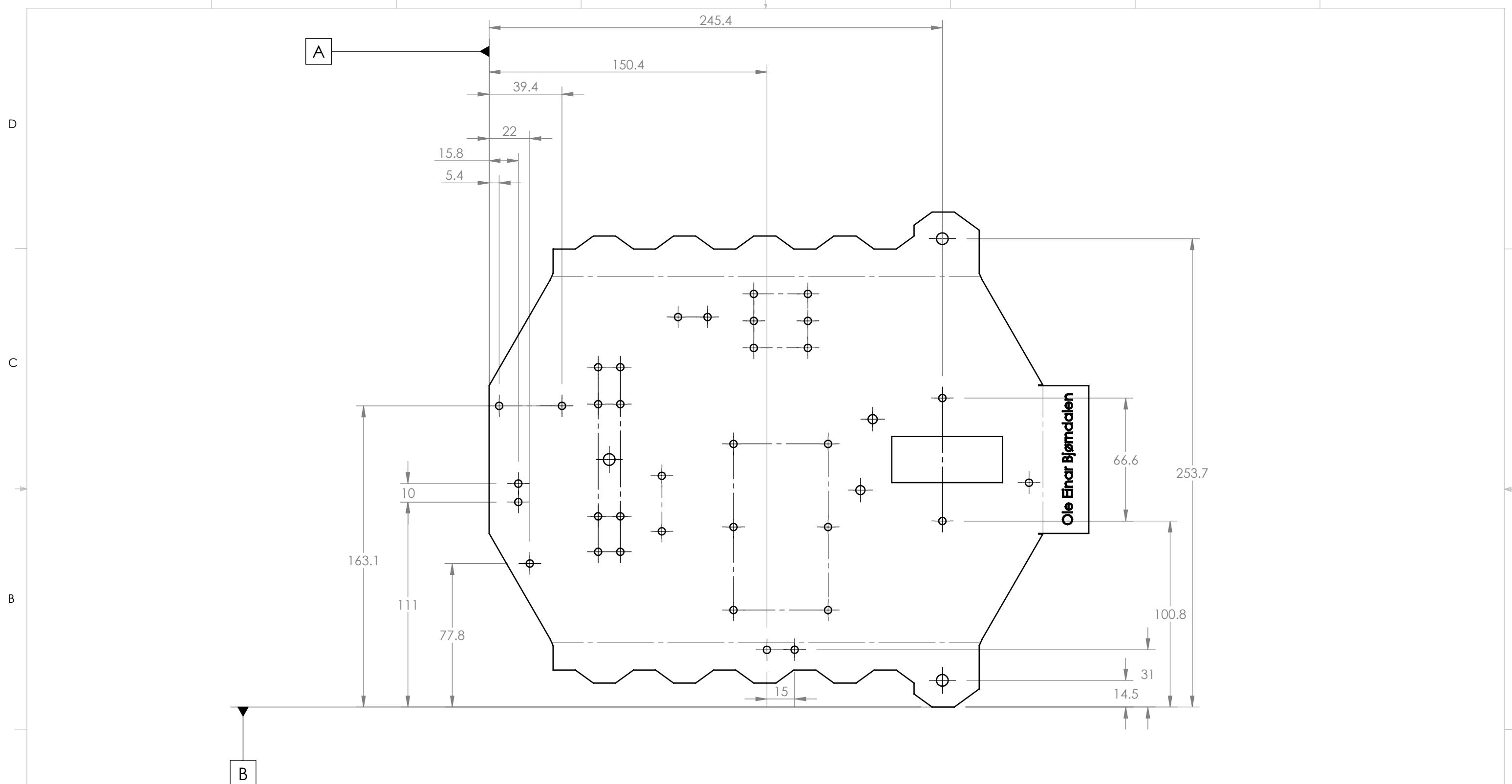
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Chassis Assembly

8 7 6 5 4 3 2 1



8 7 6 5 4 3 2 1

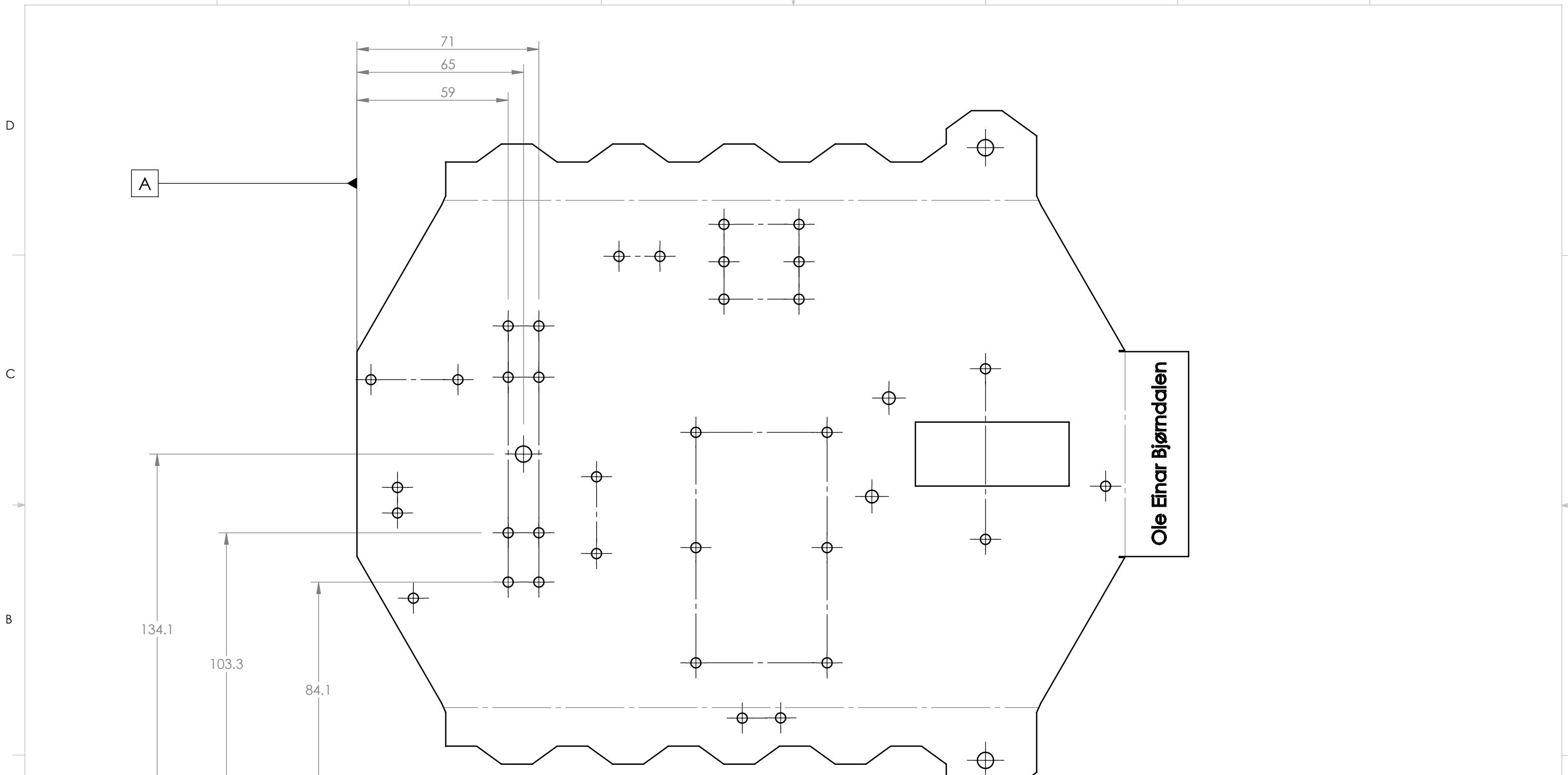


**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras
Instructors: Dr. Mertiny Dr. Duke Winter 2014		Comments: Sheet metal thickness = 0.74mm	Group name Ole Einar Bjørndalen
			Group number 13
			SM By Drew Gingras
			Reviewed by Alex Sauve Mec33
FILE NAME: Chassis		Saturday, April 05, 2014 9:41:36 AM Wednesday, March 05, 2014 10:34:28 PM	SIZE B Part supplier/manufacturer REV A Water Jet Cut / RN,KO Bend
SCALE: 1:5 Mass: 404.24		SHEET 6 OF 117	

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE: **Chassis**



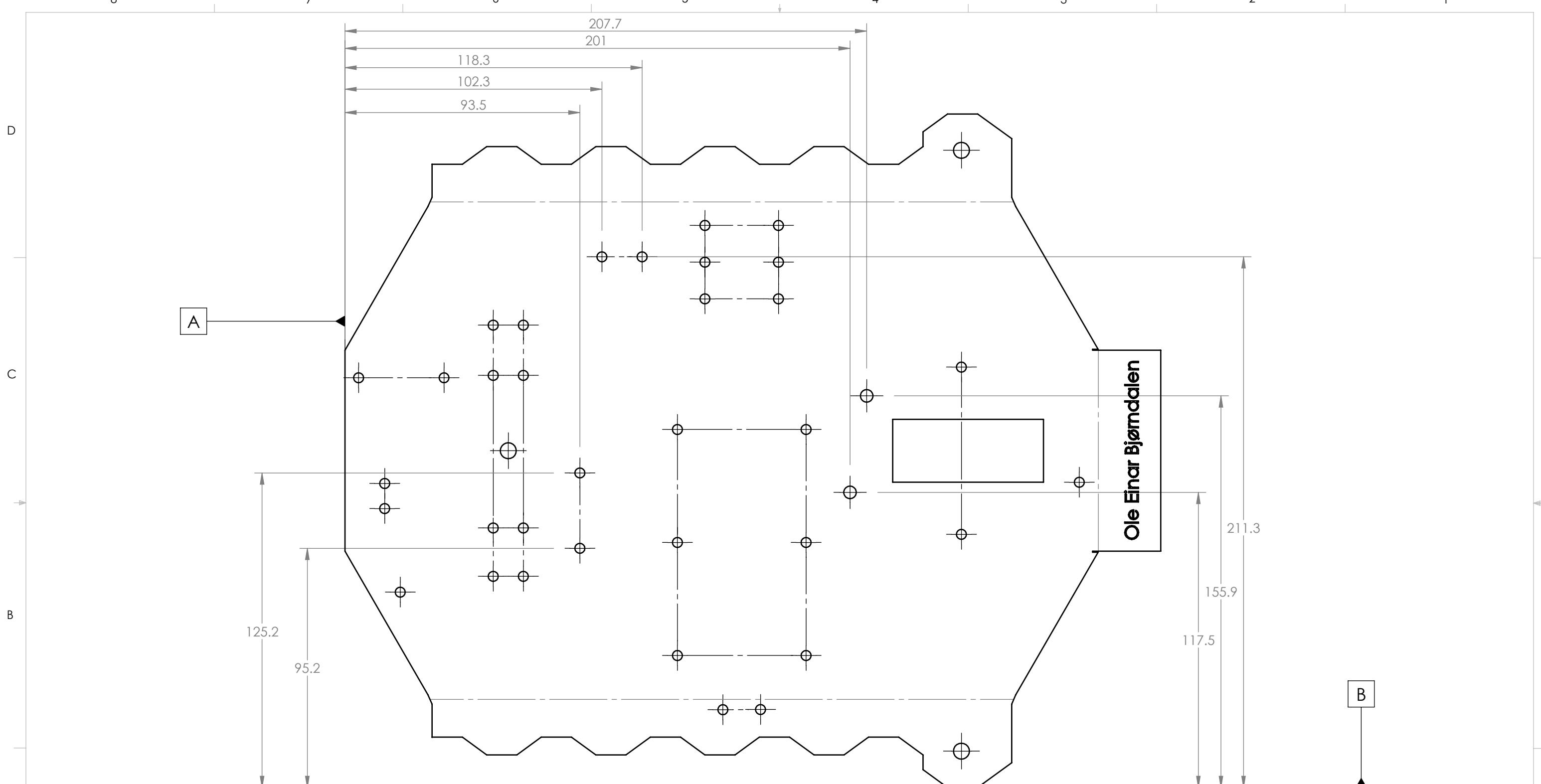
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265 UNLESS OTHERWISE SPECIFIED:
Instructors: Dr. Mertiny
Dr. Duke Winter 2014
Comments: Sheet metal thickness = 0.74mm
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR
 $X = \pm 0.5$
 $X.X = \pm 0.1$
 $X.XX = \pm 0.025$
SURFACE FINISH $0.6 \mu\text{m}$
DO NOT SCALE DRAWING

MATERIAL: Plain Carbon Steel
FILE NAME: Chassis

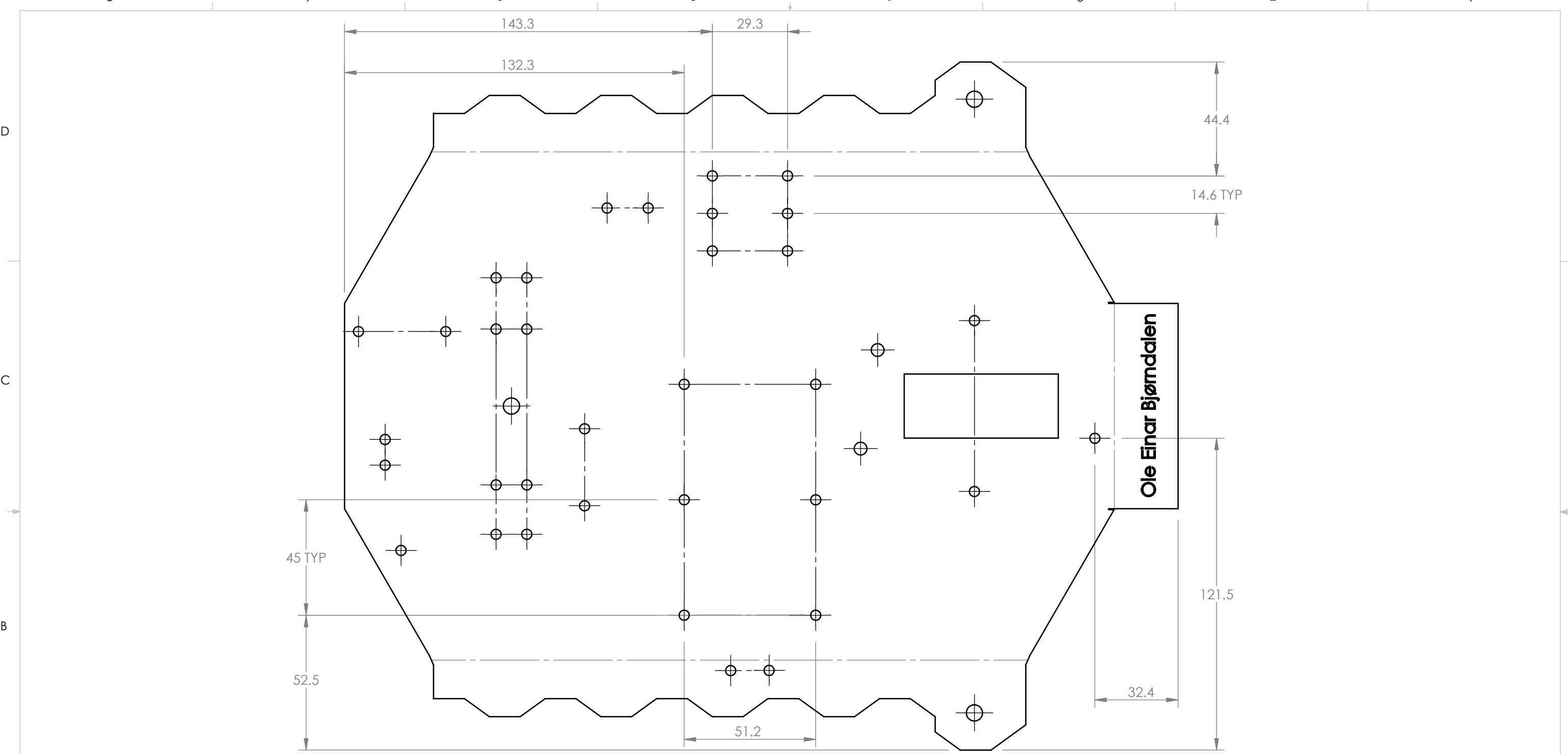
DRAWN BY: Drew Gingras
Group name: Ole Einar Bjørndalen
Group number: 13
SM By: Drew Gingras
Reviewed by: Alex Sauve
Mec33
Saturday, April 05, 2014 9:41:36 AM
Wednesday, March 05, 2014 10:34:28 PM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA
TITLE: Chassis
SIZE B Part supplier/manufacturer REV A
Water Jet Cut / RN,KO Bend
SCALE: 1:5 Mass: 404.24 SHEET 7 OF 117



Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $XX = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen	TITLE: Chassis
Comments: Sheet metal thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
		Saturday, April 05, 2014 9:41:36 AM Wednesday, March 05, 2014 10:34:28 PM	
MATERIAL: Plain Carbon Steel	SIZE B	Part supplier/manufacturer Water Jet Cut / RN,KO Bend	REV A
FILE NAME: Chassis	SCALE: 1:5	Mass: 404.24	SHEET 8 OF 117

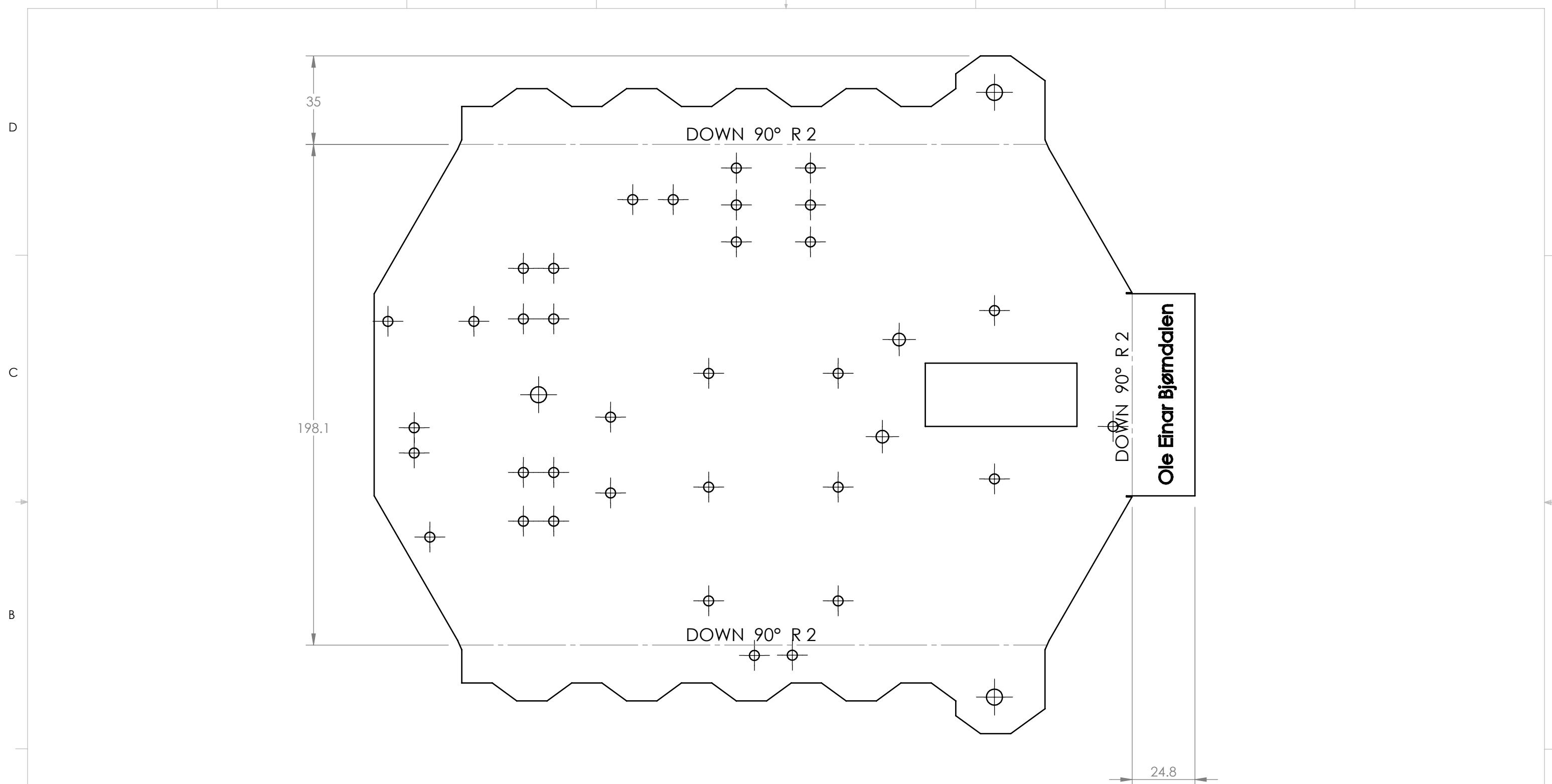
**SolidWorks Student Edition.
For Academic Use Only.**



SolidWorks Student Edition. For Academic Use Only.

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY: Drew Gingras		The Department of Mechanical Engineering UNIVERSITY OF ALBERTA		
Instructors: Dr. Mertiny Dr. Duke Winter 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$		Group name Ole Einar Bjørndalen	TITLE: Chassis			
Comments: Sheet metal thickness = 0.74mm	SURFACE FINISH $0.6 \mu\text{m}$		Group number 13				
DO NOT SCALE DRAWING		SM By Drew Gingras	Reviewed by Alex Sauve Mec33	SIZE B	Part supplier/manufacturer Water Jet Cut / RN,KO Bend		REV A
MATERIAL: Plain Carbon Steel		Saturday, April 05, 2014 9:41:36 AM Wednesday, March 05, 2014 10:34:28 PM		SCALE: 1:5	Mass: 404.24	SHEET 9 OF 117	
FILE NAME: Chassis							

8 7 6 5 4 3 2 1



Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen	
Comments: Sheet metal thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
		FILE NAME: Chassis	Saturday, April 05, 2014 9:41:36 AM Wednesday, March 05, 2014 10:34:28 PM
SIZE B	Part supplier/manufacturer Water Jet Cut / RN,KO Bend	REV A	
SCALE: 1:5	Mass: 404.24	SHEET 10 OF 117	

**SolidWorks Student Edition.
For Academic Use Only.**

8

7

6

5

4

3

2

1

D

D

C

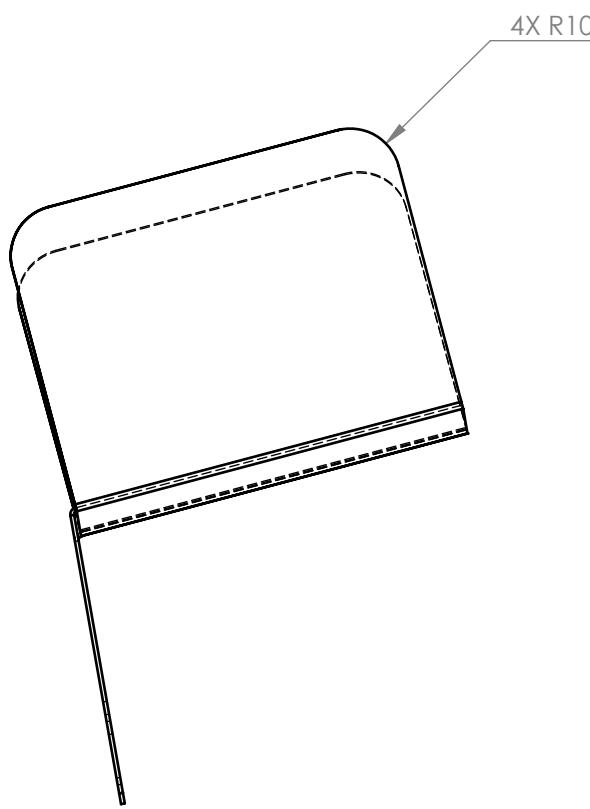
C

B

B

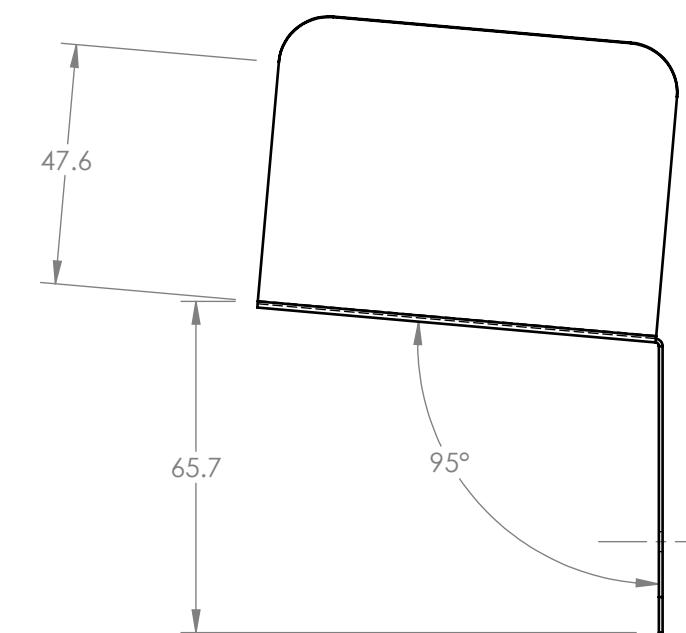
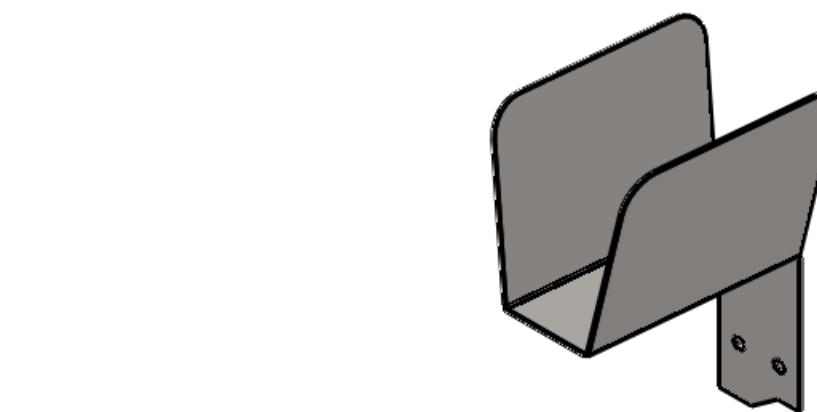
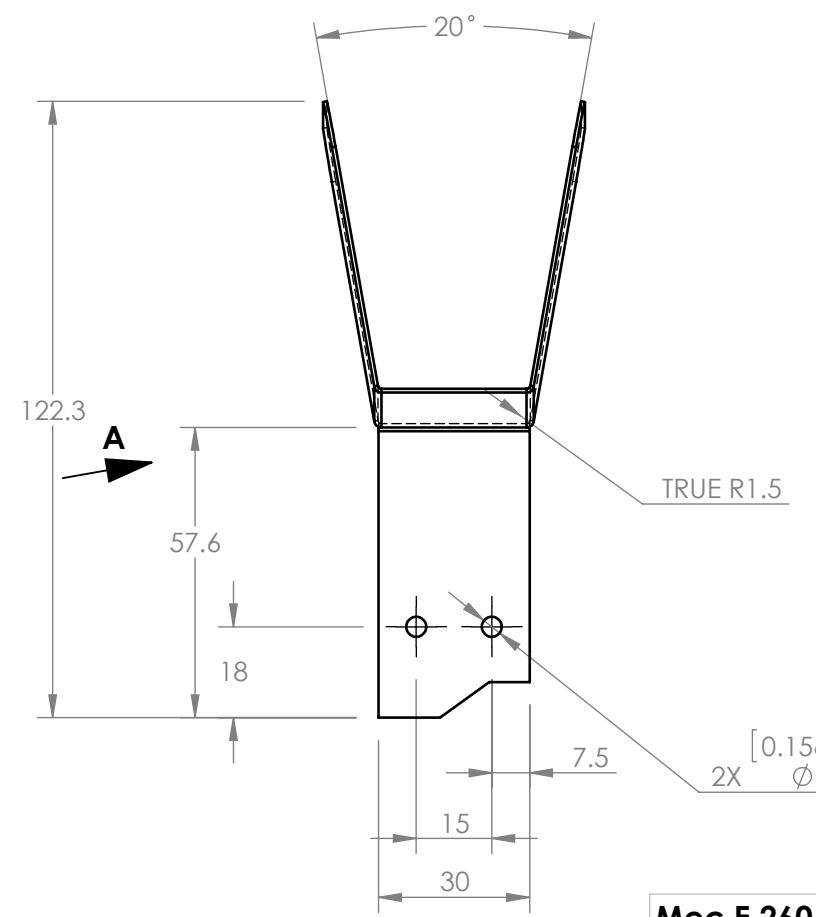
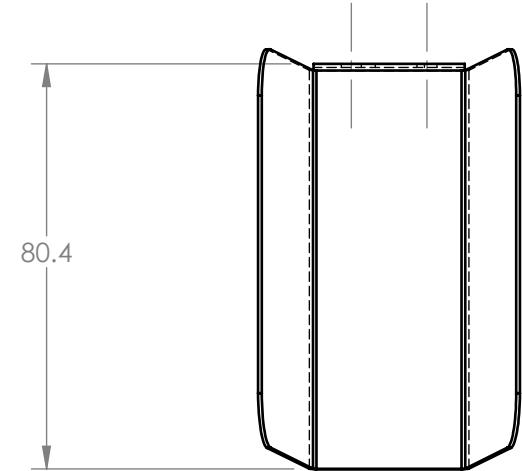
A

A



VIEW A

SolidWorks Student Edition.
For Academic Use Only.

**Mec E 260_265**

Instructors:
Dr. Mertiny
Dr. Duke Winter 2014

Comments:
Sheet metal thickness =
0.74mm



MATERIAL:
Plain Carbon Steel

FILE NAME:
Barrel

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR
 $X = \pm 0.5$
 $X.X = \pm 0.1$
 $X.XX = \pm 0.025$

SURFACE FINISH
 $0.6 \mu\text{m}$

DO NOT SCALE DRAWING

DRAWN BY:
Drew Gingras

Group name
Ole Einar
Bjørndalen

Group number
13

SM By
Kevin O'Rourke

Reviewed by
Alex Sauve
Mec33

Saturday, April 05, 2014 9:51:34 AM
Saturday, March 29, 2014 10:38:24 AM



The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:

Barrel

SIZE Part supplier/manufacturer REV

B Kevin O'Rourke B

SCALE: 1:1.5 Mass: 76.66 SHEET 11 OF 117

8 7 6 5 4 3 2 1

D

D

C

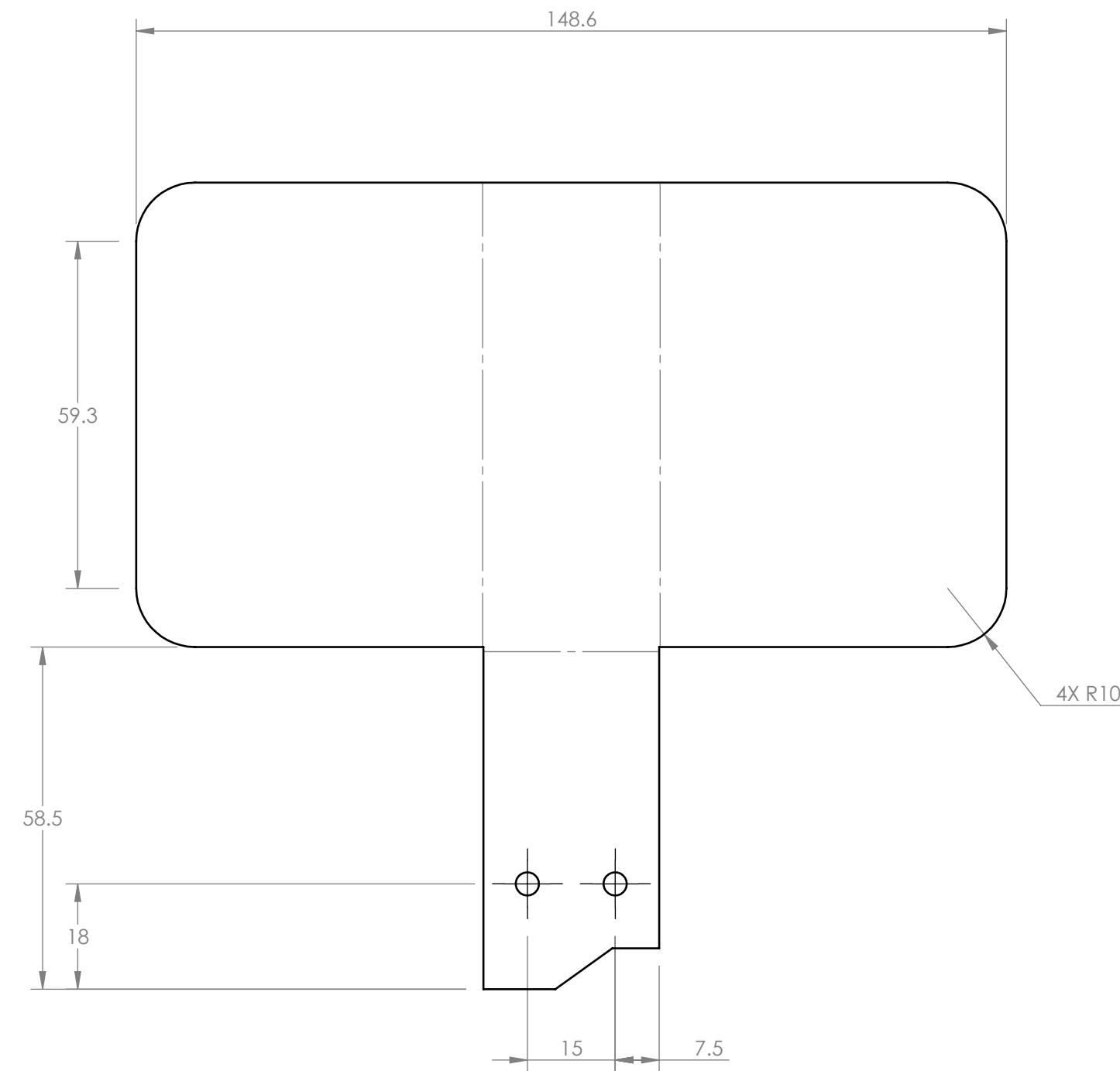
C

B

B

A

A



Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke Winter 2014

Comments:
Sheet metal thickness =
0.74mm



MATERIAL:

Plain Carbon Steel

FILE NAME:

Barrel

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR

X = ± 0.5
XX = ± 0.1
XXX = ± 0.025

SURFACE FINISH
 $0.6 \mu\text{m}$

DO NOT SCALE DRAWING

DRAWN BY:
Drew Gingras

Group name
Ole Einar
Bjørndalen

Group number
13

SM By
Kevin O'Rourke

Reviewed by
Alex Sauve

Mec33

Saturday, April 05, 2014 9:51:34 AM
Saturday, March 29, 2014 10:38:24 AM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:

Barrel

SIZE Part supplier/manufacturer REV

B Kevin O'Rourke B

SCALE: 1:1 Mass: 76.66 SHEET 12 OF 117

**SolidWorks Student Edition.
For Academic Use Only.**

8

7

6

5

4

3

2

1

D

D

C

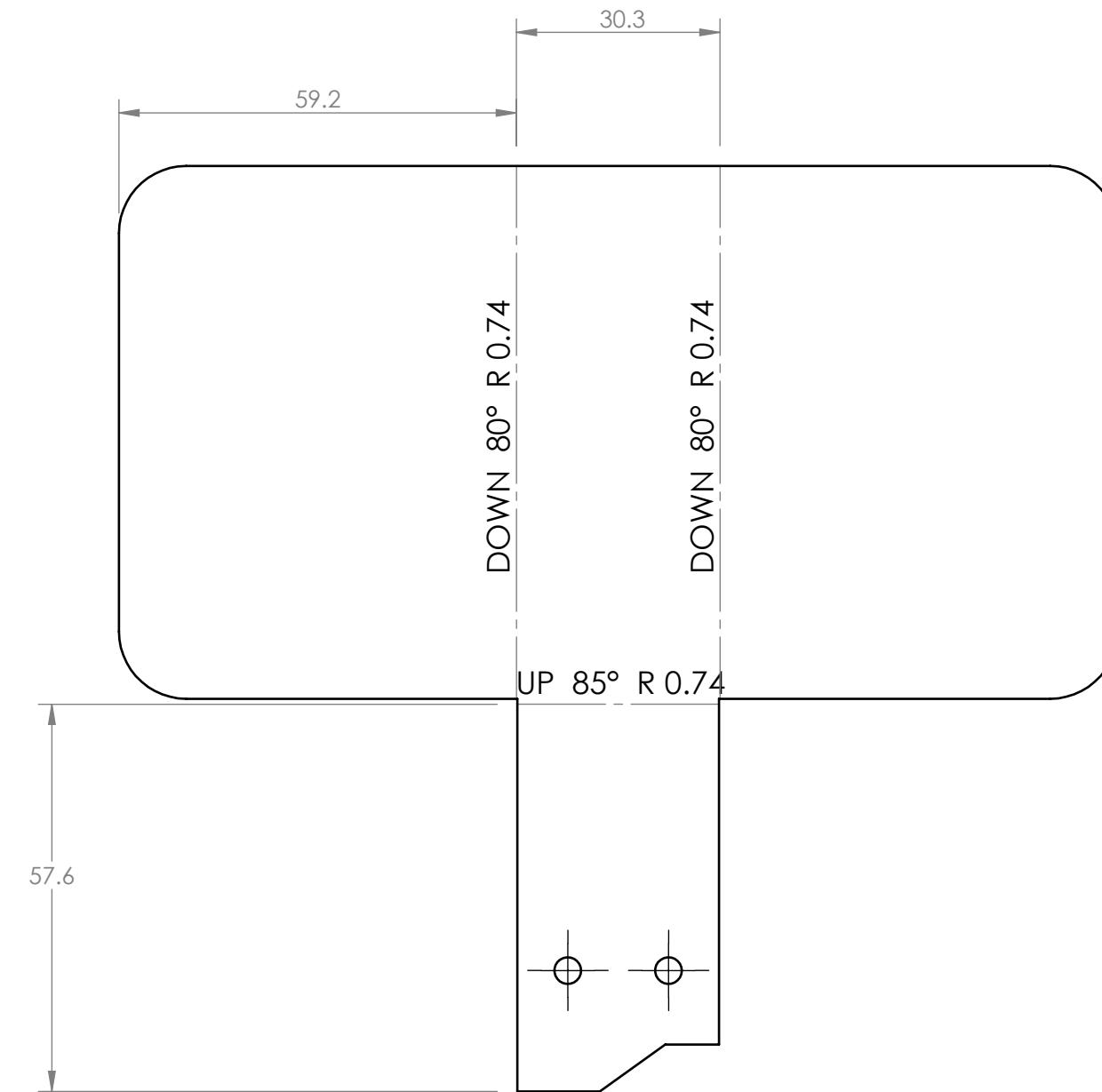
C

B

B

A

A

**Mec E 260_265**

Instructors:
Dr. Mertiny
Dr. Duke Winter 2014

Comments:
Sheet metal thickness =
0.74mm



MATERIAL:
Plain Carbon Steel

FILE NAME:
Barrel

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR

X = ± 0.5
XX = ± 0.1
XXX = ± 0.025

SURFACE FINISH
 $0.6 \mu\text{m}$

DO NOT SCALE DRAWING

DRAWN BY:
Drew Gingras

Group name
Ole Einar
Bjørndalen

Group number
13

SM By
Kevin O'Rourke

Reviewed by
Alex Sauve

Mec33

Saturday, April 05, 2014 9:51:34 AM
Saturday, March 29, 2014 10:38:24 AM

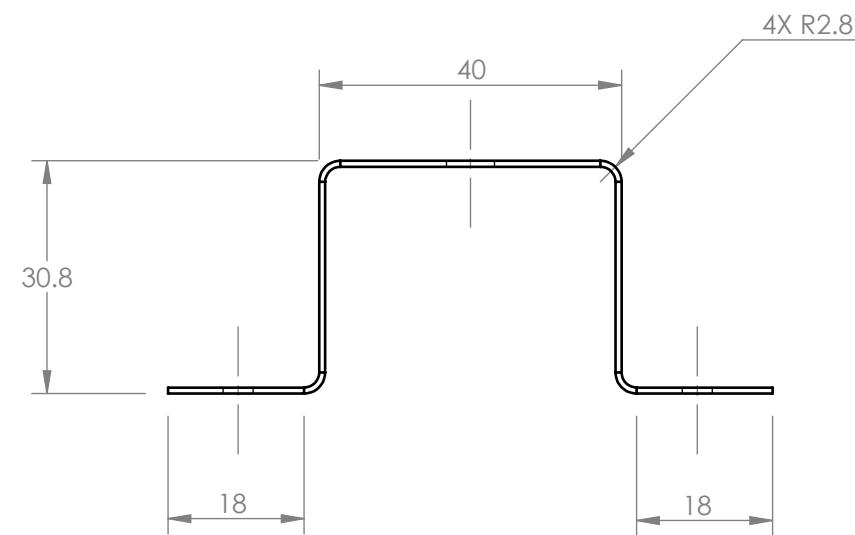
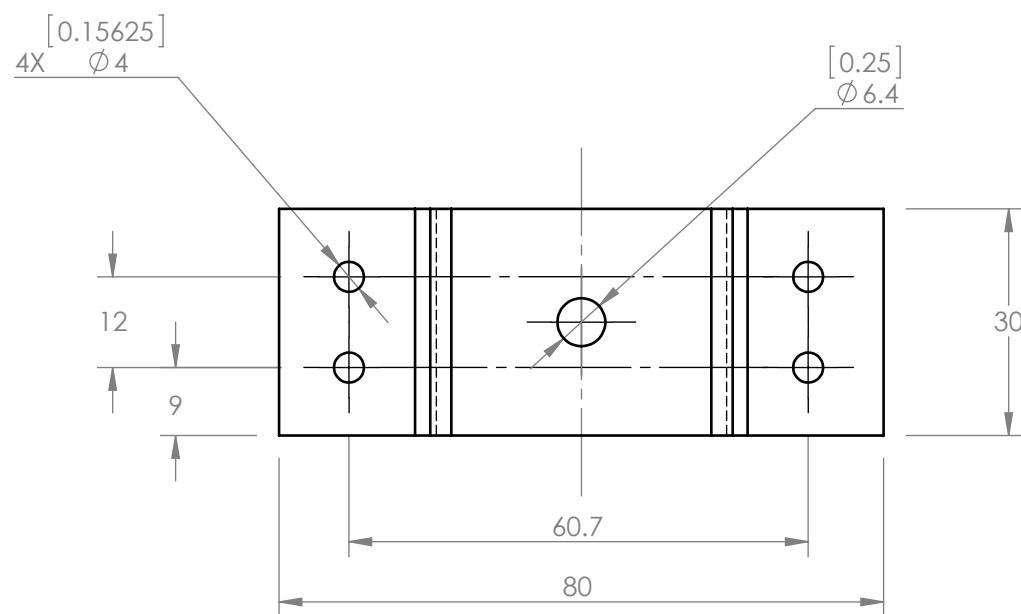
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Barrel

SIZE **B** Part supplier/manufacturer
Kevin O'Rourke REV B

SCALE: 1:1 Mass: 76.66 SHEET 13 OF 117

**SolidWorks Student Edition.
For Academic Use Only.**



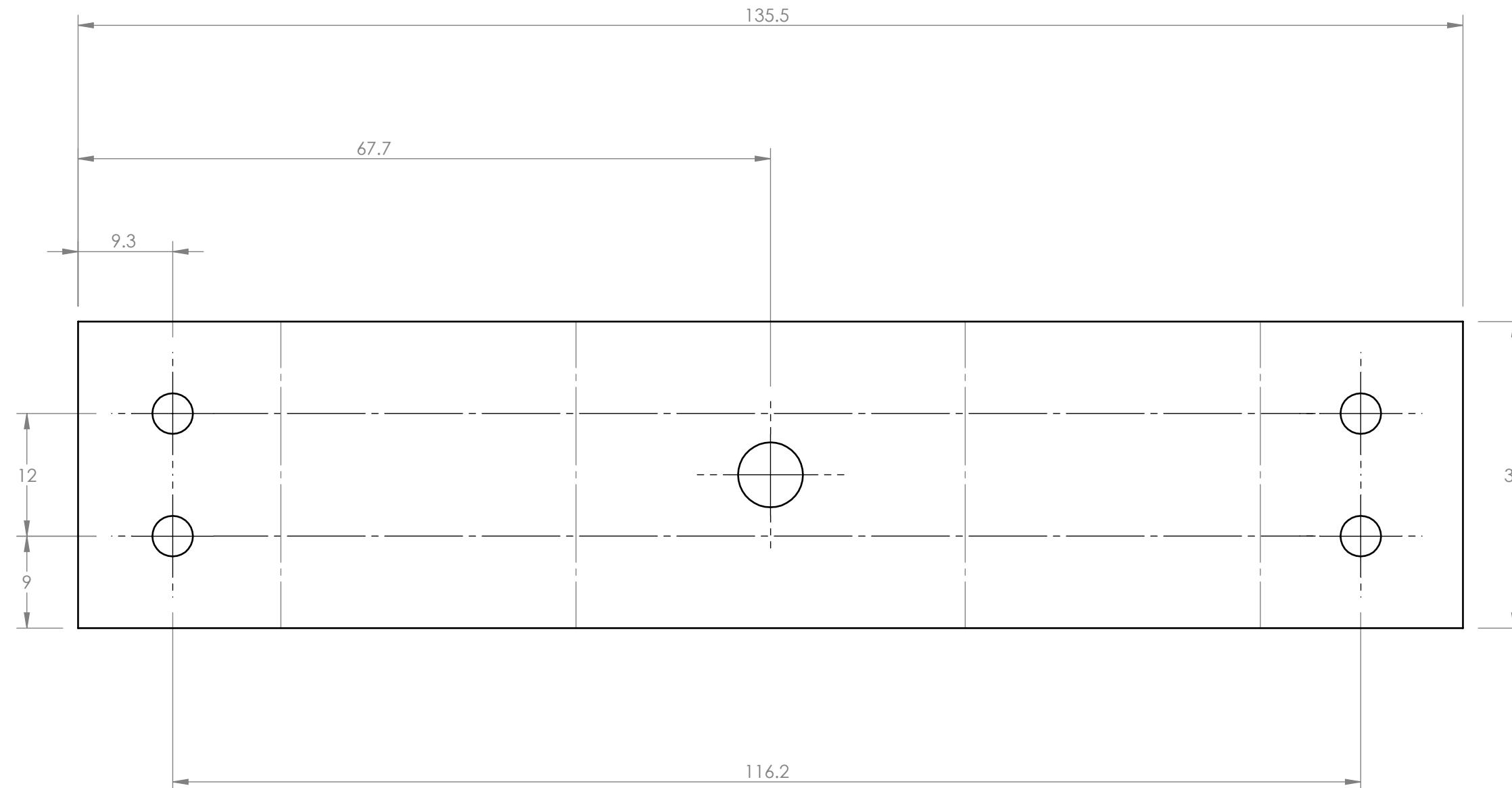
SolidWorks Student Edition. For Academic Use Only.

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY: Drew Gingras		The Department of Mechanical Engineering UNIVERSITY OF ALBERTA		
Instructors: Dr. Merifin Dr. Duke Winter 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$		Group name Ole Einar Bjørndalen	Group number 13	TITLE: Rod Support		
Comments: Sheet metal thickness = 0.74mm	SURFACE FINISH 0.6 μm		SM By Drew Gingras	Reviewed by Alex Sauve Mec33	SIZE B	Part supplier/manufacturer Alex Sauve	REV A
	DO NOT SCALE DRAWING		Saturday, April 05, 2014 9:51:34 AM Thursday, March 06, 2014 7:23:34 PM	SCALE: 1:1	Mass: 24.93	SHEET 14 OF 117	
MATERIAL: Plain Carbon Steel		FILE NAME: Rod Support					

8 7 6 5 4 3 2 1

D

D



C

C

B

B

A

A

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014		Group name Ole Einar Bjørndalen	TITLE: Rod Support
Comments: Sheet metal thickness = 0.74mm		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
MATERIAL: Plain Carbon Steel	FILE NAME: Rod Support	Saturday, April 05, 2014 9:51:34 AM Thursday, March 06, 2014 7:23:34 PM	SIZE B Part supplier/manufacturer Alex Sauve REV A
			SCALE: 2:1 Mass: 24.93 SHEET 15 OF 117

8 7 6 5 4 3 2 1

D

D

C

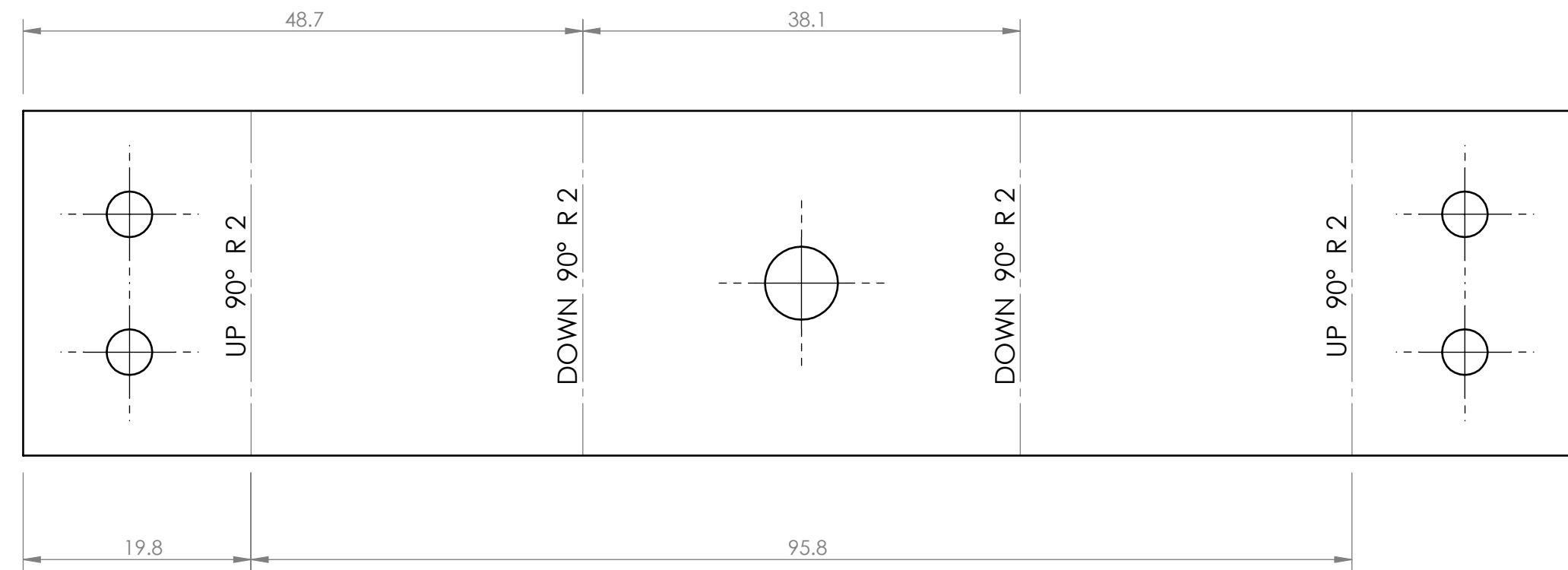
C

B

B

A

A



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Comments: Sheet metal thickness = 0.74mm	Group name Ole Einar Bjørndalen	TITLE: Rod Support
		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
			SIZE B Part supplier/manufacturer Alex Sauve REV A
			SCALE: 2:1 Mass: 24.93 SHEET 16 OF 117
			Saturday, April 05, 2014 9:51:34 AM Thursday, March 06, 2014 7:23:34 PM

8 7 6 5 4 3 2 1

D

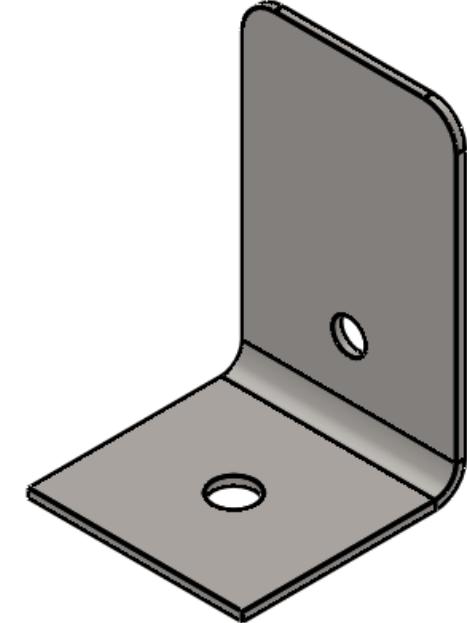
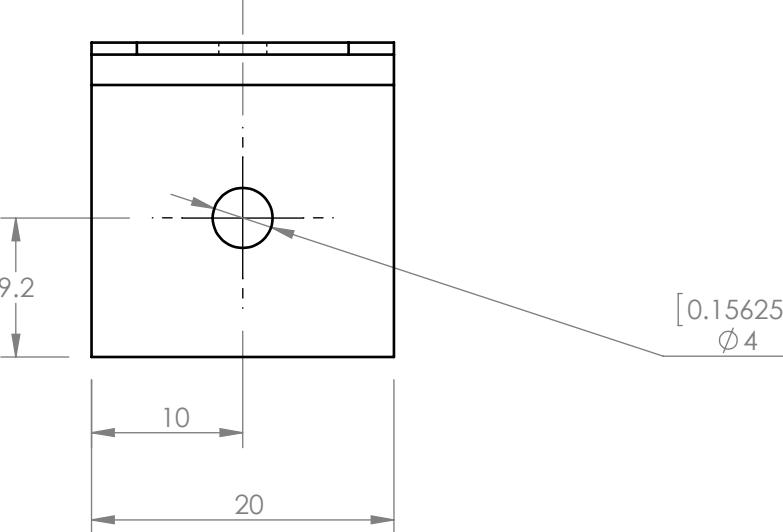
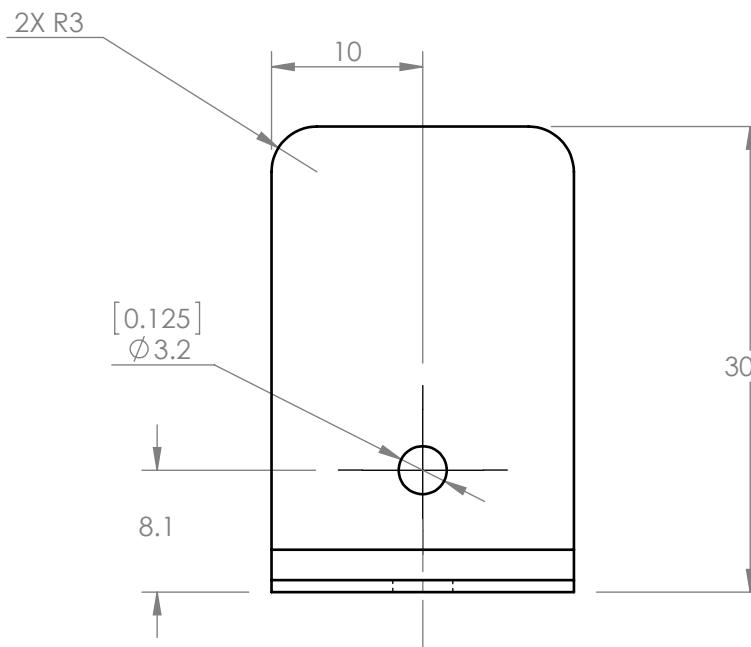
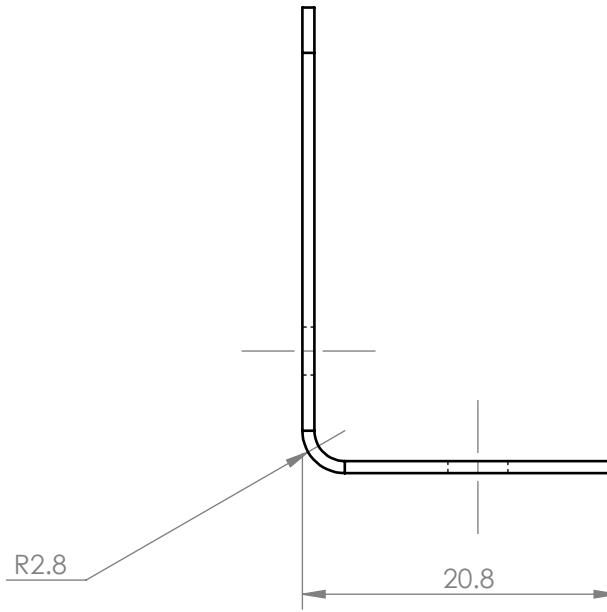
D

C

C

A

A



Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke Winter 2014

Comments:
Sheet metal thickness =
0.74mm



MATERIAL:
Plain Carbon Steel
FILE NAME:
Drive Axle L-Support

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: ± 0.5°
LINEAR

X = ± 0.5
XX = ± 0.1
XXX = ± 0.025

SURFACE FINISH
μm

DO NOT SCALE DRAWING

DRAWN BY:
Drew Gingras

Group name
Ole Einar
Bjørndalen
Group number
13

SM By
Drew Gingras

Reviewed by
Alex Sauve
Mec33

Saturday, April 05, 2014 9:51:34 AM
Thursday, March 06, 2014 7:34:27 PM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Drive Axel L-Support

SIZE **B** Part supplier/manufacturer **Boston Maris** REV **A**

SCALE: 2:1 Mass: 6.06 SHEET 17 OF 117

SolidWorks Student Edition.
For Academic Use Only.

8

7

6

5

4

3

2

1

D

D

C

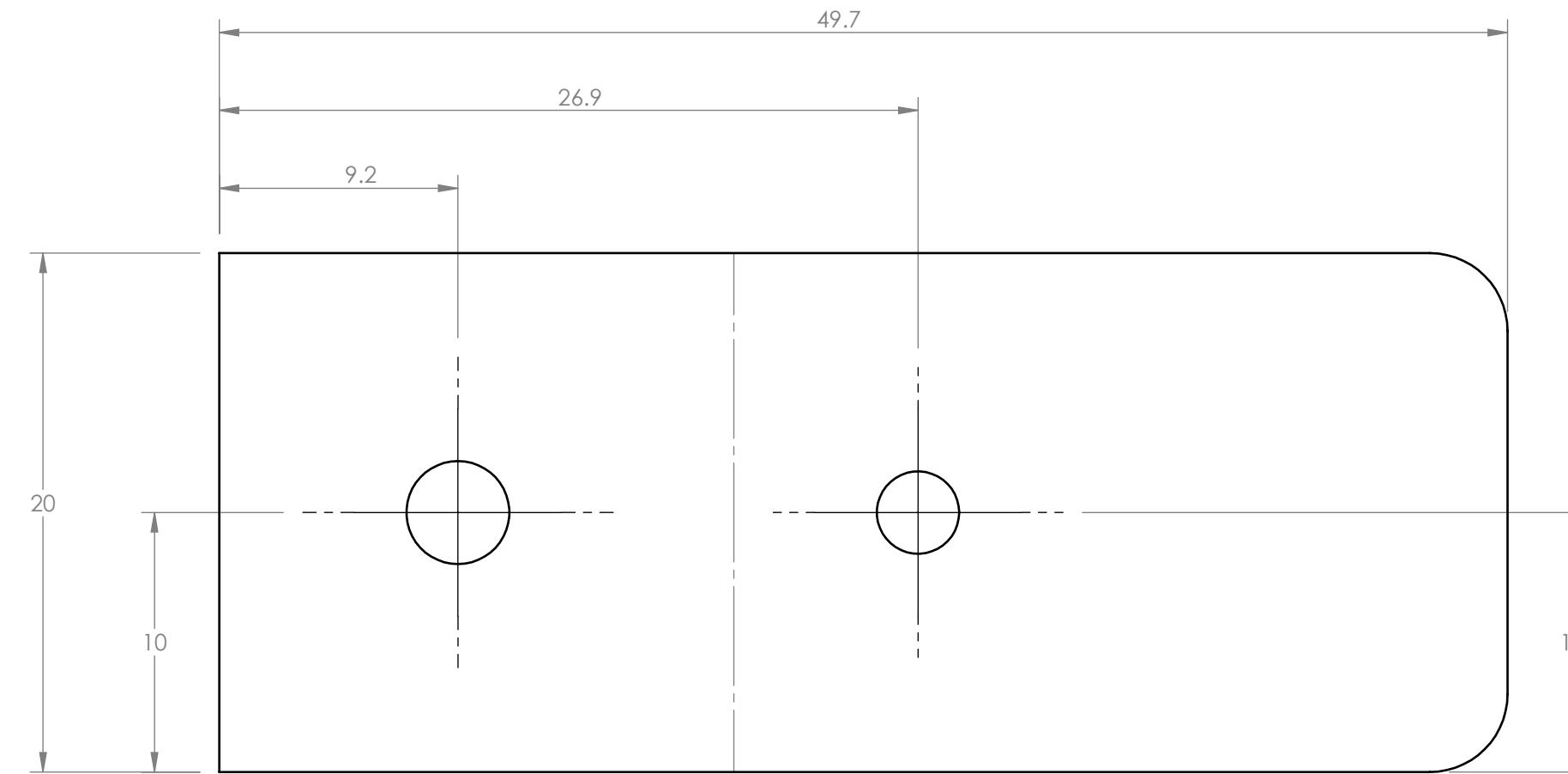
C

B

B

A

A



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras
Instructors: Dr. Mertiny Dr. Duke Winter 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen
Comments: Sheet metal thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13
		SM By Drew Gingras
		Reviewed by Alex Sauve Mec33
MATERIAL: Plain Carbon Steel	Saturday, April 05, 2014 9:51:34 AM Thursday, March 06, 2014 7:34:27 PM	FILE NAME: Drive Axle L-Support

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Drive Axel L-Support

SIZE	Part supplier/manufacturer	REV
B	Boston Maris	A
SCALE: 4:1	Mass: 6.06	SHEET 18 OF 117

8 7 6 5 4 3 2 1

D

D

C

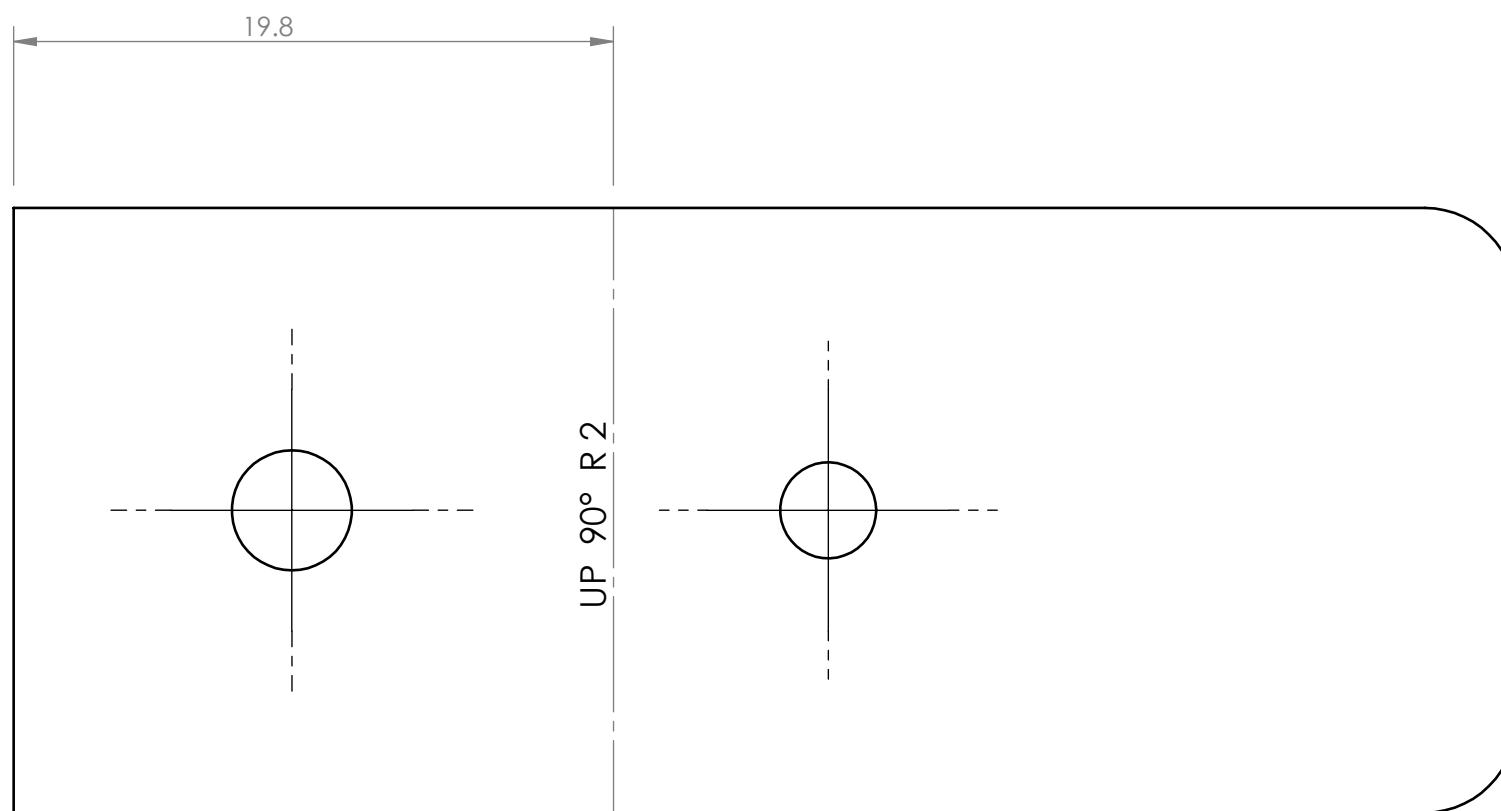
C

B

B

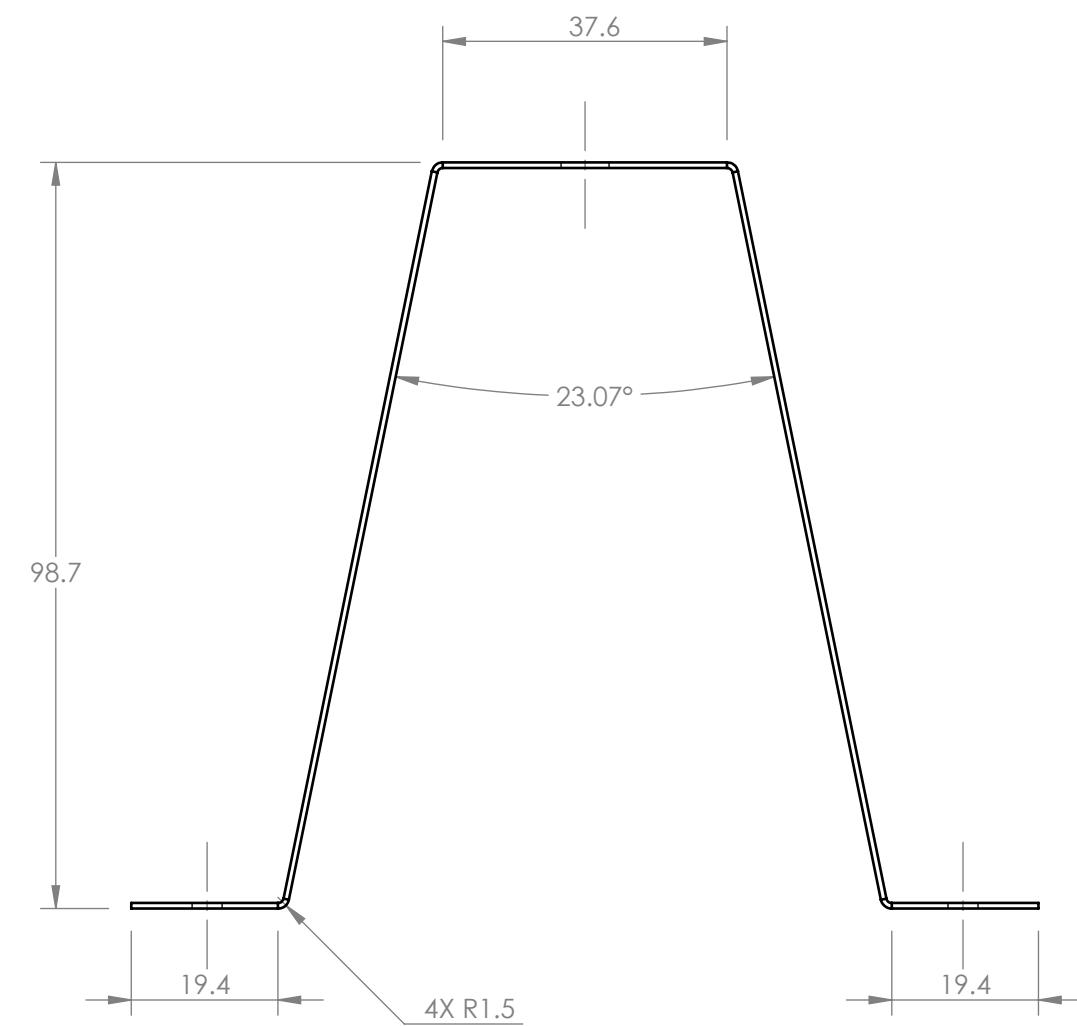
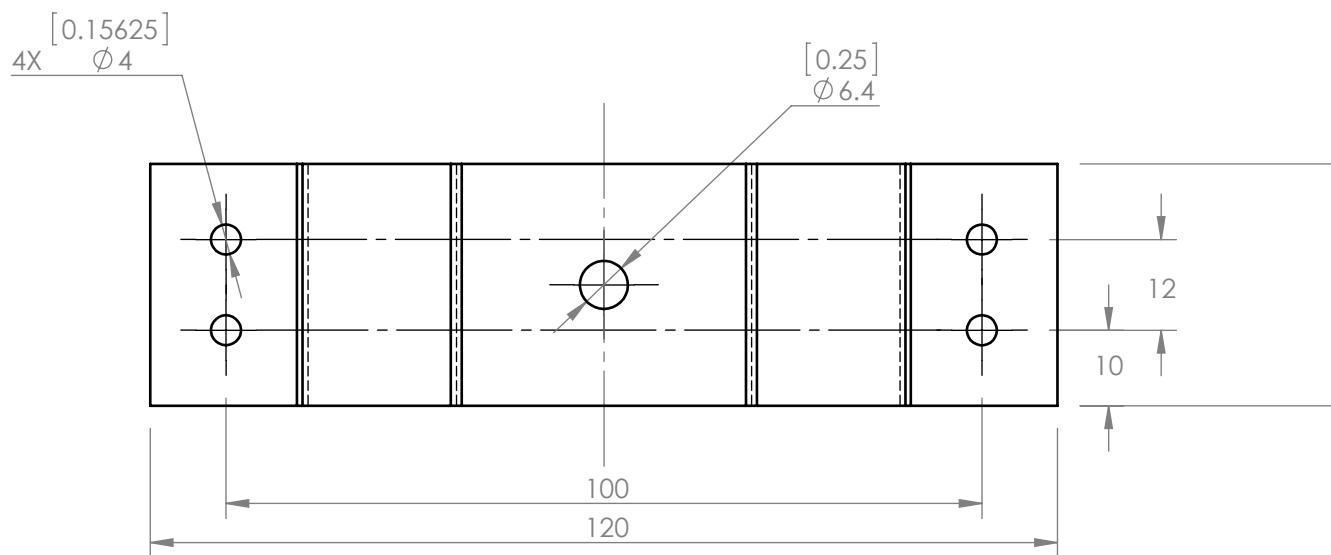
A

A



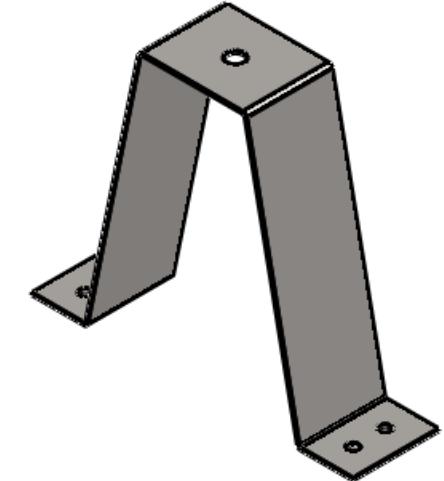
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Comments: Sheet metal thickness = 0.74mm	Group name Ole Einar Bjørndalen	TITLE: Drive Axel L-Support
		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
		Saturday, April 05, 2014 9:51:34 AM Thursday, March 06, 2014 7:34:27 PM	
MATERIAL: Plain Carbon Steel	FILE NAME: Drive Axle L-Support	SIZE B	Part supplier/manufacturer Boston Maris
		REV A	
		SCALE: 4:1	Mass: 6.06
			SHEET 19 OF 117



**SolidWorks Student Edition.
For Academic Use Only.**

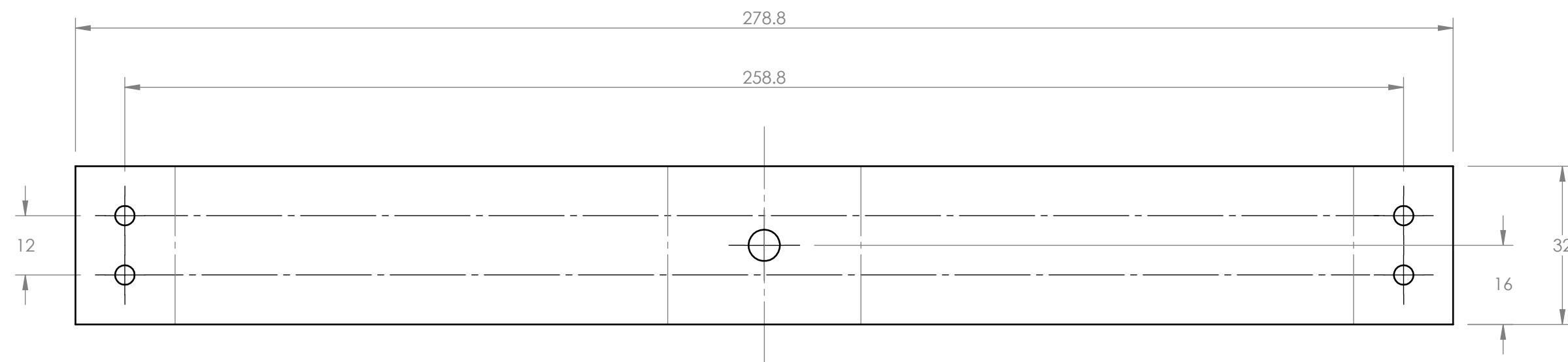
Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
Comments:	Sheet metal thickness = 0.74mm	Group name	Ole Einar Bjørndalen	TITLE: Steering System Support #2	
Instructors:	Dr. Mertiny Dr. Duke Winter 2014	Group number	13	SIZE Part supplier/manufacturer REV	
		SM By	Alex Sauve	B Drew Gingras A	
Reviewed by	Alex Sauve Mec33	DO NOT SCALE DRAWING		SCALE: 1:1 Mass: 50.80 SHEET 20 OF 117	
MATERIAL:	Plain Carbon Steel	FILE NAME:	steering support #2		



8 7 6 5 4 3 2 1

D

D



B

B

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Group name Ole Einar Bjørndalen	Group number 13	TITLE: Steering System Support
Comments: Sheet metal thickness = 0.74mm	SM By Alex Sauve	Reviewed by Alex Sauve Mec33	SIZE Part supplier/manufacturer REV B Drew Gingras A
	SURFACE FINISH $0.6 \mu\text{m}$	DO NOT SCALE DRAWING	SCALE: 1:1 Mass: 50.80 SHEET 21 OF 117
MATERIAL: Plain Carbon Steel	FILE NAME: steering support #2	Saturday, April 05, 2014 9:51:33 AM Monday, March 17, 2014 8:29:22 PM	

8

7

6

5

4

3

2

1

D

D

C

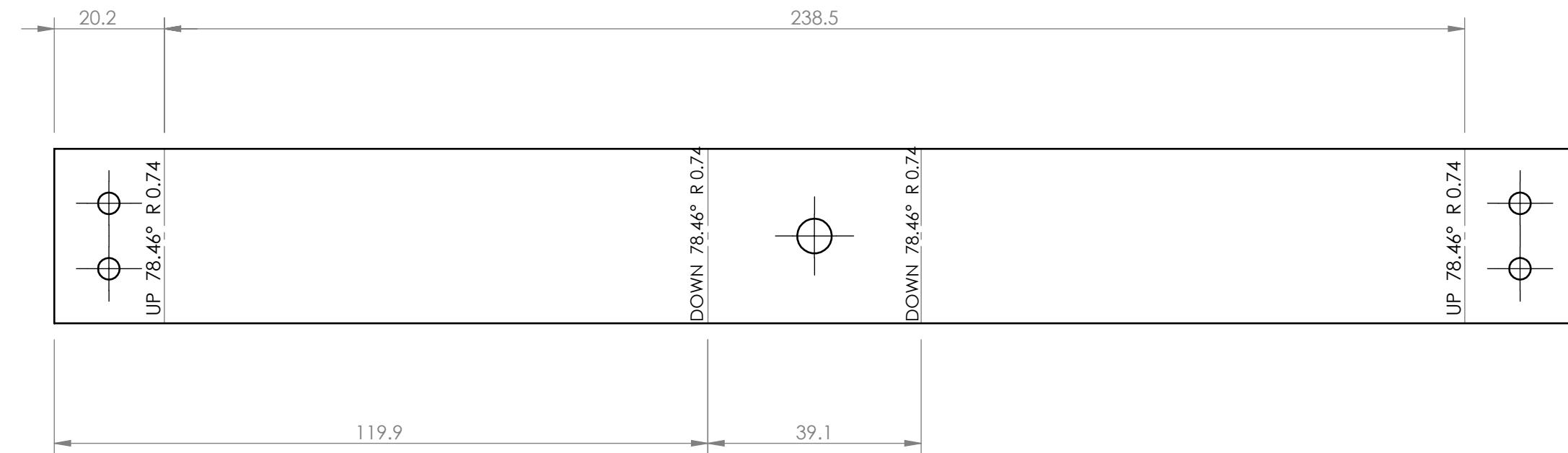
C

B

B

A

A



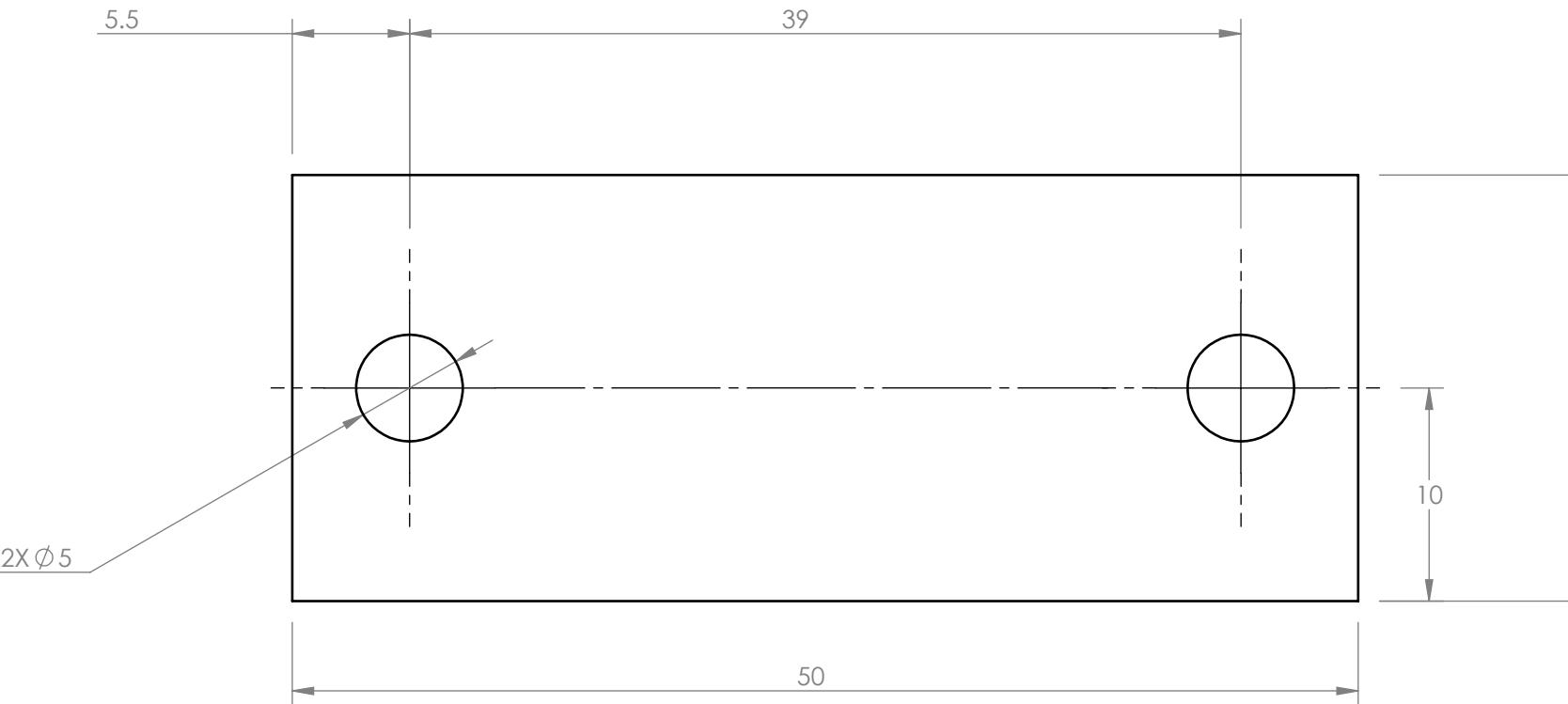
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen	TITLE: Steering System Support #2
Comments: Sheet metal thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13	
		SM By Alex Sauve	SIZE Part supplier/manufacturer REV B Drew Gingras A
		Reviewed by Alex Sauve Mec33	SCALE: 1:1 Mass: 50.80 SHEET 22 OF 117
			Saturday, April 05, 2014 9:51:33 AM Monday, March 17, 2014 8:29:22 PM

8 7 6 5 4 3 2 1

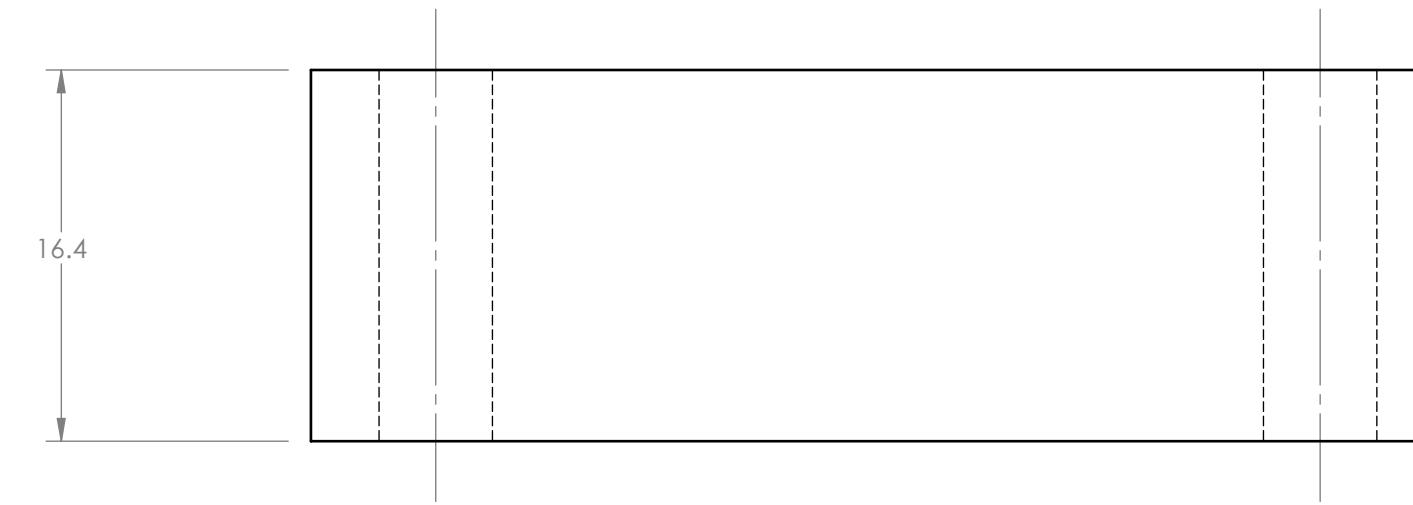
D

D



C

C



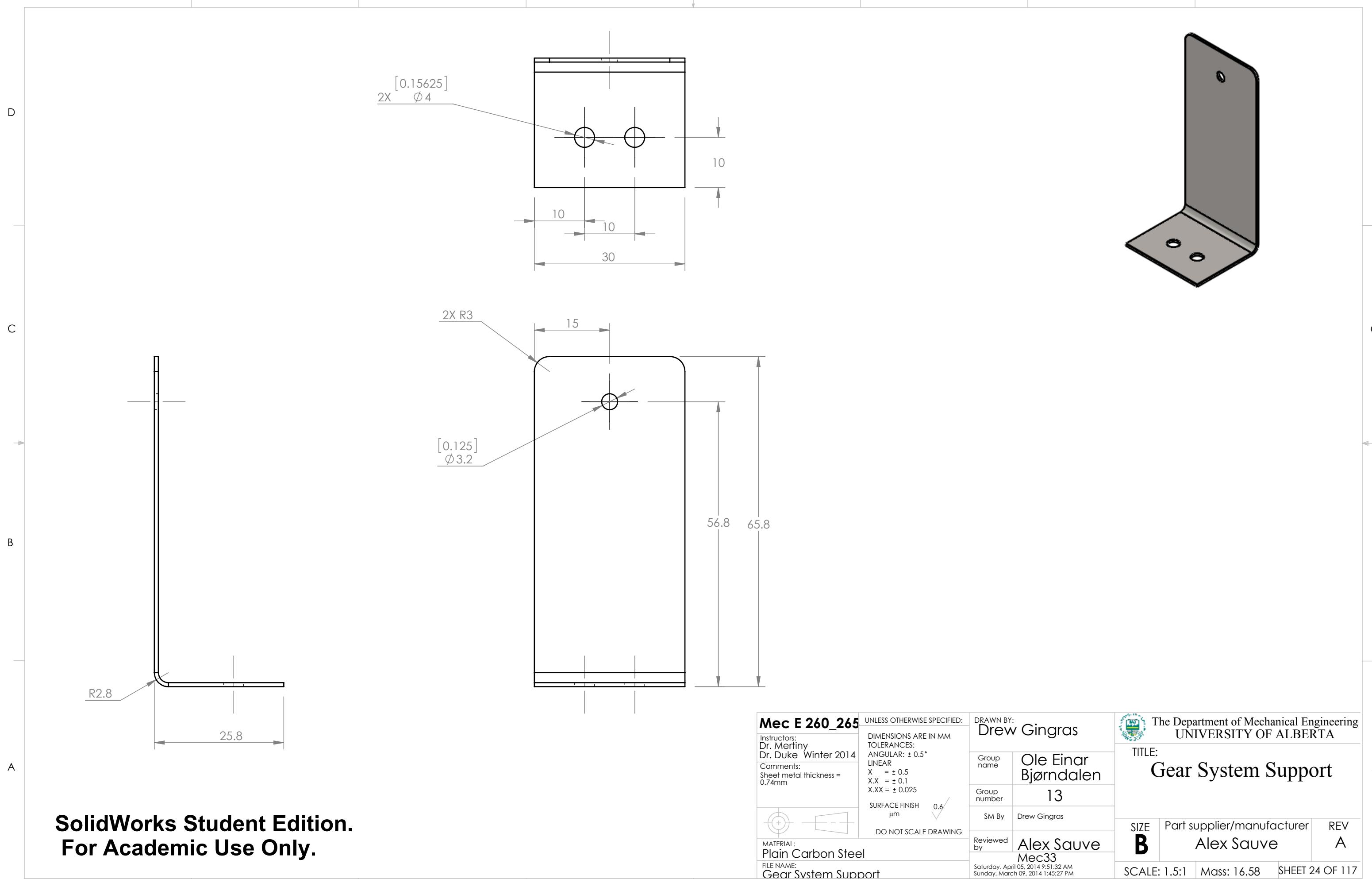
B

B

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Comments:	Group name Ole Einar Bjørndalen	TITLE: Motor 1 Spacer
		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
		Saturday, April 05, 2014 9:51:33 AM Sunday, March 09, 2014 4:37:32 PM	
		SIZE B	Part supplier/manufacturer Ruby Nicholls
		REV A	
		SCALE: 3:1	Mass: 0.25
			SHEET 23 OF 117

8 7 6 5 4 3 2 1



8

7

6

5

4

3

2

1

D

D

C

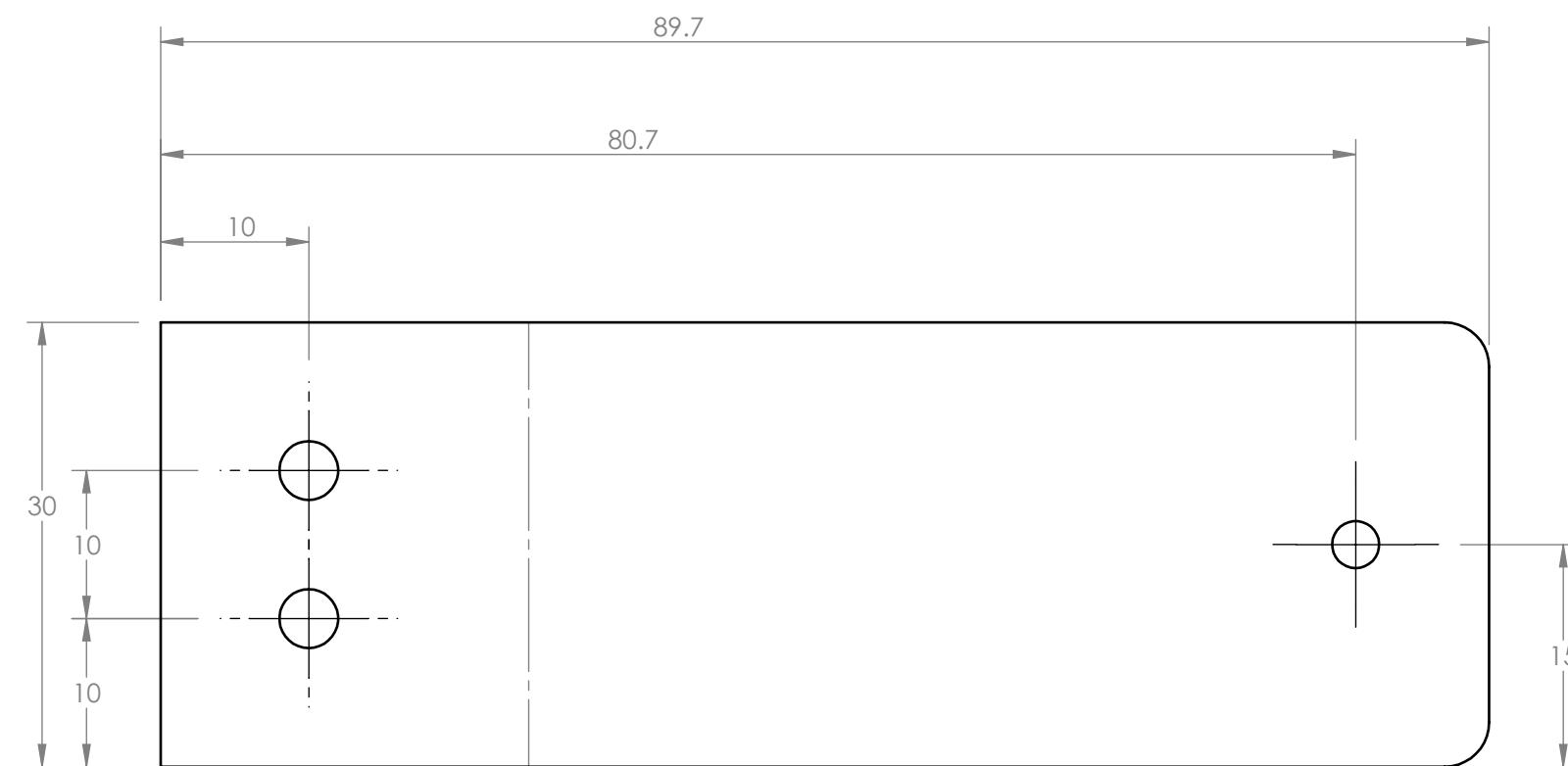
C

B

B

A

A



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	 The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Ayranci Dr. Duke Fall 2013 Comments: Sheet metal thickness = 0.74mm	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen	
	DO NOT SCALE DRAWING	Group number 13	
		SM By Drew Gingras	
		Reviewed by Mec33	
		Saturday, April 05, 2014 9:51:32 AM Sunday, March 09, 2014 1:45:27 PM	
SIZE B	Part supplier/manufacturer Alex Sauve	REV A	
SCALE: 1:5	Mass: 16.58	SHEET 25 OF 117	

8 7 6 5 4 3 2 1

D

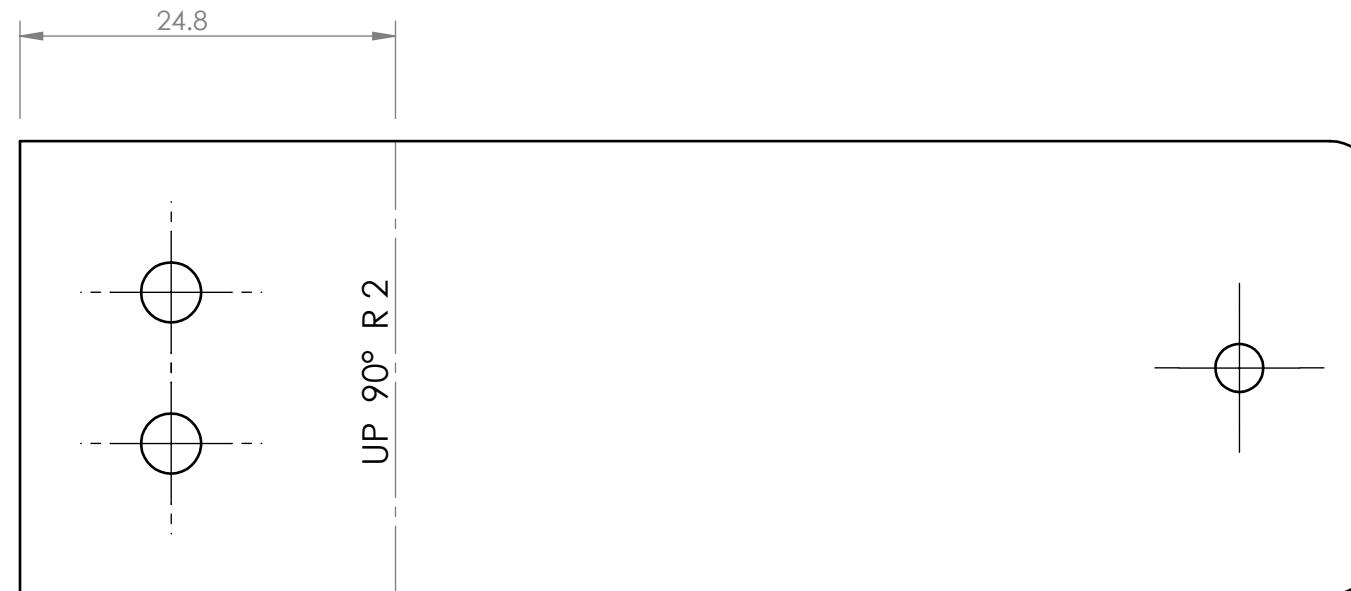
D

C

C

B

B



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen	TITLE: Gear System Support
Comments: Sheet metal thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13	SIZE Part supplier/manufacturer REV B Alex Sauve A
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	SCALE: 2:1 Mass: 16.58 SHEET 26 OF 117
			Saturday, April 05, 2014 9:51:32 AM Sunday, March 09, 2014 1:45:27 PM

8 7 6 5 4 3 2 1

D

D

C

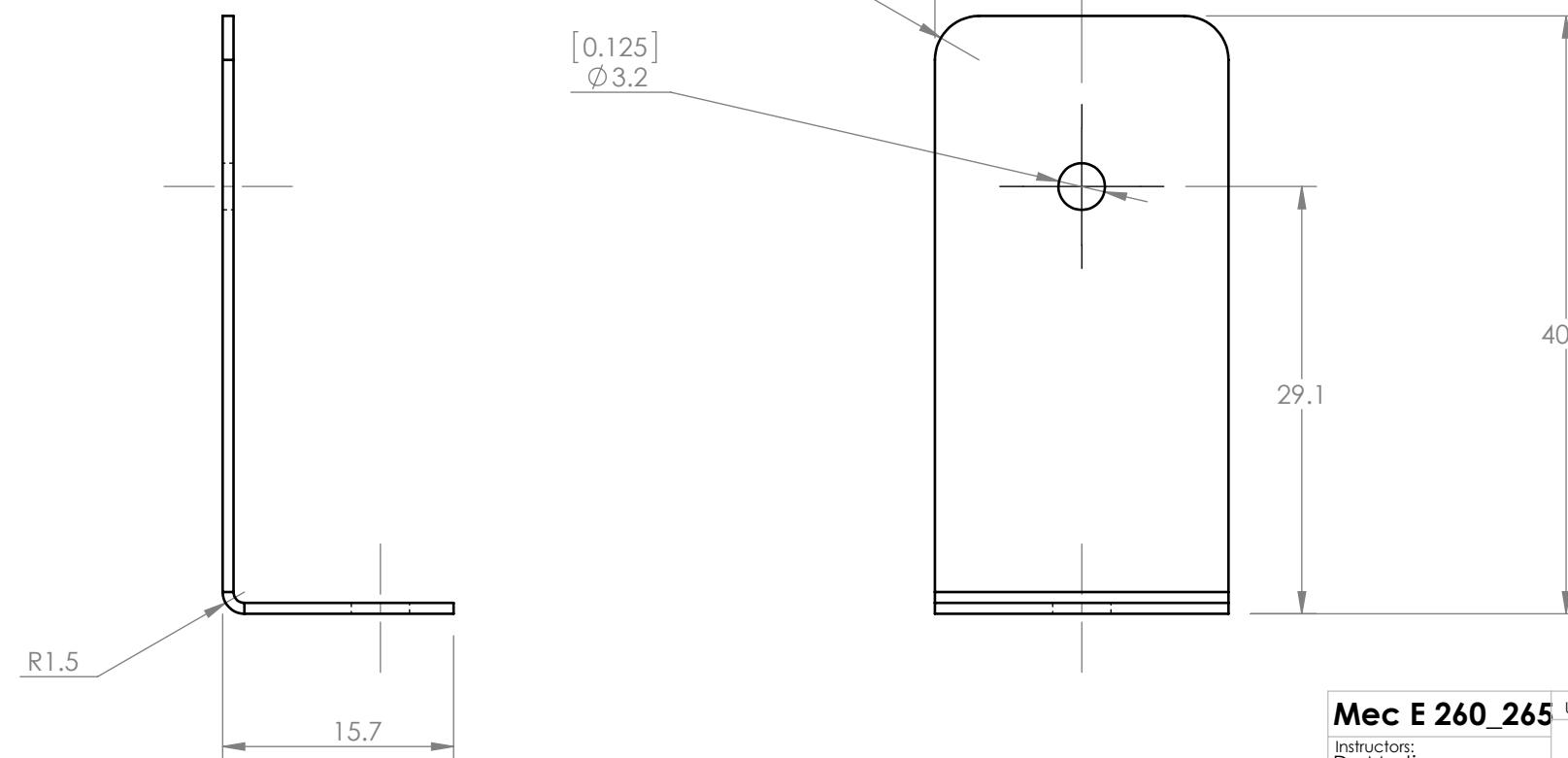
C

B

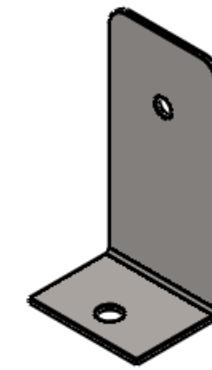
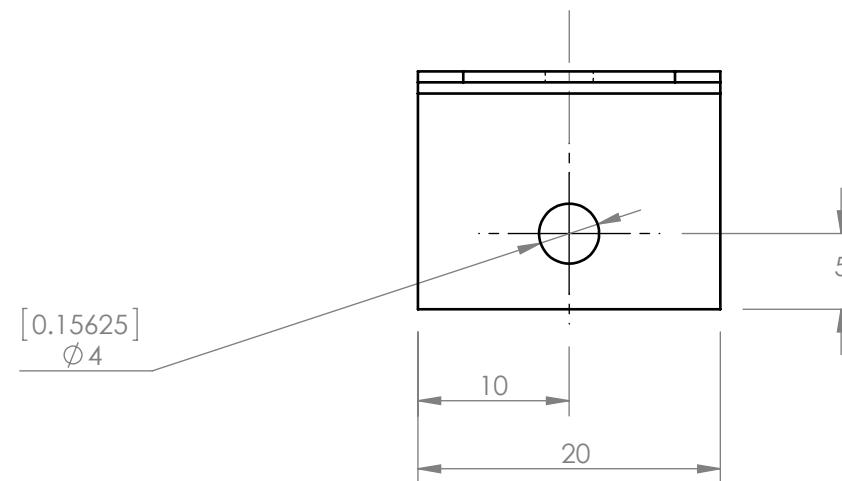
B

A

A



**SolidWorks Student Edition.
For Academic Use Only.**



Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY:
Instructors: Dr. Mertiny Dr. Duke Winter 2014		DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Drew Gingras
Comments: Sheet metal thickness = 0.74mm		SURFACE FINISH $0.6 \mu\text{m}$	Ole Einar Bjørndalen
		DO NOT SCALE DRAWING	13
			SM By Reviewed by Saturday, April 05, 2014 9:51:33 AM Tuesday, March 18, 2014 3:51:16 PM
MATERIAL: Plain Carbon Steel			Alex Sauve Mec33
FILE NAME: Motor 1 Worm Support			Saturday, April 05, 2014 9:51:33 AM Tuesday, March 18, 2014 3:51:16 PM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Motor 1 Worm Support

SIZE	Part supplier/manufacturer	REV
B	Boston Maris	A
SCALE: 2:1	Mass: 6.21	SHEET 27 OF 117

8 7 6 5 4 3 2 1



D

D

C

C

B

B

A

A

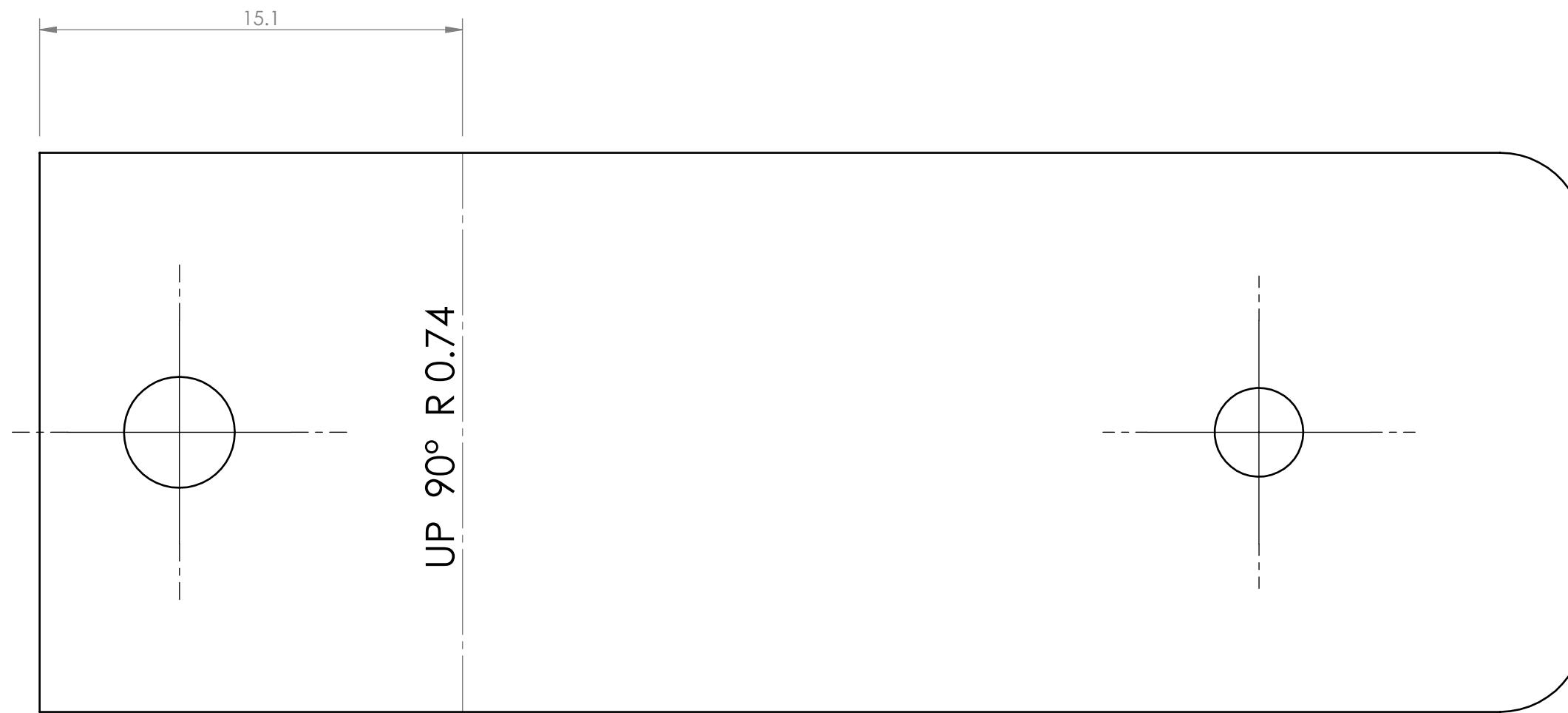
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Comments: Sheet metal thickness = 0.74mm	Group name Ole Einar Bjørndalen	
		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
		Saturday, April 05, 2014 9:51:33 AM Tuesday, March 18, 2014 3:51:16 PM	
	MATERIAL: Plain Carbon Steel	SIZE B	Part supplier/manufacturer Boston Maris
	FILE NAME: Motor 1 Worm Support	REV A	
		SCALE: 5:1	Mass: 6.21
			SHEET 28 OF 117

8 7 6 5 4 3 2 1

D

D



C

C

B

B

A

A

**SolidWorks Student Edition.
For Academic Use Only.**

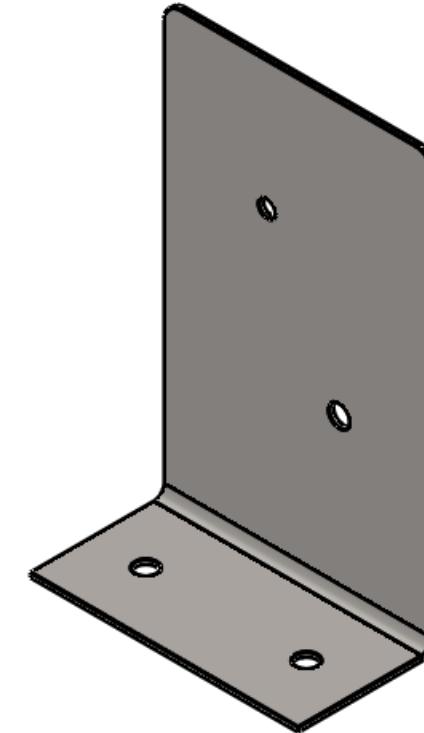
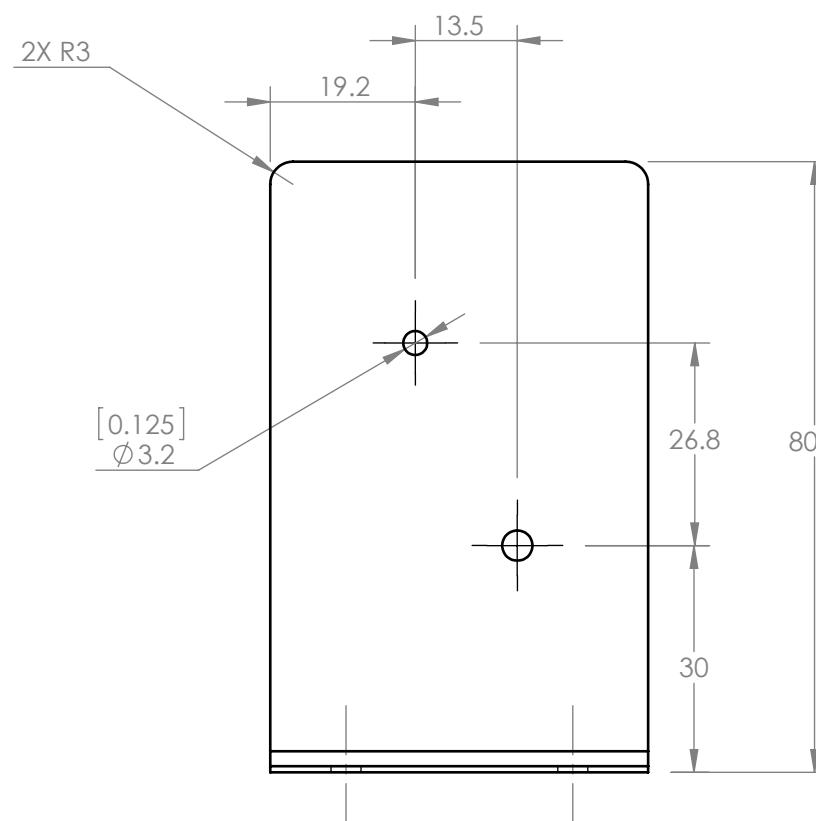
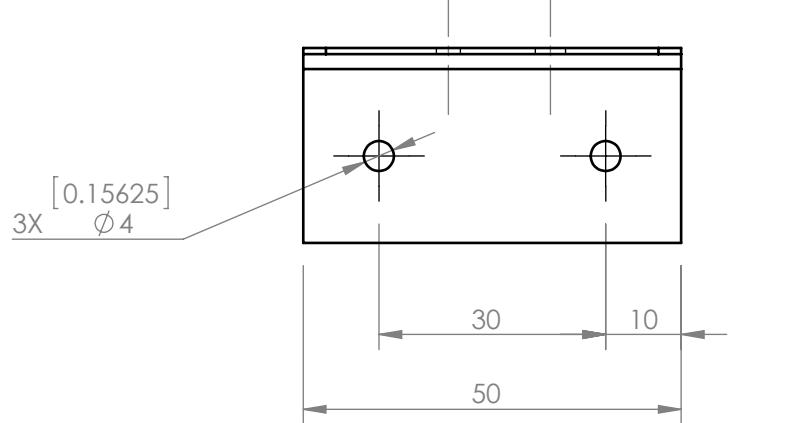
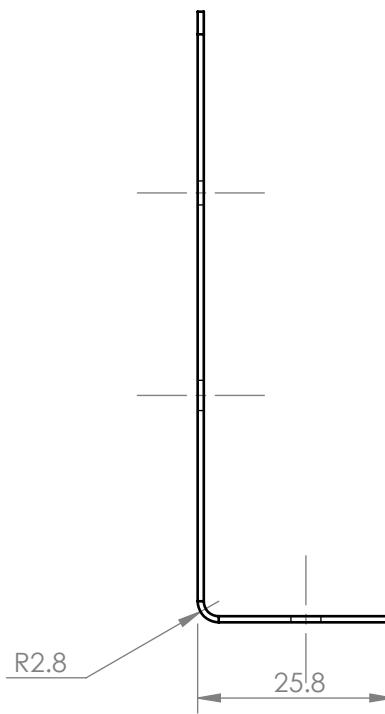
Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Comments: Sheet metal thickness = 0.74mm	Group name Ole Einar Bjørndalen	TITLE: Motor 1 Worm Support
		Group number 13	
		SM By Drew Gingras	SIZE B
		Reviewed by Alex Sauve Mec33	Part supplier/manufacturer Boston Maris
			REV A
			SCALE: 5:1
			Mass: 6.21
			SHEET 29 OF 117

8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

D

D



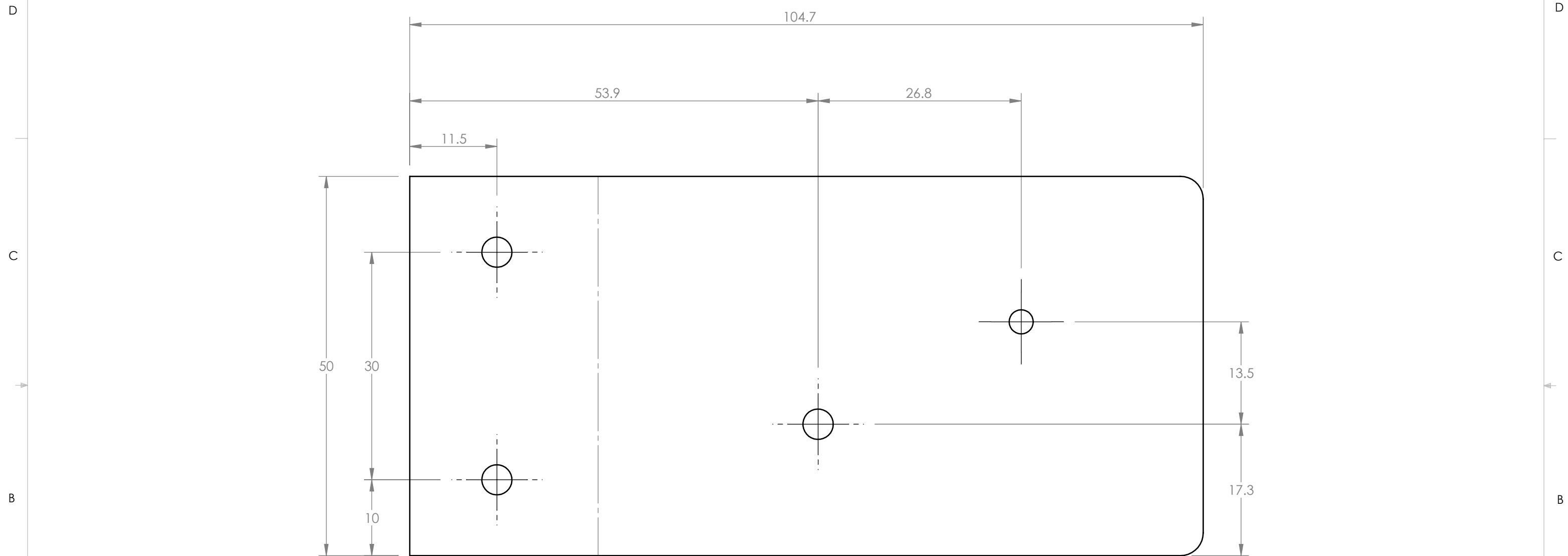
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED:
Instructors: Dr. Mertiny Dr. Duke Winter 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$
Comments: Sheet metal thickness = 0.74mm	SURFACE FINISH $0.6 \mu\text{m}$
	DO NOT SCALE DRAWING
	MATERIAL: Plain Carbon Steel
	FILE NAME: Gear System Support 2

DRAWN BY:	Drew Gingras
Group name	Ole Einar Bjørndalen
Group number	13
SM By	Drew Gingras
Reviewed by	Alex Sauve Mec33

The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	TITLE: Gear System Support 2	A
SIZE B	Part supplier/manufacturer Kevin O'Rourke	REV A
SCALE: 1:1	Mass: 32.38	SHEET 30 OF 117

8 7 6 5 4 3 2 1



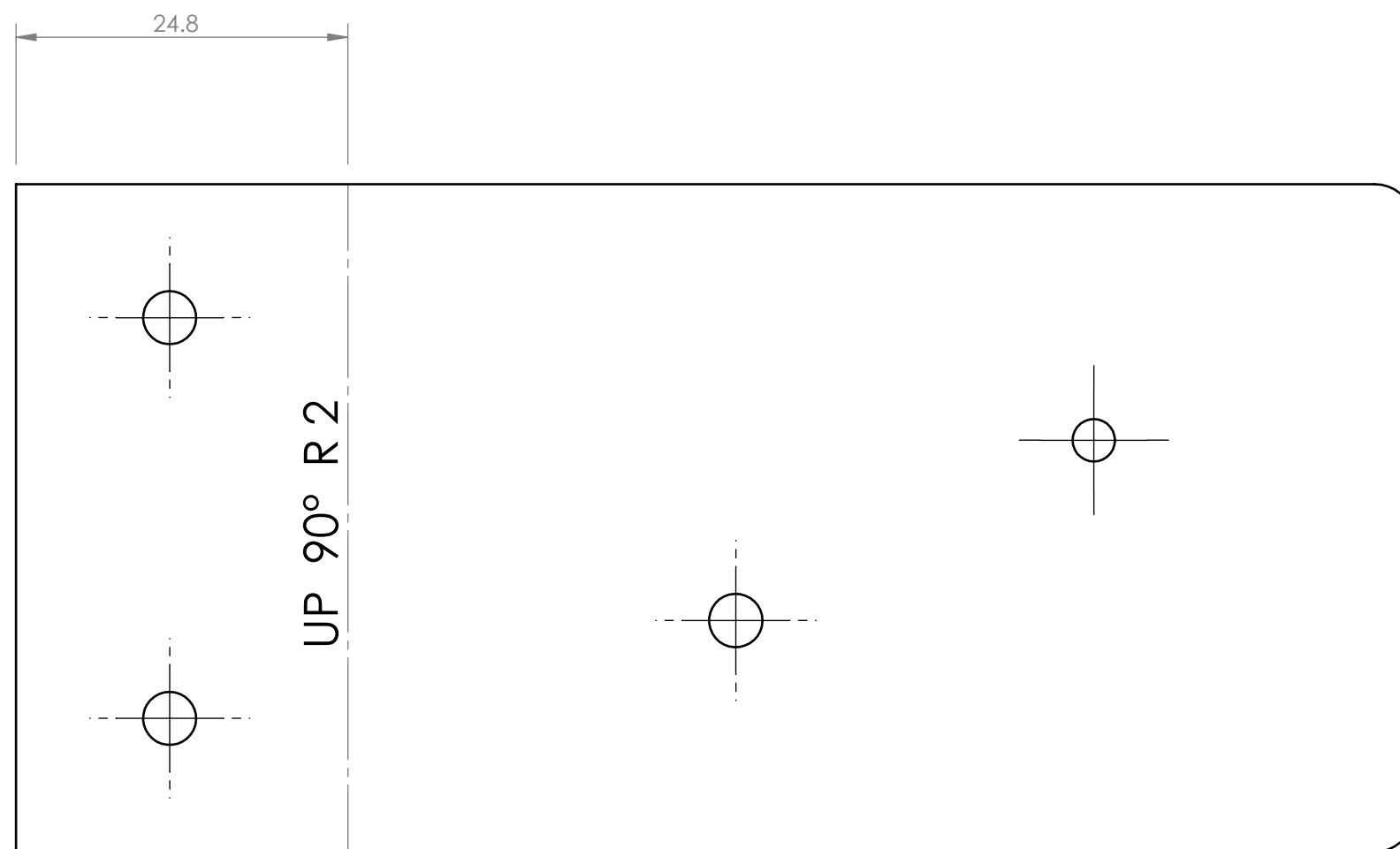
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Ayrancı Dr. Duke Fall 2013 Comments: Sheet metal thickness = 0.74mm	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen	TITLE: Gear System Support 2
	DO NOT SCALE DRAWING	Group number 13	SIZE B
	MATERIAL: Plain Carbon Steel	SM By Drew Gingras	Part supplier/manufacturer Kevin O'Rourke
	FILE NAME: Gear System Support 2	Reviewed by Mec33	REV A
		Saturday, April 05, 2014 9:51:33 AM Monday, March 10, 2014 9:16:14 PM	SCALE: 1:5
		Mass: 32.38	SHEET 31 OF 117

8 7 6 5 4 3 2 1

D

D



C

C

B

B

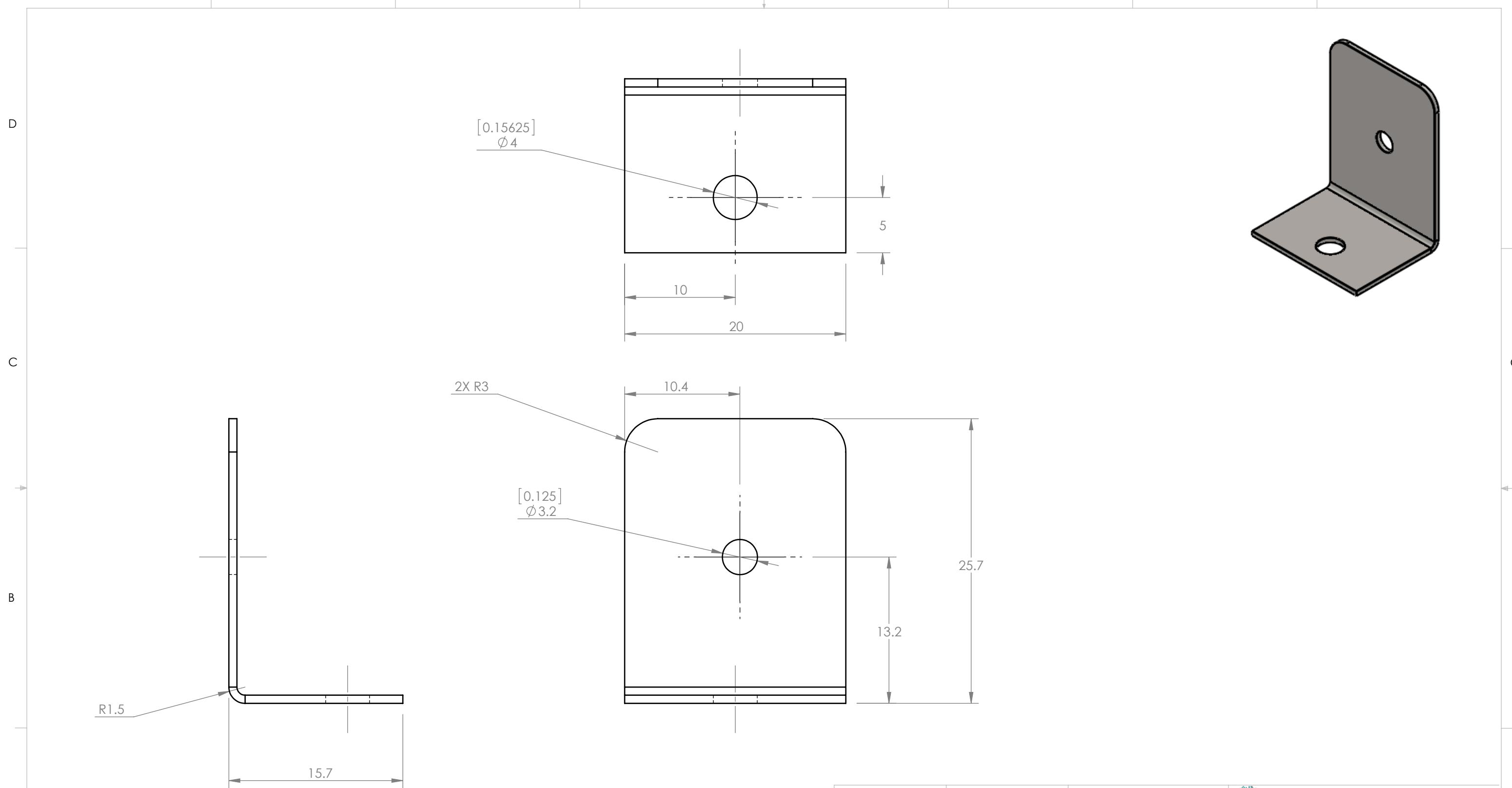
A

A

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014		Group name Ole Einar Bjørndalen	TITLE: Gear System Support 2
Comments: Sheet metal thickness = 0.74mm		Group number 13	
		SM By Drew Gingras	
	DO NOT SCALE DRAWING	Reviewed by Alex Sauve Mec33	
MATERIAL: Plain Carbon Steel			SIZE Part supplier/manufacturer REV B Kevin O'Rourke A
FILE NAME: Gear System Support 2			SCALE: 2:1 Mass: 32.38 SHEET 32 OF 117
			Saturday, April 05, 2014 9:51:33 AM Monday, March 10, 2014 9:16:14 PM

8 7 6 5 4 3 2 1



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras
Instructors: Dr. Mertiny Dr. Duke Winter 2014		Group name Ole Einar Bjørndalen	
Comments: Sheet metal thickness = 0.74mm		Group number 13	
		SM By Drew Gingras	
DO NOT SCALE DRAWING		Reviewed by Alex Sauve Mec33	
MATERIAL: Plain Carbon Steel		Saturday, April 05, 2014 9:51:33 AM Saturday, March 29, 2014 10:26:06 AM	
FILE NAME: Motor 2 Worm Support			
SIZE B	Part supplier/manufacturer Drew Gingras	REV B	
SCALE: 3:1	Mass: 4.49	SHEET 33 OF 117	

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Motor 2 Worm Support

8

7

6

5

4

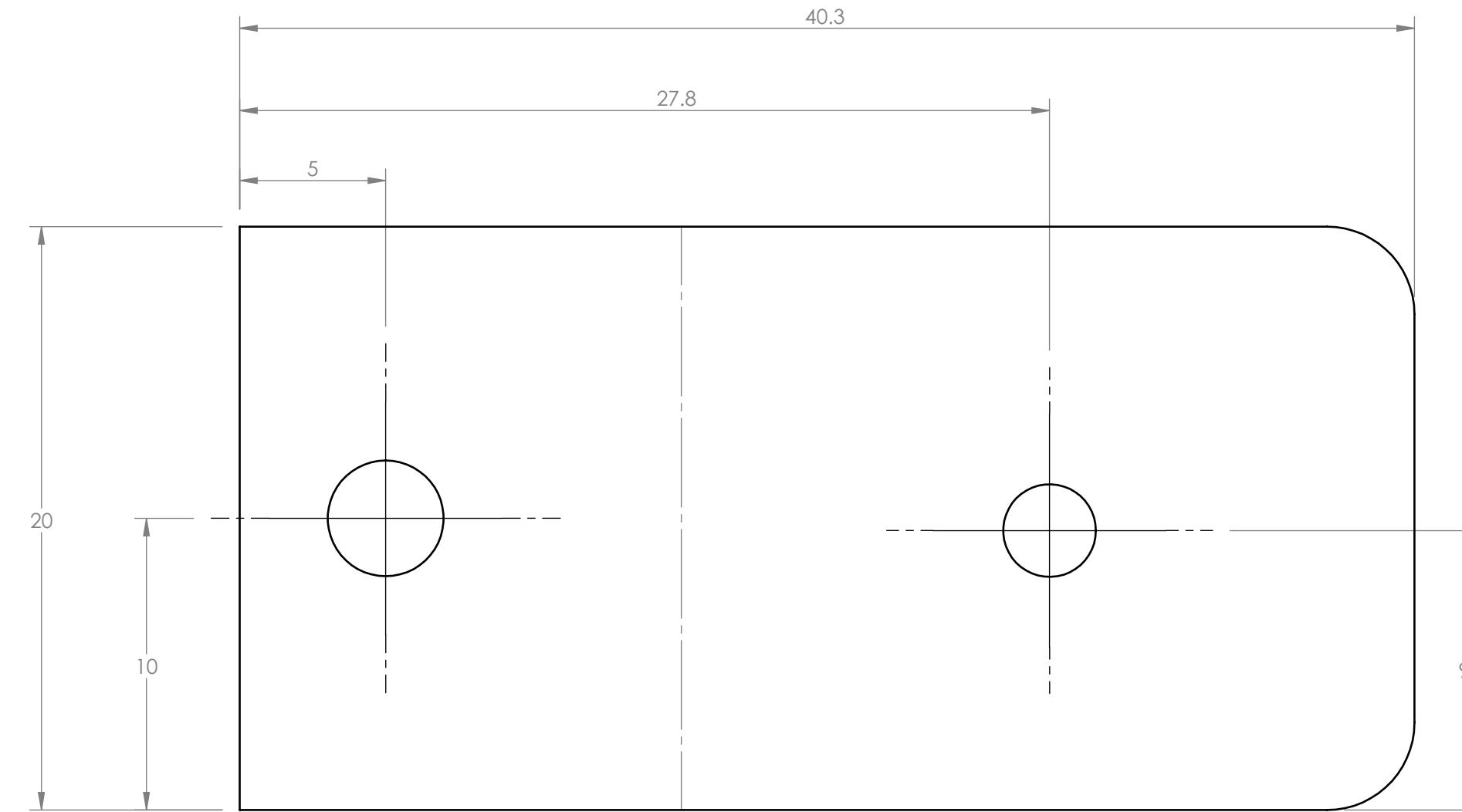
3

2

1

D

D



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Group name Ole Einar Bjørndalen	
Comments: Sheet metal thickness = 0.74mm	Group number 13	
	SM By Drew Gingras	
	Reviewed by Alex Sauve Mec33	
	FILE NAME: Motor 2 Worm Support	
	Saturday, April 05, 2014 9:51:33 AM Saturday, March 29, 2014 10:26:06 AM	
SIZE	Part supplier/manufacturer	REV
B	Drew Gingras	B
SCALE: 5:1	Mass: 4.49	SHEET 34 OF 117

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Motor 2 Worm Support

SIZE Part supplier/manufacturer REV
B Drew Gingras B

SCALE: 5:1 Mass: 4.49 SHEET 34 OF 117

8 7 6 5 4 3 2 1

D

D

C

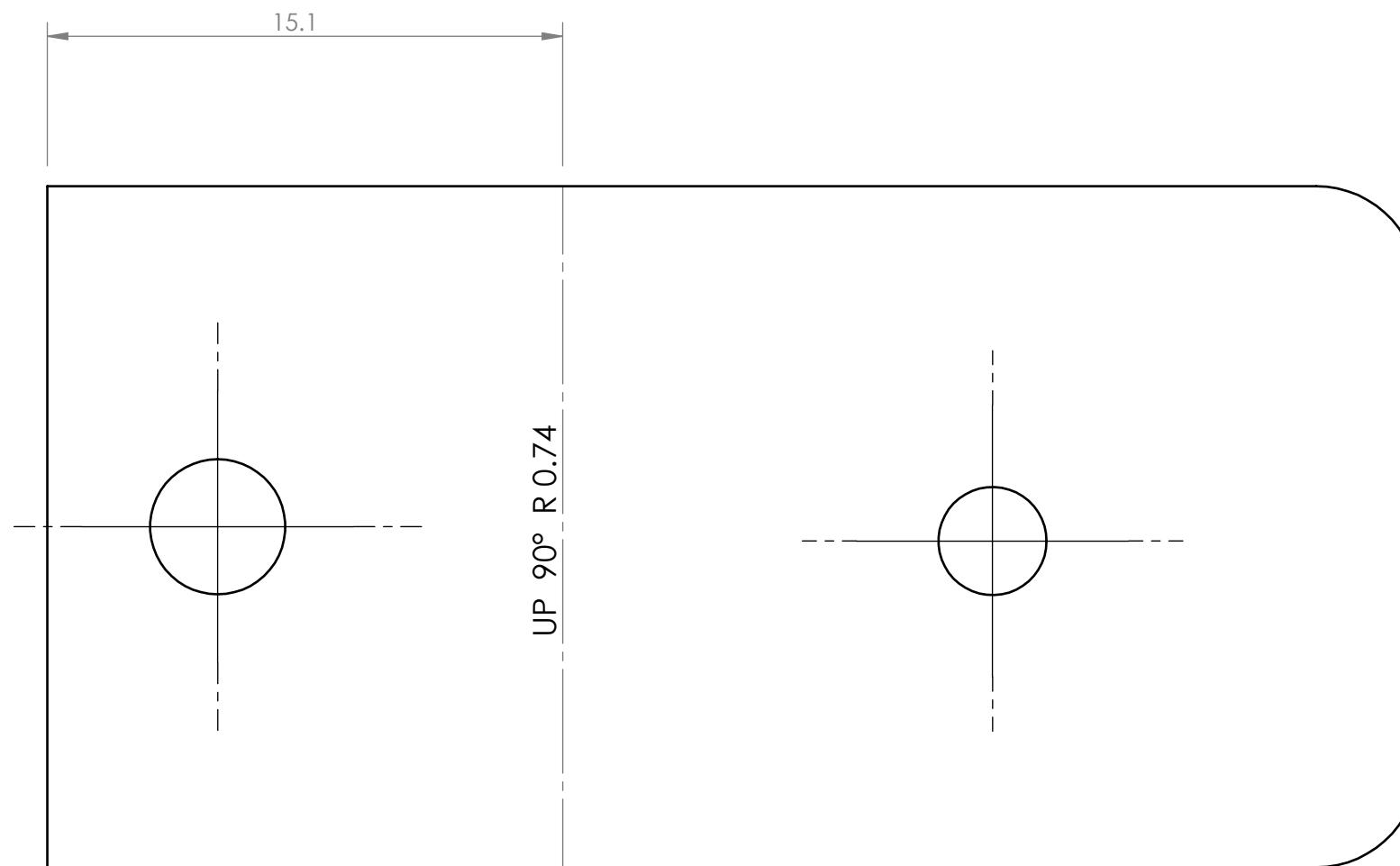
C

B

B

A

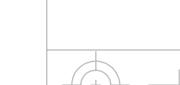
A



Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke Winter 2014

Comments:
Sheet metal thickness =
0.74mm



MATERIAL:

Plain Carbon Steel

FILE NAME:

Motor 2 Worm Support

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR

X = ± 0.5
X.X = ± 0.1
X.XX = ± 0.025

SURFACE FINISH

0.6 μm

DO NOT SCALE DRAWING

DRAWN BY:
Drew Gingras

Group name
Ole Einar
Bjørndalen

Group number
13

SM By
Drew Gingras

Reviewed by
Alex Sauve
Mec33

Saturday, April 05, 2014 9:51:33 AM
Saturday, March 29, 2014 10:26:06 AM



The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

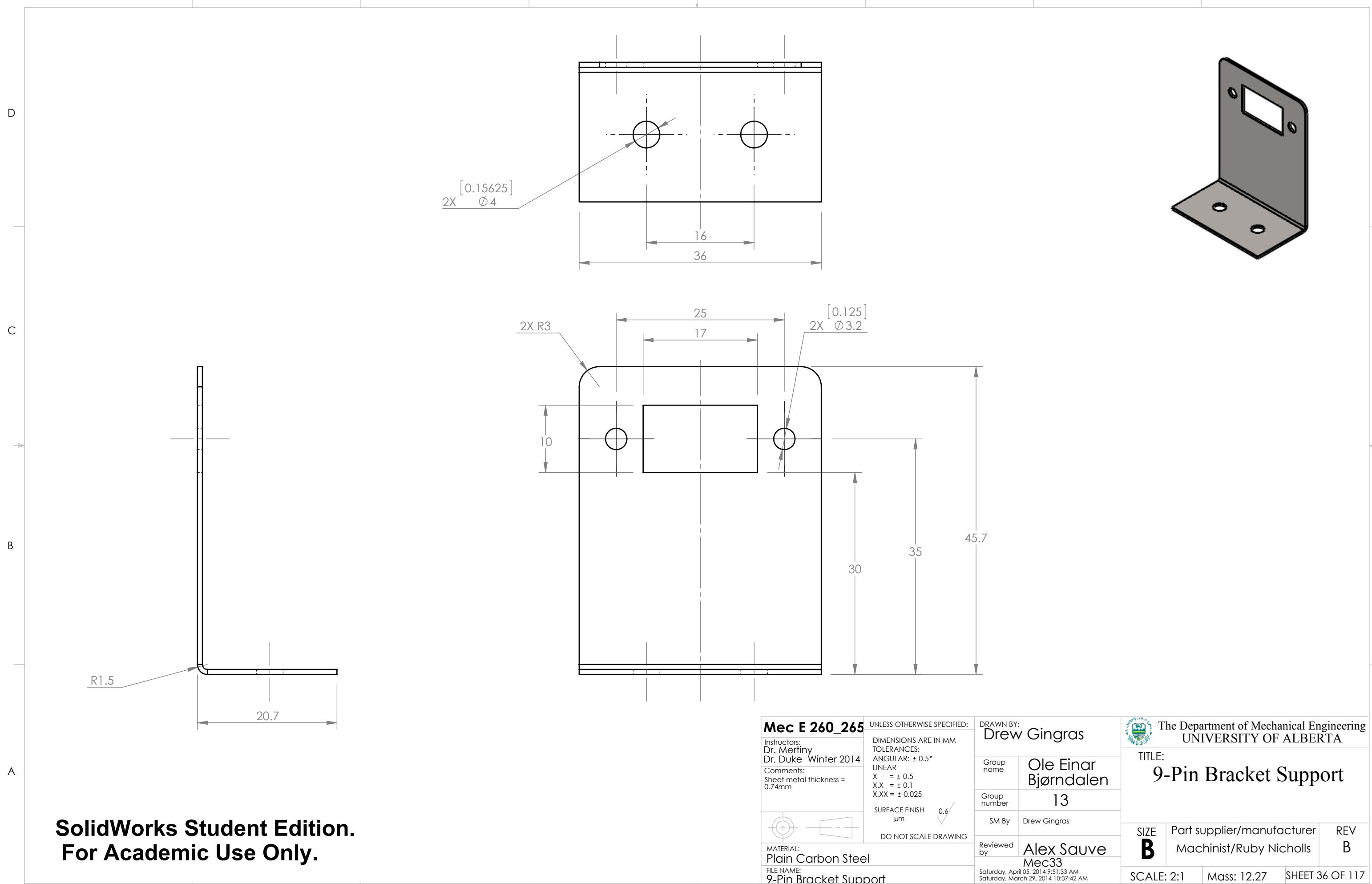
TITLE:
Motor 2 Worm Support

SIZE **B** Part supplier/manufacturer **Drew Gingras** REV **B**

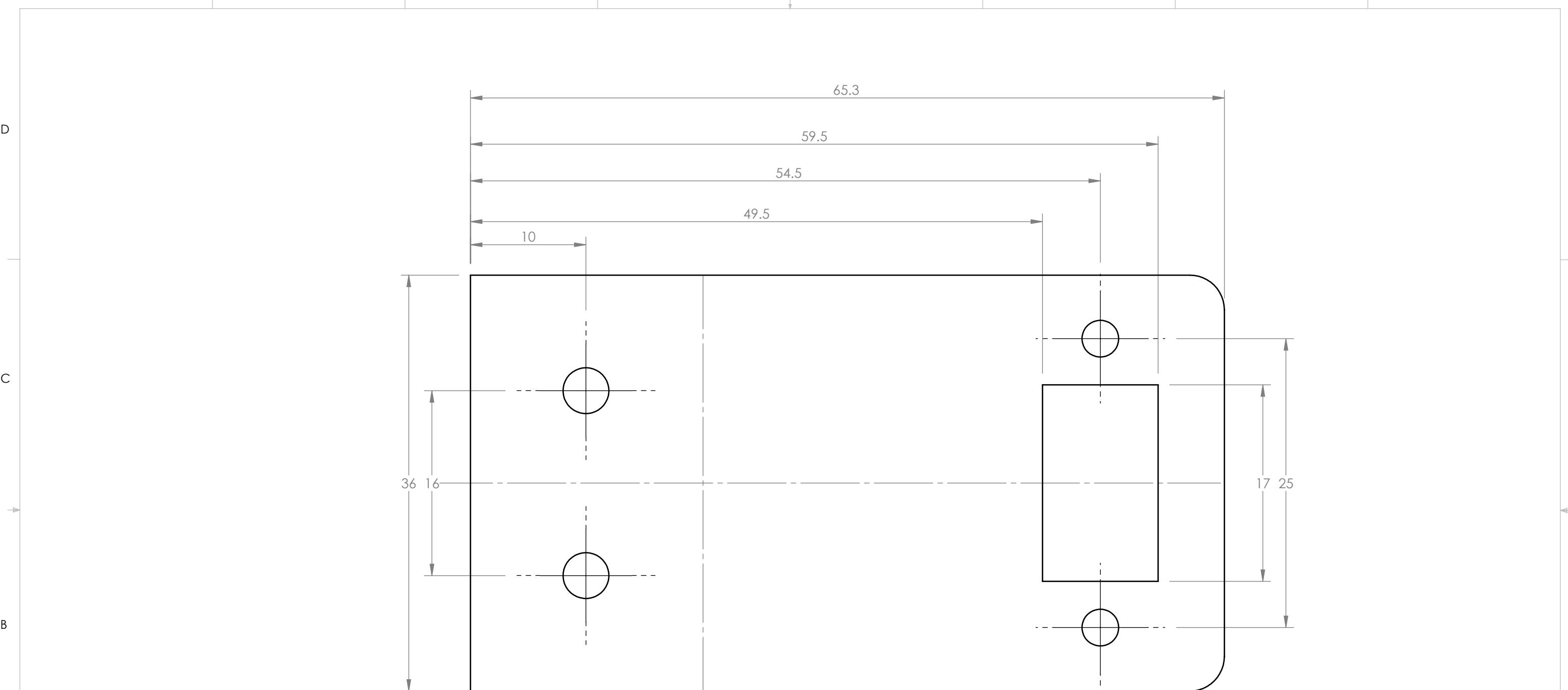
SCALE: 5:1 Mass: 4.49 SHEET 35 OF 117

**SolidWorks Student Edition.
For Academic Use Only.**

8 7 6 5 4 3 2 1



8 7 6 5 4 3 2 1



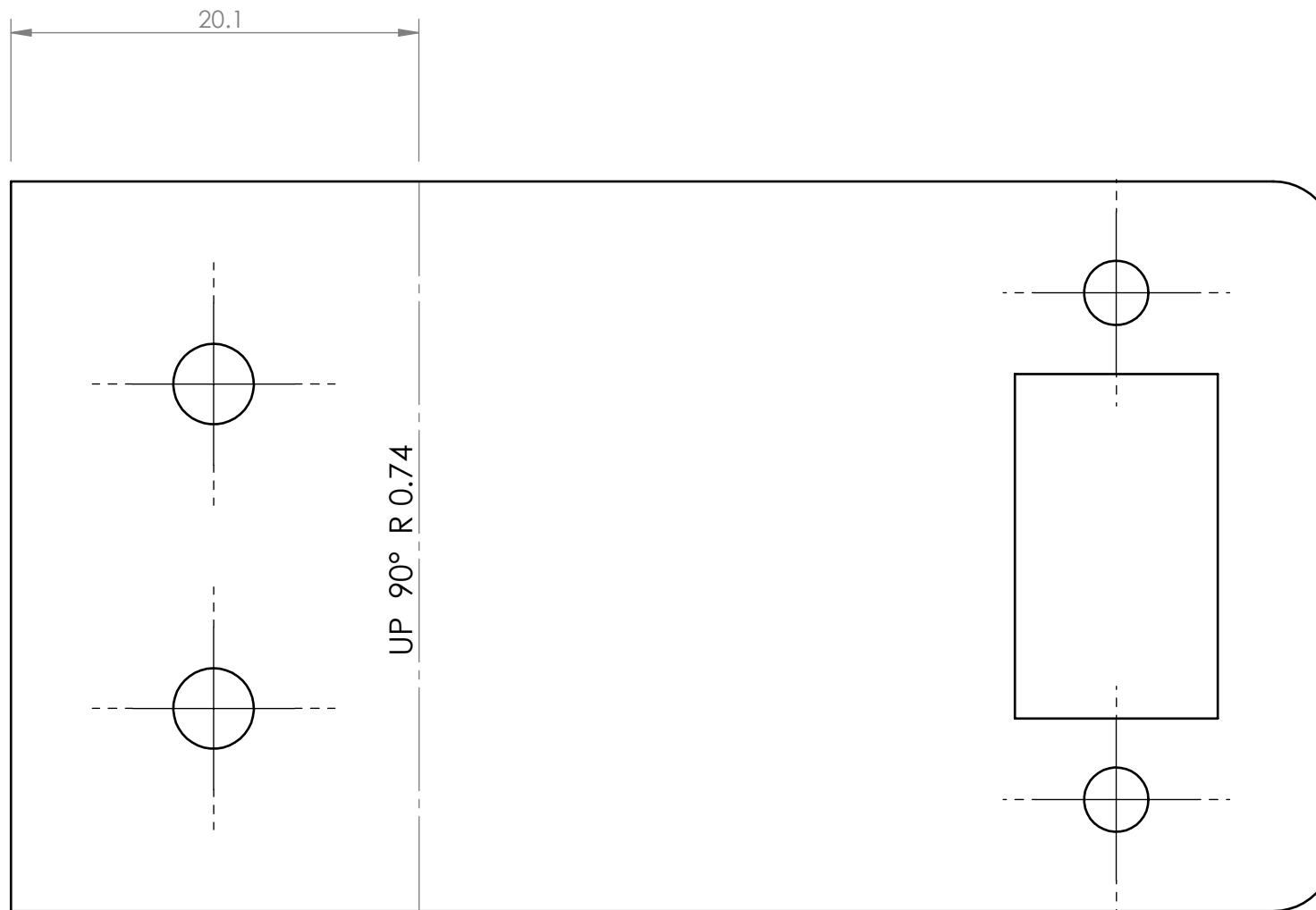
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Comments: Sheet metal thickness = 0.74mm	Group name Ole Einar Bjørndalen	
		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
		Saturday, April 05, 2014 9:51:33 AM Saturday, March 29, 2014 10:37:42 AM	
	MATERIAL: Plain Carbon Steel	SIZE B	Part supplier/manufacturer Machinist/Ruby Nicholls
	FILE NAME: 9-Pin Bracket Support	REV B	
		SCALE: 3:1	Mass: 12.27
			SHEET 37 OF 117

8 7 6 5 4 3 2 1

D

D



C

C

B

B

A

A

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Winter 2014		Group name Ole Einar Bjørndalen	
Comments: Sheet metal thickness = 0.74mm		Group number 13	
		SM By Drew Gingras	
		Reviewed by Alex Sauve Mec33	
			Saturday, April 05, 2014 9:51:33 AM Saturday, March 29, 2014 10:37:42 AM
MATERIAL: Plain Carbon Steel	DO NOT SCALE DRAWING 0.6 μm		
FILE NAME: 9-Pin Bracket Support			
			SIZE B Part supplier/manufacturer REV Machinist/Ruby Nicholls B
			SCALE: 3:1 Mass: 12.27 SHEET 38 OF 117

8 7 6 5 4 3 2 1

D

D

C

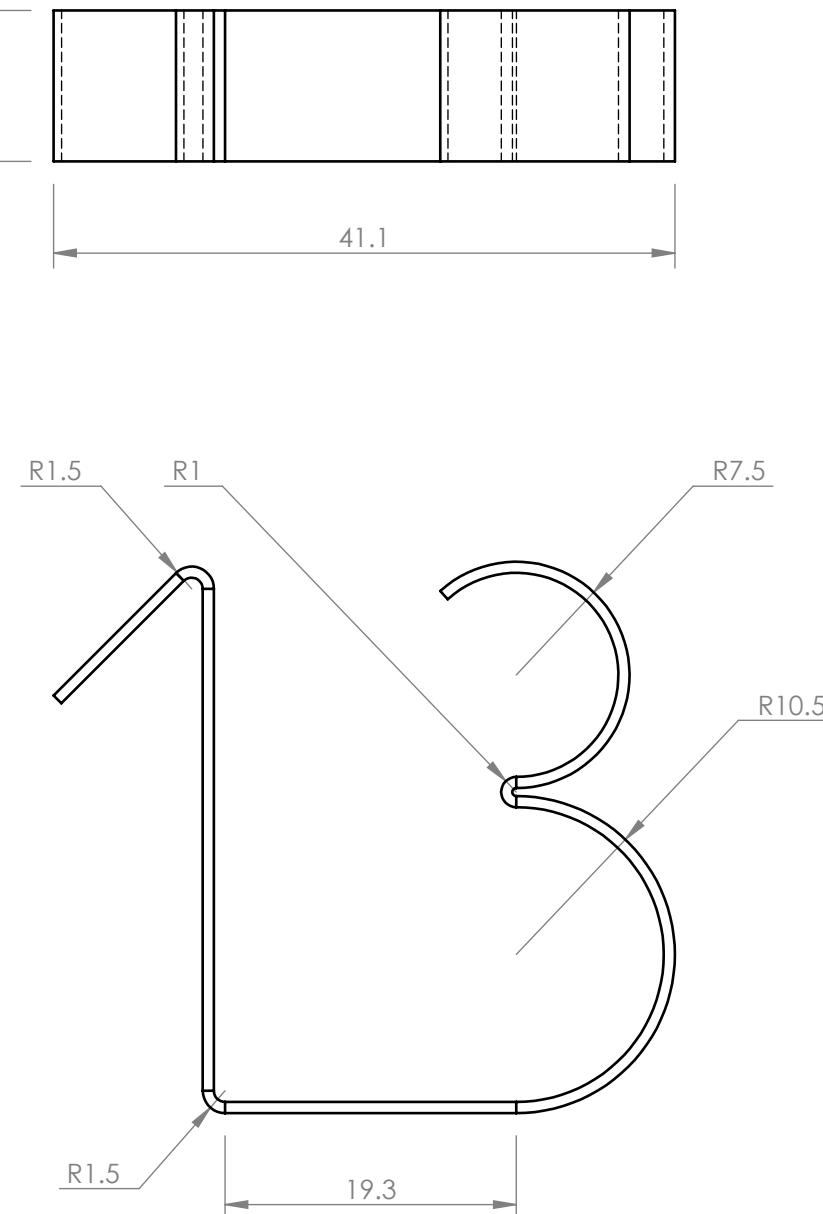
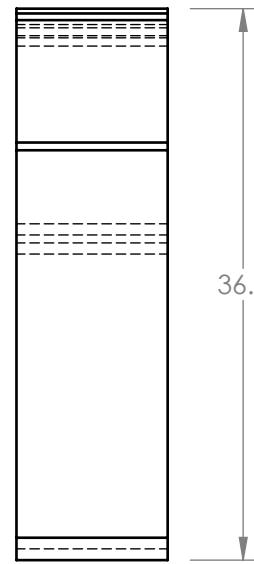
C

B

B

A

A



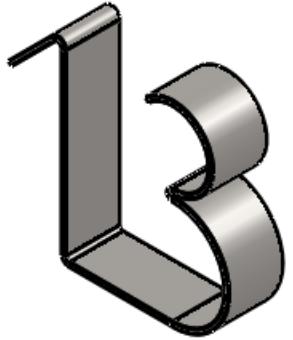
Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras
Instructors: Dr. Mertiny Dr. Duke Winter 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name Ole Einar Bjørndalen
Comments: Sheet metal thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13
		SM By Drew Gingras
		Reviewed by Alex Sauve Mec33
MATERIAL: Plain Carbon Steel	Saturday, April 05, 2014 9:51:33 AM	SIZE B
FILE NAME: GROUP 13! - The 13	Saturday, March 29, 2014 10:54:08 AM	Part supplier/manufacturer Alex Sauve

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
GROUP 13! - The 13

SIZE B	Part supplier/manufacturer Alex Sauve	REV B
SCALE: 2:1	Mass: 7.45	SHEET 39 OF 117

SolidWorks Student Edition.
For Academic Use Only.



8

7

6

5

4

3

2

1

D

D

C

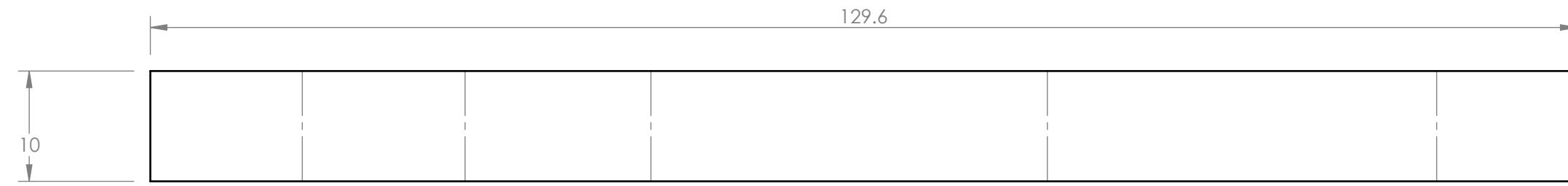
C

B

B

A

A



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
Instructors: Dr. Mertiny Dr. Duke Winter 2014	Comments: Sheet metal thickness = 0.74mm	Group name Ole Einar Bjørndalen	Group number 13	TITLE: GROUP 13! - The 13	
		Group number 13	SM By Drew Gingras		
		Reviewed by Alex Sauve Mec33		SIZE B	REV B
		FILE NAME: GROUP 13! - The 13	Saturday, April 05, 2014 9:51:33 AM Saturday, March 29, 2014 10:54:08 AM	Part supplier/manufacturer Alex Sauve	SCALE: 2:1 Mass: 7.45 SHEET 40 OF 117

8

7

6

5

4

3

2

1

D

D

C

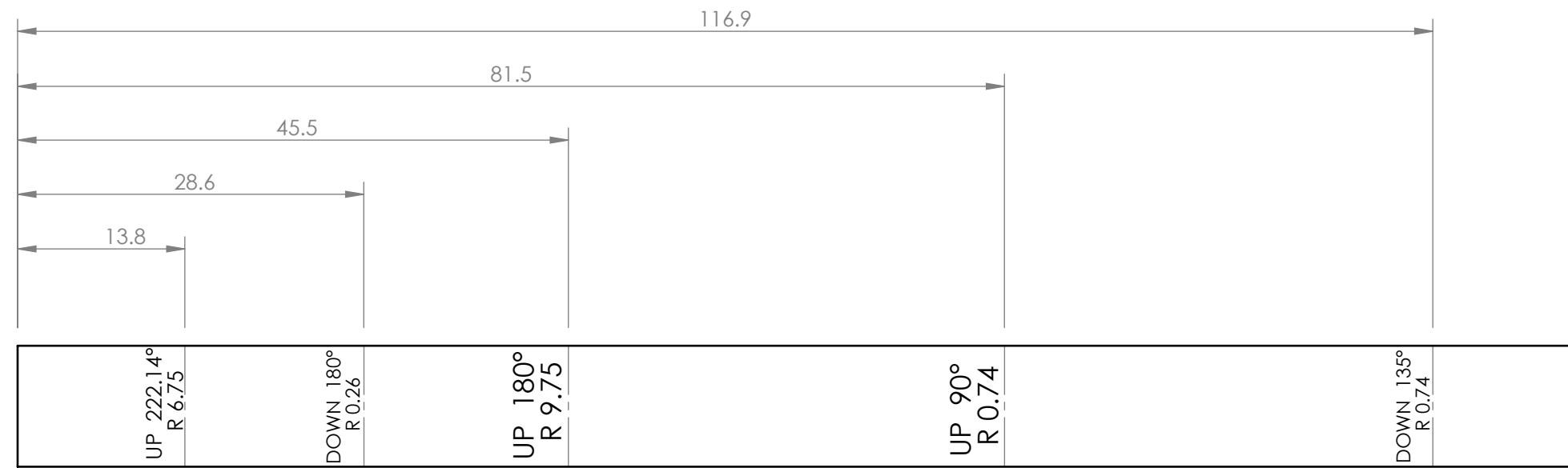
C

B

B

A

A



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Drew Gingras
Instructors: Dr. Mertiny Dr. Duke Winter 2014		Group name Ole Einar Bjørndalen	
Comments: Sheet metal thickness = 0.74mm		Group number 13	
		SM By Drew Gingras	
MATERIAL: Plain Carbon Steel		Reviewed by Alex Sauve Mec33	
FILE NAME: GROUP 13! - The 13		Saturday, April 05, 2014 9:51:33 AM Saturday, March 29, 2014 10:54:08 AM	
SIZE B	Part supplier/manufacturer Alex Sauve	REV B	
SCALE: 2:1	Mass: 7.45	SHEET 41 OF 117	

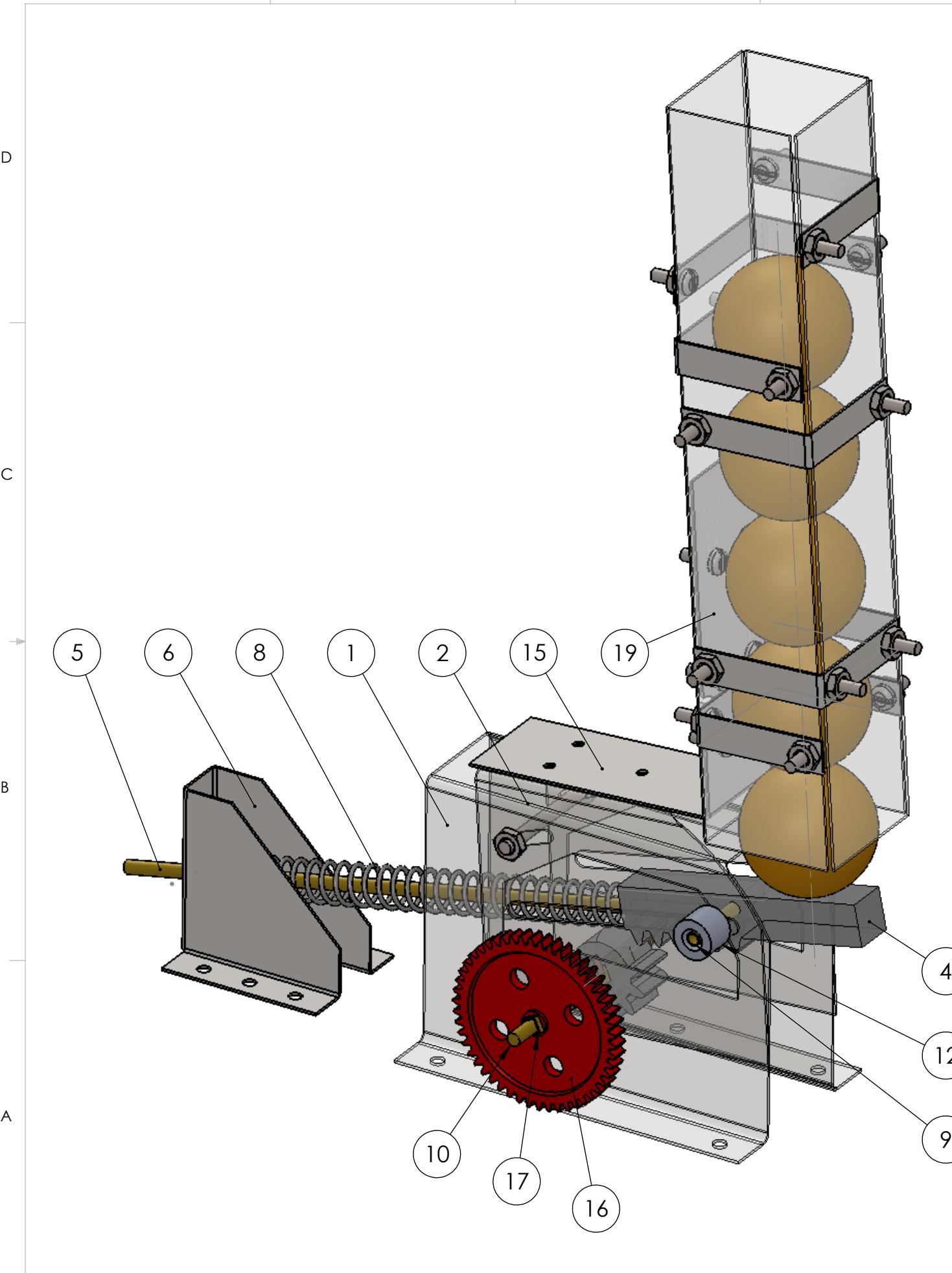
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
GROUP 13! - The 13

SOLIDWORKS

2014

8 7 6 5 4 3 2 1



ITEM NO.	PART NUMBER	MATERIAL	MODEL AUTHOR	SHEET NO.	QTY.
1	Interior Shot Support	Plain Carbon Steel	Alexandre Sauve	45, 46, 47	1
2	Angle Adjuster	Plain Carbon Steel	Alexandre Sauve	54, 55, 56	1
3	Trigger Gear	PE High Density	Alexandre Sauve	64	1
4	Trigger Rack	PE High Density	Alexandre Sauve	63	1
5	Shaft Hollow 5-32in	Brass	Alexandre Sauve	58	1
6	back support	Plain Carbon Steel	Alexandre Sauve	48, 49, 50	1
7	tube segment 5-32 square	Brass	Alexandre Sauve	60	1
8	Spring	AISI 316 Stainless Steel Sheet (SS)	N/A	N/A	1
9	Trigger Rack Pin 5_32in hollow	Brass	Alexandre Sauve	57	1
10	Shaft Solid 4mm	Brass	Alexandre Sauve	59	1
11	ping pong ball	Plastic	Alexandre Sauve	N/A	5
12	Collar 1-4in	1060 Alloy	Alexandre Sauve	N/A	2
13	B18.6.7M - M4 x 0.7 x 40 Slotted PHMS -40N	Plain Carbon Steel	Solidworks Toolbox	N/A	1
14	B18.2.4.5M - Hex jam nut, M5 x 0.8 --D-N	Plain Carbon Steel	Solidworks Toolbox	N/A	7
15	L-bracket	Plain Carbon Steel	Alexandre Sauve	51, 52, 53	1
16	Metric - Spur gear 1M 50T 20PA 5FW ---S50N75H50L3N	ABS Plastic	Alexandre Sauve	62	1
17	Square tubing - big	Brass	Alexandre Sauve	61	1
18	Axle to Tubing Locking S Bend	Copper	Alexandre Sauve	111	3
19	Hopper Subassembly	Various Materials	Alexandre Sauve	65-75	1

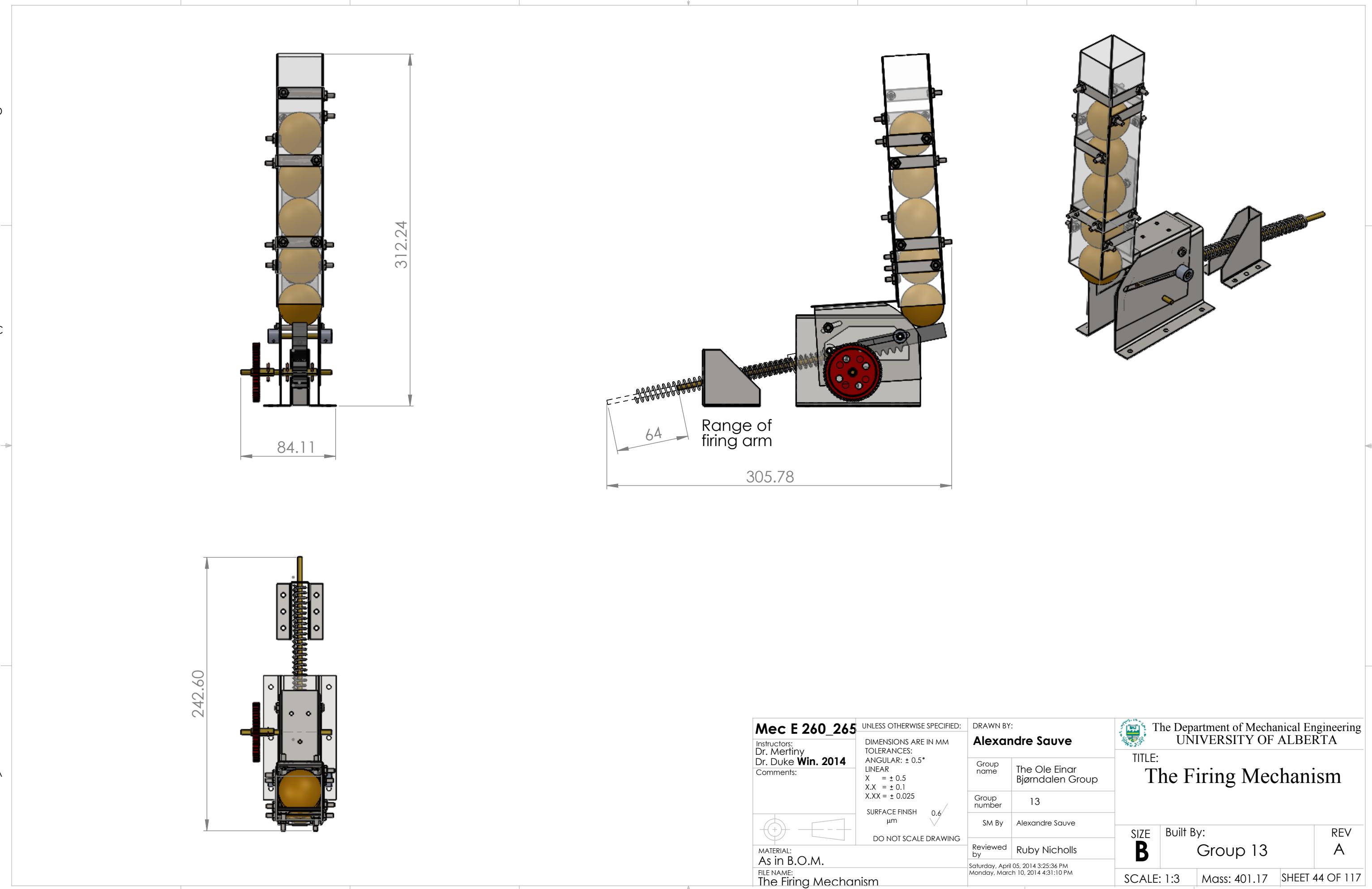
Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke	Comments: Win. 2014	Group name The Ole Einar Bjørndalen Group	
		Group number 13	
		SM By Alexandre Sauve	
		Reviewed by Ruby Nicholls	
		Saturday, April 05, 2014 3:25:36 PM Monday, March 10, 2014 4:31:10 PM	
TITLE: The Firing Mechanism		SIZE B Built By: Alexandre Sauve REV A	
FILE NAME: The Firing Mechanism		SCALE: 3:4 Mass: 401.17 SHEET 42 OF 117	

8 7 6 5 4 3 2 1

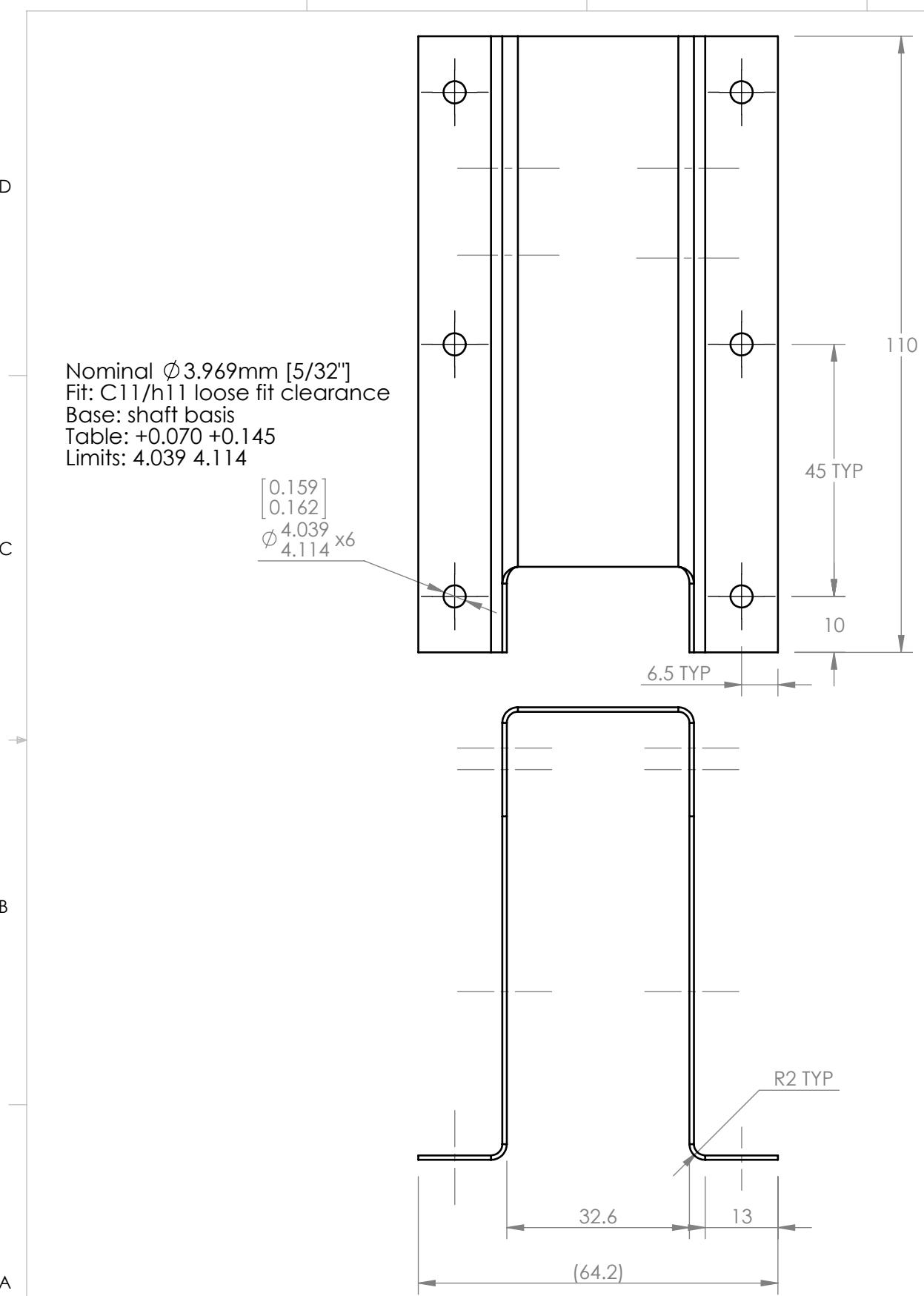
The diagram shows the exploded view of the Firing Mechanism. Components are labeled 1 through 19. The parts include an interior shot support (1), angle adjuster (2), trigger gear (3), trigger rack (4), shaft hollow (5), back support (6), tube segment (7), spring (8), trigger rack pin (9), ping pong ball (10), collar (11), L-bracket (12), slotted PHMS (13), hex jam nut (14), spur gear (15), axle to tubing locking S bend (16), square tubing (17), and a hopper assembly (18).

ITEM NO.	PART NAME	MATERIAL	SW-Author (Author)	SHEET NO.	QTY.
1	Interior Shot Support	Plain Carbon Steel	Alexandre Sauve	45,46,47	1
2	Angle Adjuster	Plain Carbon Steel	Alexandre Sauve		1
3	Trigger Gear	PE High Density	Alexandre Sauve		1
4	Trigger Rack	PE High Density	Alexandre Sauve		1
5	Shaft Hollow 5-32in	Brass	Alexandre Sauve		1
6	back support	Plain Carbon Steel	Alexandre Sauve		1
7	tube segment 5-32 square	Brass	Alexandre Sauve		1
8	Spring	AISI 316 Stainless Steel Sheet (SS)	N/A		1
9	Trigger Rack Pin 5_32in hollow	Brass	Alexandre Sauve		1
10	Shaft Solid 4mm	Brass	Alexandre Sauve		1
11	ping pong ball	Plastic	N/A		5
12	Collar 1-4in	1060 Alloy	Alexandre Sauve		2
13	B18.6.7M - M4 x 0.7 x 40 Slotted PHMS --40N	Plain Carbon Steel	Solidworks Toolbox		1
14	B18.2.4.5M - Hex jam nut, M5 x 0.8 --D-N	Plain Carbon Steel	Solidworks Toolbox		7
15	L-bracket	Plain Carbon Steel	Alexandre Sauve		1
16	Metric - Spur gear 1M 50T 20PA 5FW --S50N75H50L3N	ABS Plastic	ABS Plastic		1
17	Square tubing - big	Brass	Alexandre Sauve		1
18	Axle to Tubing Locking S Bend	Copper	Alexandre Sauve		3

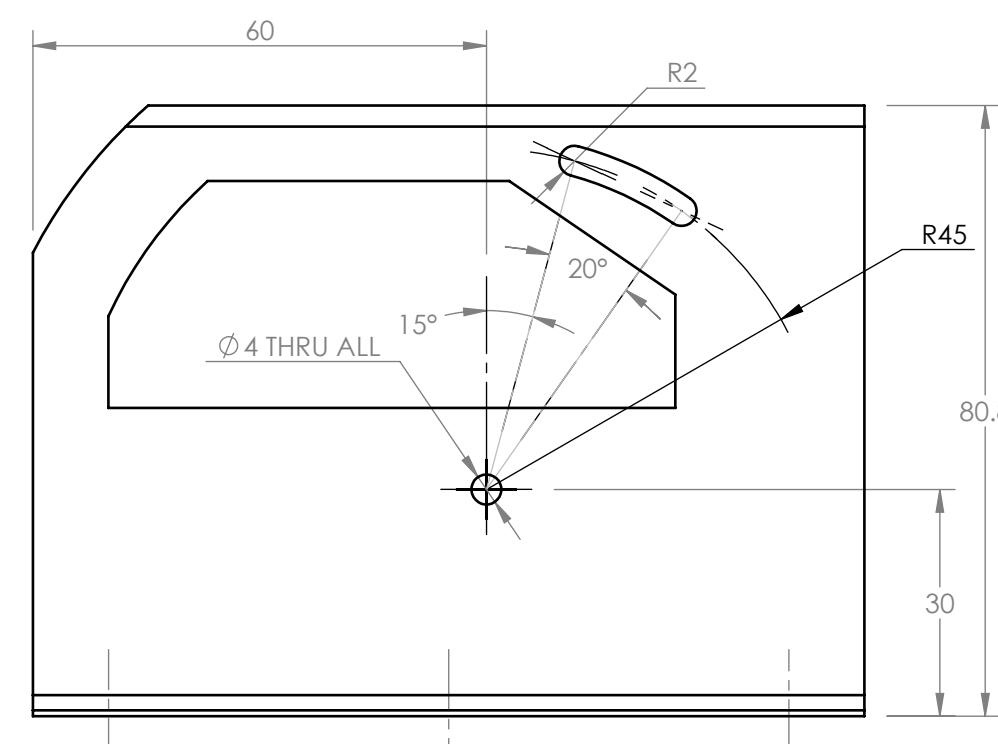
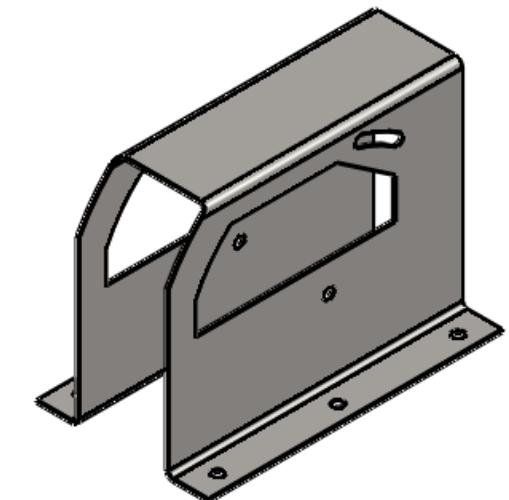
Mec E 260 265 UNLESS OTHERWISE SPECIFIED:
19 Hopper Subassembly DRAWN BY:
Instructors: Dr. Meritny Dr. Duke Win. 2014 VARIOUS MATERIALS
Comments: Alexander Sauve
UNLESS OTHERWISE SPECIFIED:
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR X = ± 0.5
XX = ± 0.1
X.XX = ± 0.025
SURFACE FINISH $0.6 \mu\text{m}$
DO NOT SCALE DRAWING
MATERIAL: As in B.O.M.
FILE NAME: The Firing Mechanism
Saturday, April 05, 2014 3:25:36 PM
Reviewed by Ruby Nicholls
Saturday, April 05, 2014 3:25:36 PM
Monday, March 10, 2014 4:31:10 PM
The Department of Mechanical Engineering
ALEXANDRE SAUVE UNIVERSITY OF ALBERTA
TITLE: The Firing Mechanism
SIZE: B Built By: Group 13 REV: A
SCALE: 1:2 Mass: 401.17 SHEET 43 OF 117



8 7 6 5 4 3 2 1



Please Mark: Drawn by Alex Sauve
Reviewed by Boston Maris



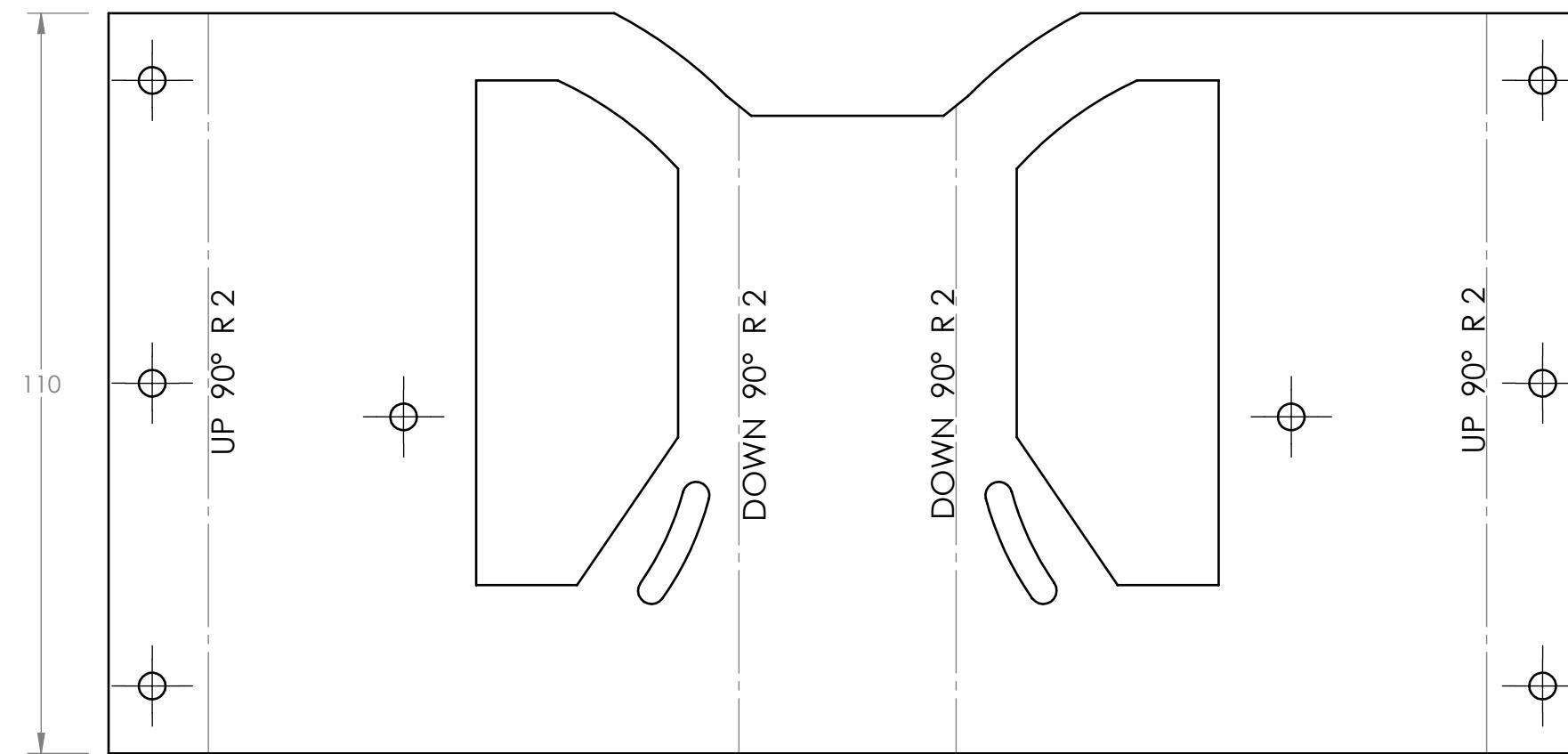
Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	SHEET METAL THICKNESS IS 0.74mm	Group name The Ole Einar Bjørndalen Group	
Comments: Sheet metal thickness is 0.74mm		Group number 13	
		SM By Alexandre Sauve + Drew Gingras	
		Reviewed by Boston Maris	
		Saturday, April 05, 2014 10:48:50 AM Monday, March 10, 2014 4:02:31 PM	
SIZE B	Built By: Water Jet	REV A	
SCALE: 1:1	Mass: 120.22	SHEET 45 OF 117	

SolidWorks Student Edition.
For Academic Use Only.

8 7 6 5 4 3 2 1

Please Mark: Drawn by Alex Sauve
Reviewed by Boston Maris

D



C

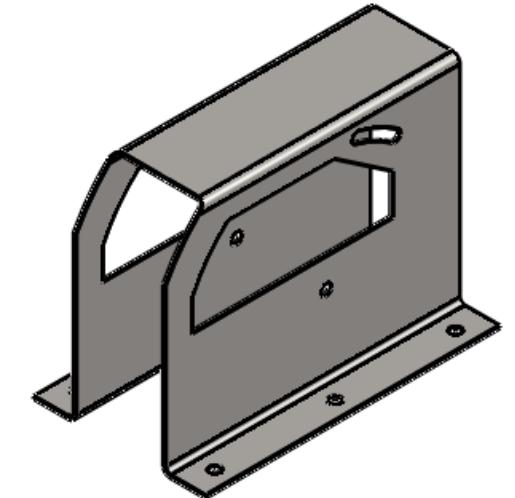
B

A

A

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY:
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Alexandre Sauve
Comments: Sheet metal thickness is 0.74mm		SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
		DO NOT SCALE DRAWING	Group number 13
			SM By Alexandre Sauve + Drew Gingras
			Reviewed by Boston Maris
			Saturday, April 05, 2014 10:48:50 AM Monday, March 10, 2014 4:02:31 PM
FILE NAME: Interior Shot Support			

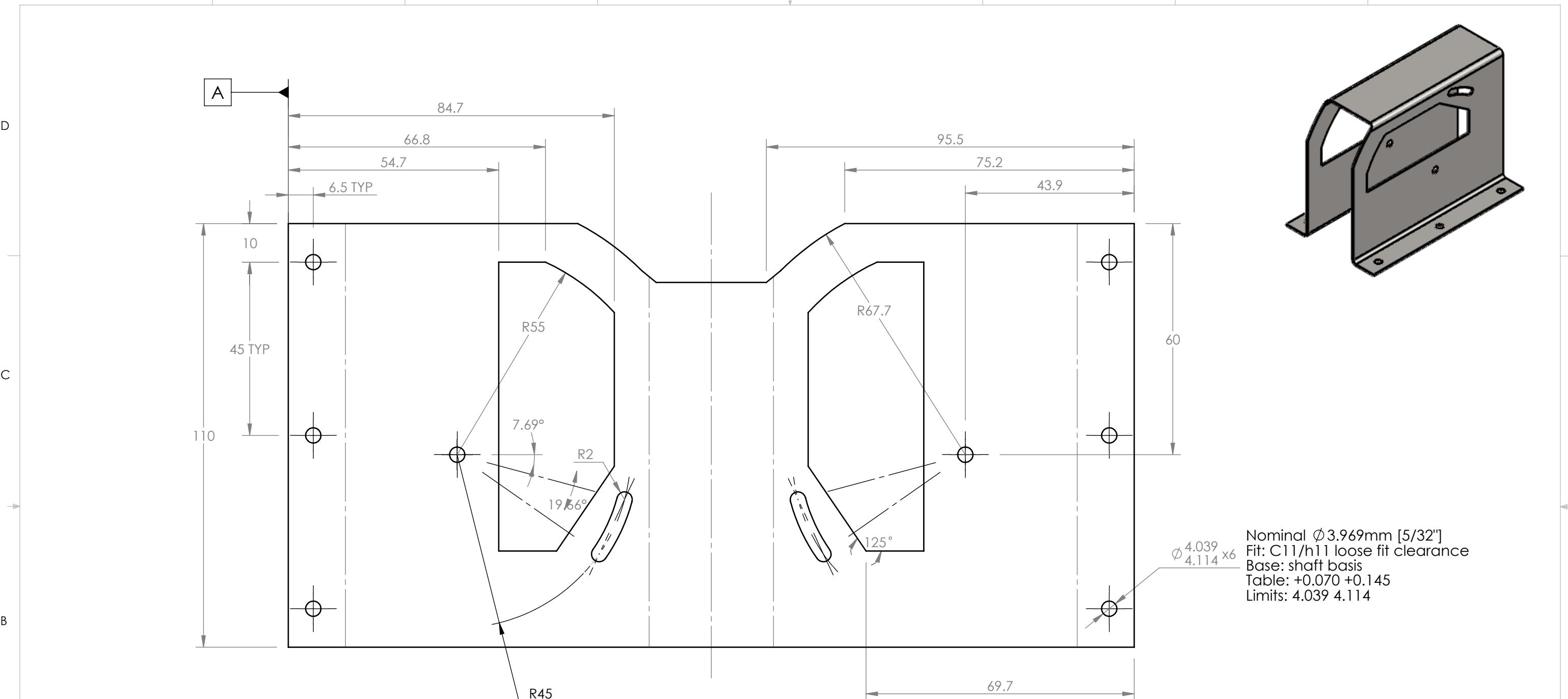


The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
(M) Interior Shot Support

SIZE	Built By:	REV
B	Water Jet	A
SCALE: 1:1	Mass: 120.22	SHEET 46 OF 117

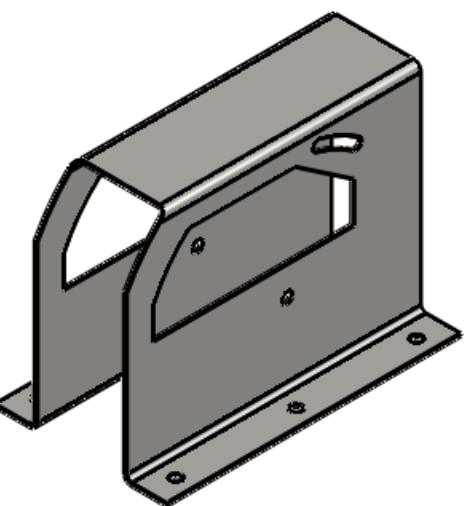
8 7 6 5 4 3 2 1



Please Mark: Drawn by Alex Sauve
Reviewed by Boston Maris

SolidWorks Student Edition.
For Academic Use Only.

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke Win. 2014		Comments: Sheet metal thickness is 0.74 mm	Group name The Ole Einar Bjørndalen Group
Comments: Sheet metal thickness is 0.74 mm		Group number 13	Group number 13
Comments: Sheet metal thickness is 0.74 mm		SM By Alexandre Sauve + Drew Gingras	SM By Alexandre Sauve + Drew Gingras
Comments: Sheet metal thickness is 0.74 mm		Reviewed by Boston Maris	Reviewed by Boston Maris
Comments: Sheet metal thickness is 0.74 mm		Saturday, April 05, 2014 10:48:50 AM Monday, March 10, 2014 4:02:31 PM	Saturday, April 05, 2014 10:48:50 AM Monday, March 10, 2014 4:02:31 PM
SIZE B	Built By: Water Jet	REV A	
SCALE: 1:1	Mass: 120.22	SHEET 47 OF 117	



8 7 6 5 4 3 2 1

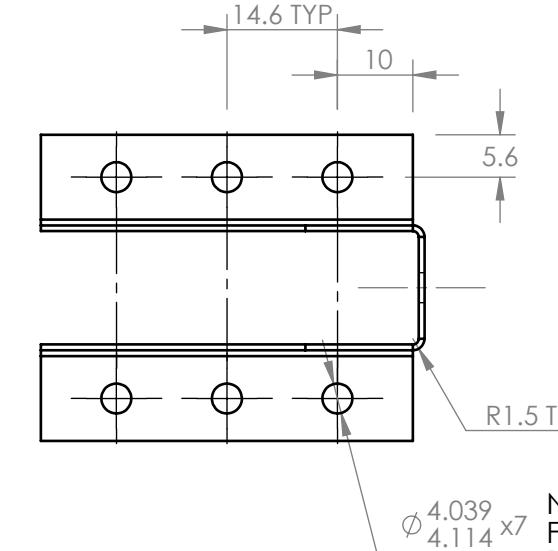
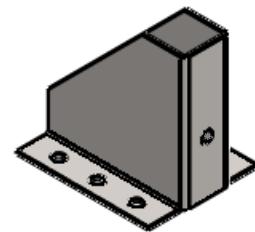
D

C

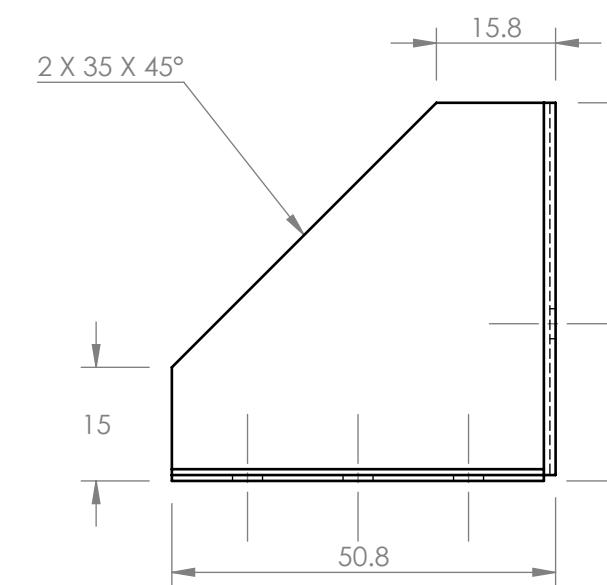
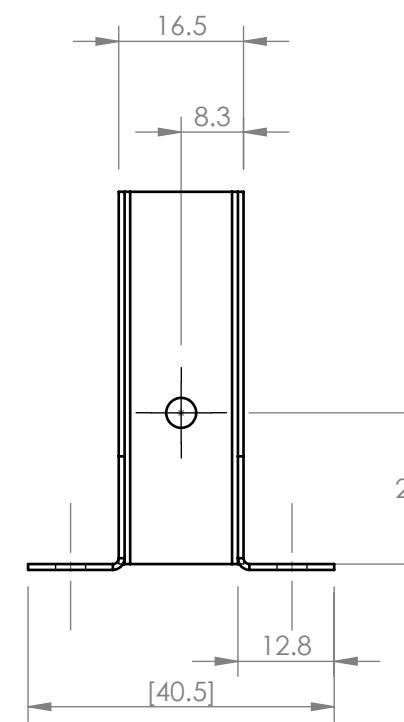
B

A

1



Nominal $\phi 3.969\text{mm}$ [5/32"]
Fit: C11/h11 loose fit clearance
Base: shaft basis
Table: +0.070 +0.145
Limits: 4.039 4.114



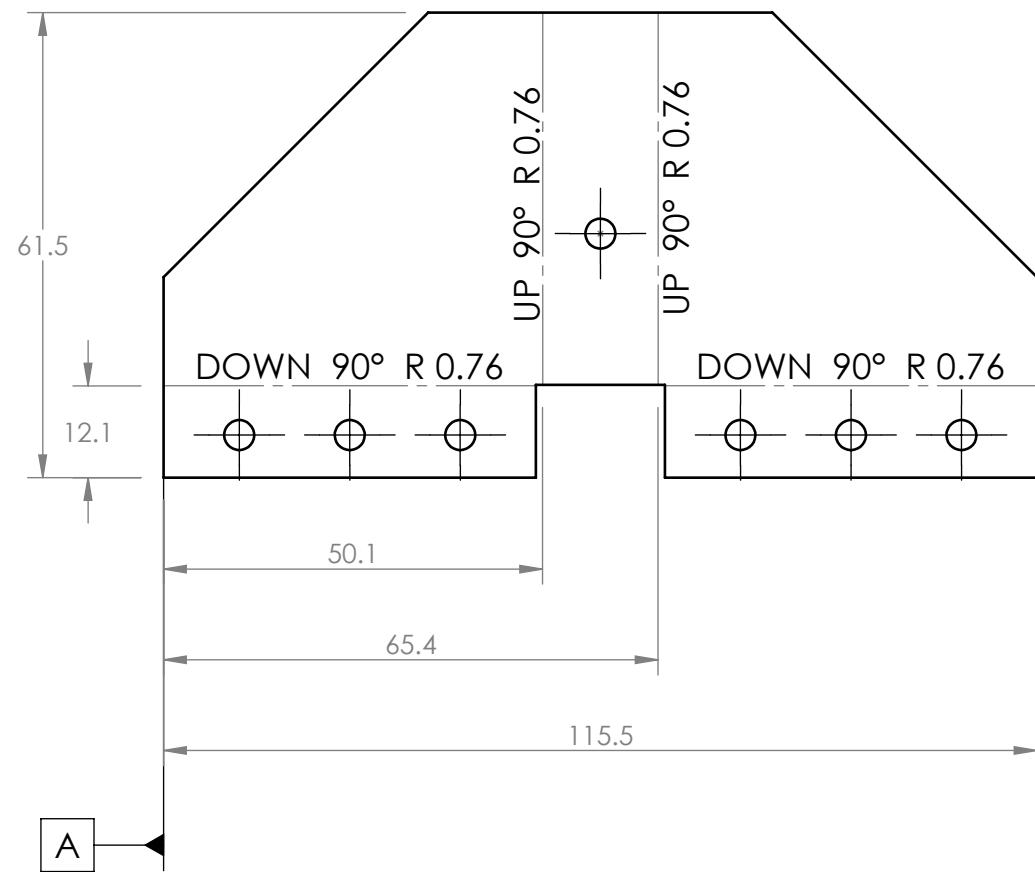
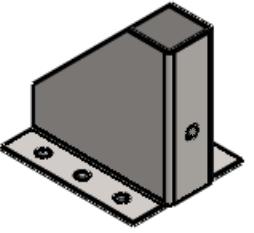
SolidWorks Student Edition.
For Academic Use Only.

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	Comments: Sheet metal thickness is 0.74 mm	
		SURFACE FINISH $0.6 \mu\text{m}$	
		DO NOT SCALE DRAWING	
MATERIAL: Plain Carbon Steel		Reviewed by Boston Maris	
FILE NAME: back support		Saturday, April 05, 2014 10:48:49 AM Sunday, March 09, 2014 5:48:53 PM	
SIZE B	Built By: Drew Gringas	REV A	
SCALE: 1:1		Mass:	
		SHEET 48 OF 117	

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

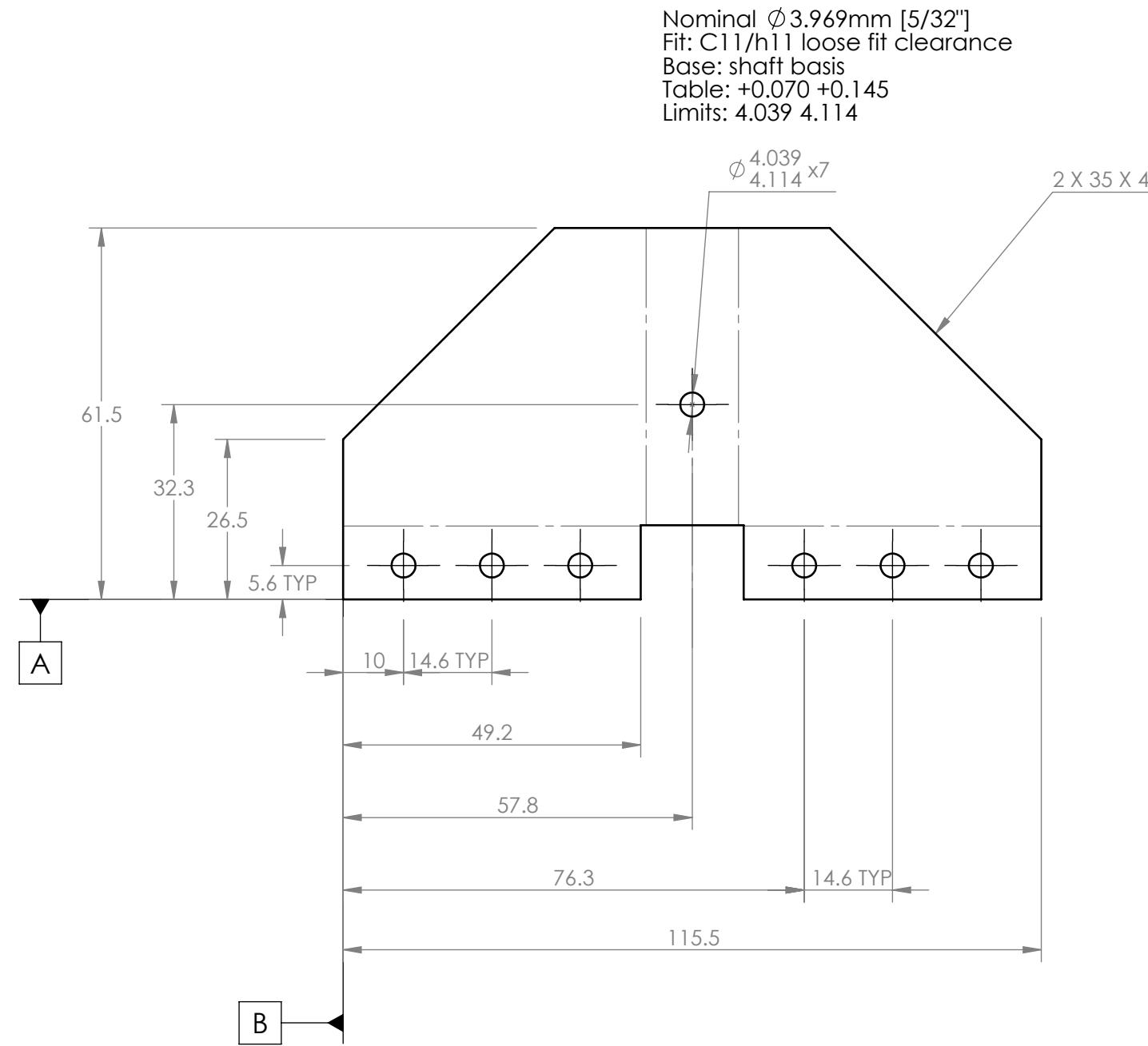
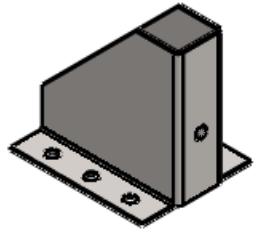
TITLE:
Back Support

A



SolidWorks Student Edition.
For Academic Use Only.

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments: Sheet metal thickness is 0.74 mm	Group name The Ole Einar Bjørndalen Group	TITLE: Back Support
		Group number 13	
		SM By Ruby Nicholls	
		Reviewed by Boston Maris	
		Saturday, April 05, 2014 10:48:49 AM Sunday, March 09, 2014 5:48:53 PM	
SIZE B	Built By: Drew Gingras	REV A	
SCALE: 1:1	Mass: 33.20	SHEET 49 OF 117	



Mec E 260_265 UNLESS OTHERWISE SPECIFIED:
Instructors: Dr. Mertiny
Dr. Duke Win. 2014
Comments: Sheet metal thickness is 0.74 mm
MATERIAL: Plain Carbon Steel
FILE NAME: back support

DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR
 $X = \pm 0.5$
 $X.X = \pm 0.1$
 $X.XX = \pm 0.025$
SURFACE FINISH $0.6 \mu\text{m}$
DO NOT SCALE DRAWING

Saturday, April 05, 2014 10:48:49 AM
Sunday, March 09, 2014 5:48:53 PM

DRAWN BY:
Alexandre Sauve

Group name The Ole Einar Bjørndalen Group

Group number 13

SM By Ruby Nicholls

Reviewed by Ruby Nicholls

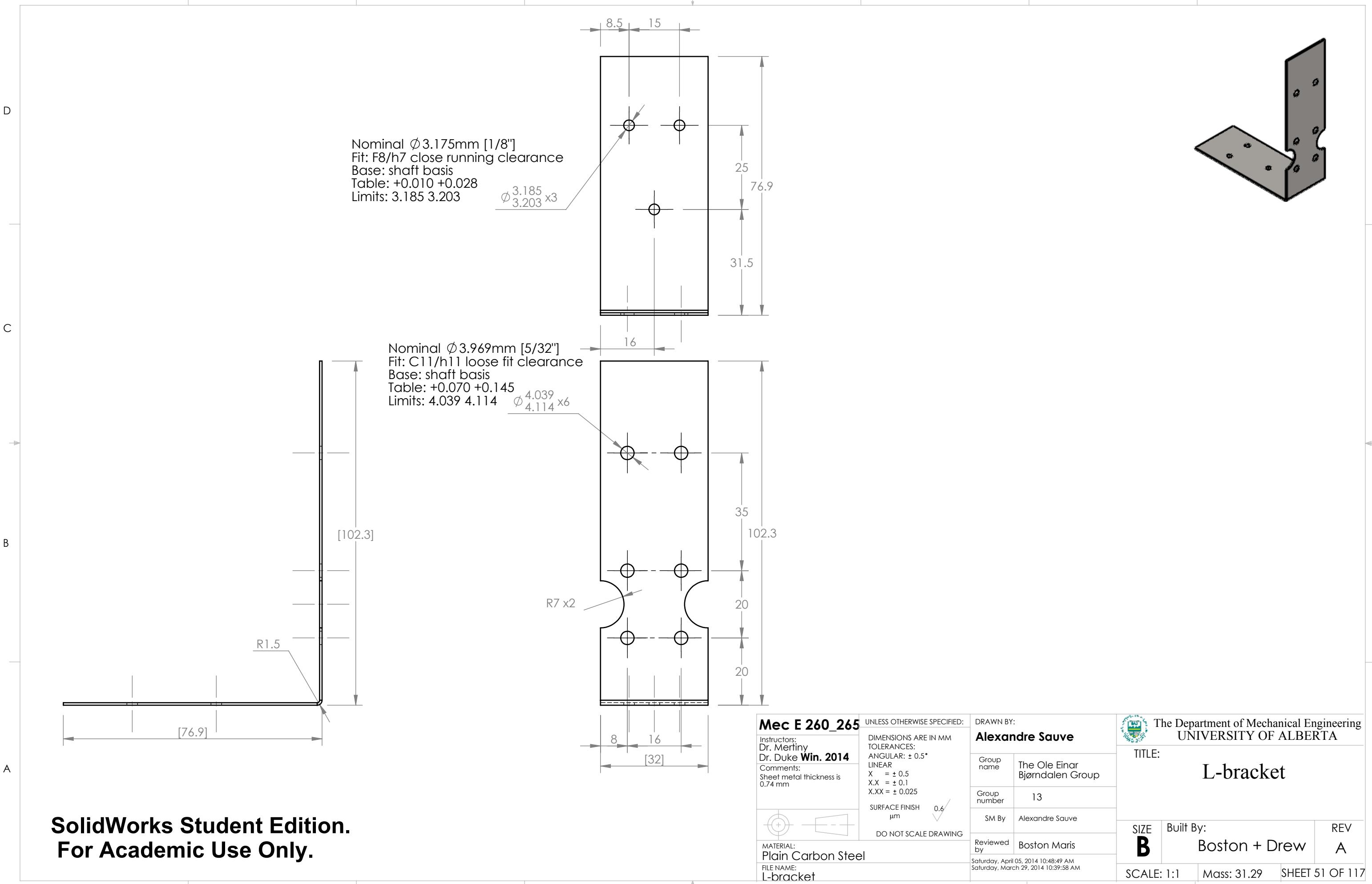
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Back Support

SIZE **B** Built By: **Drew Gingras** REV **A**

SCALE: 1:1 Mass: 33.20 SHEET 50 OF 117

SolidWorks Student Edition.
For Academic Use Only.



SolidWorks Student Edition. For Academic Use Only.

8

7

6

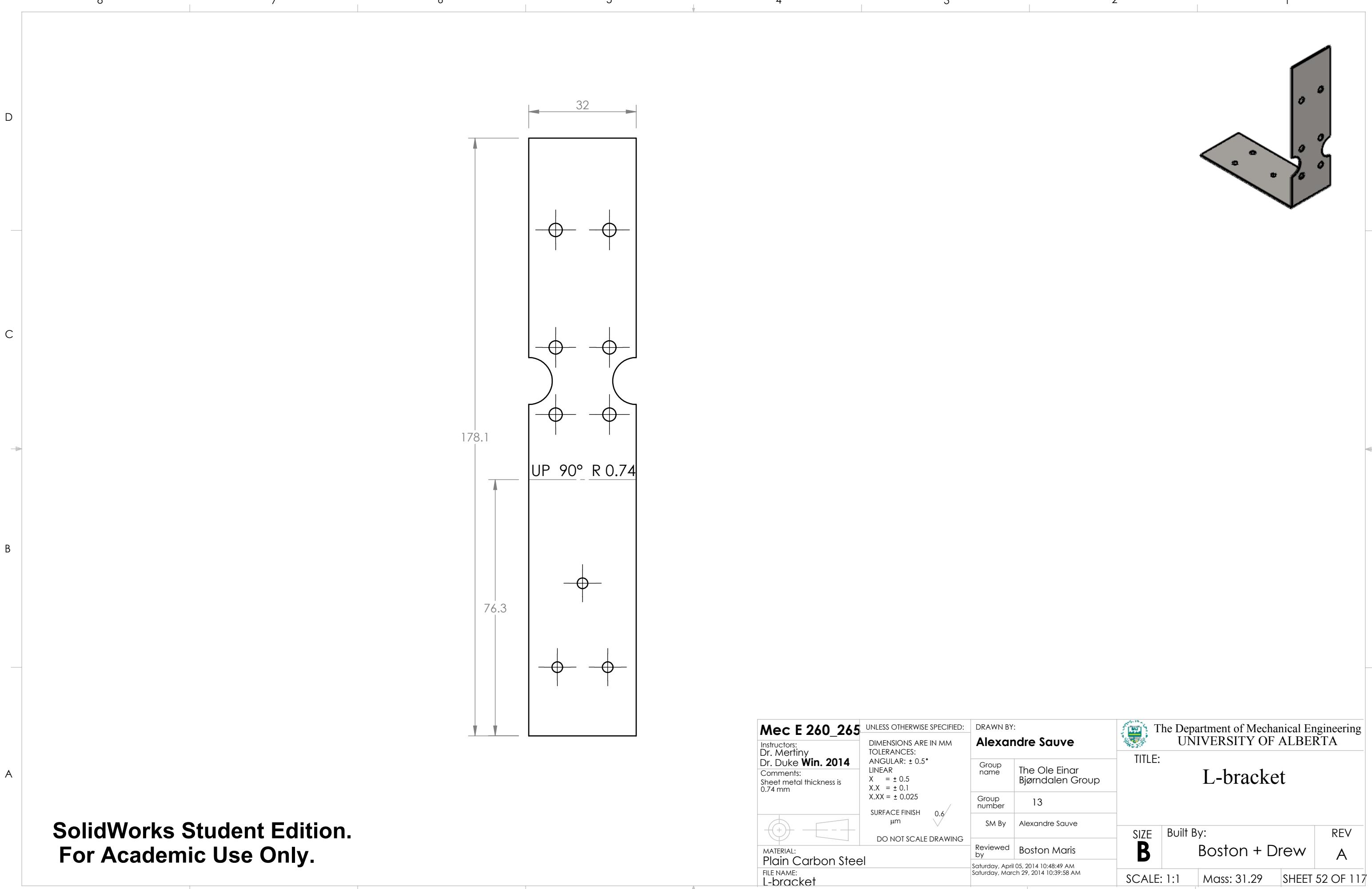
5

4

3

2

1



SolidWorks Student Edition.
For Academic Use Only.

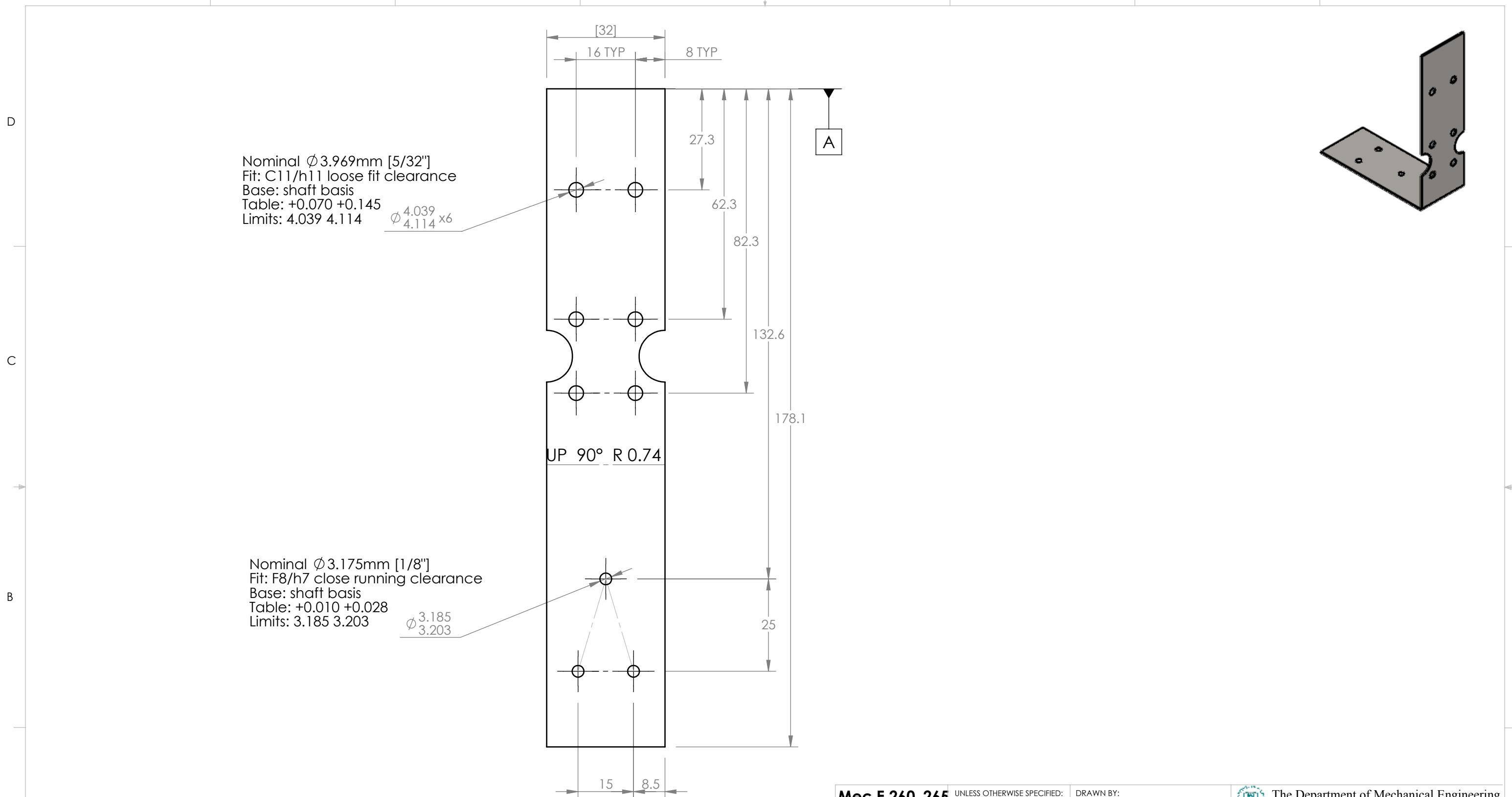
Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke Win. 2014		Group name The Ole Einar Bjørndalen Group
Comments: Sheet metal thickness is 0.74 mm		Group number 13
		SM By Alexandre Sauve
		Reviewed by Boston Maris
	DO NOT SCALE DRAWING 	Saturday, April 05, 2014 10:48:49 AM Saturday, March 29, 2014 10:39:58 AM
MATERIAL: Plain Carbon Steel		
FILE NAME: L-bracket		
		SIZE B Built By: Boston + Drew REV A
		SCALE: 1:1 Mass: 31.29 SHEET 52 OF 117

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE: **L-bracket**

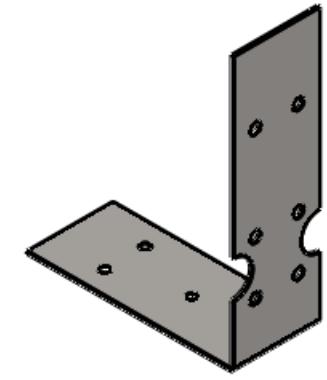
REV **A**

8 7 6 5 4 3 2 1



Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke Win. 2014		SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
Comments: Sheet metal thickness is 0.74 mm		Group number 13	SM By Alexandre Sauve
		Reviewed by Boston Maris	Saturday, April 05, 2014 10:48:49 AM
MATERIAL: Plain Carbon Steel		FILE NAME: L-bracket	Saturday, March 29, 2014 10:39:58 AM
SIZE B	Built By: Boston + Drew	REV A	
SCALE: 1:1	Mass: 31.29	SHEET 53 OF 117	

**SolidWorks Student Edition.
For Academic Use Only.**



The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
L-bracket

SIZE **B** Built By: Boston + Drew REV **A**
SCALE: 1:1 Mass: 31.29 SHEET 53 OF 117

8

7

6

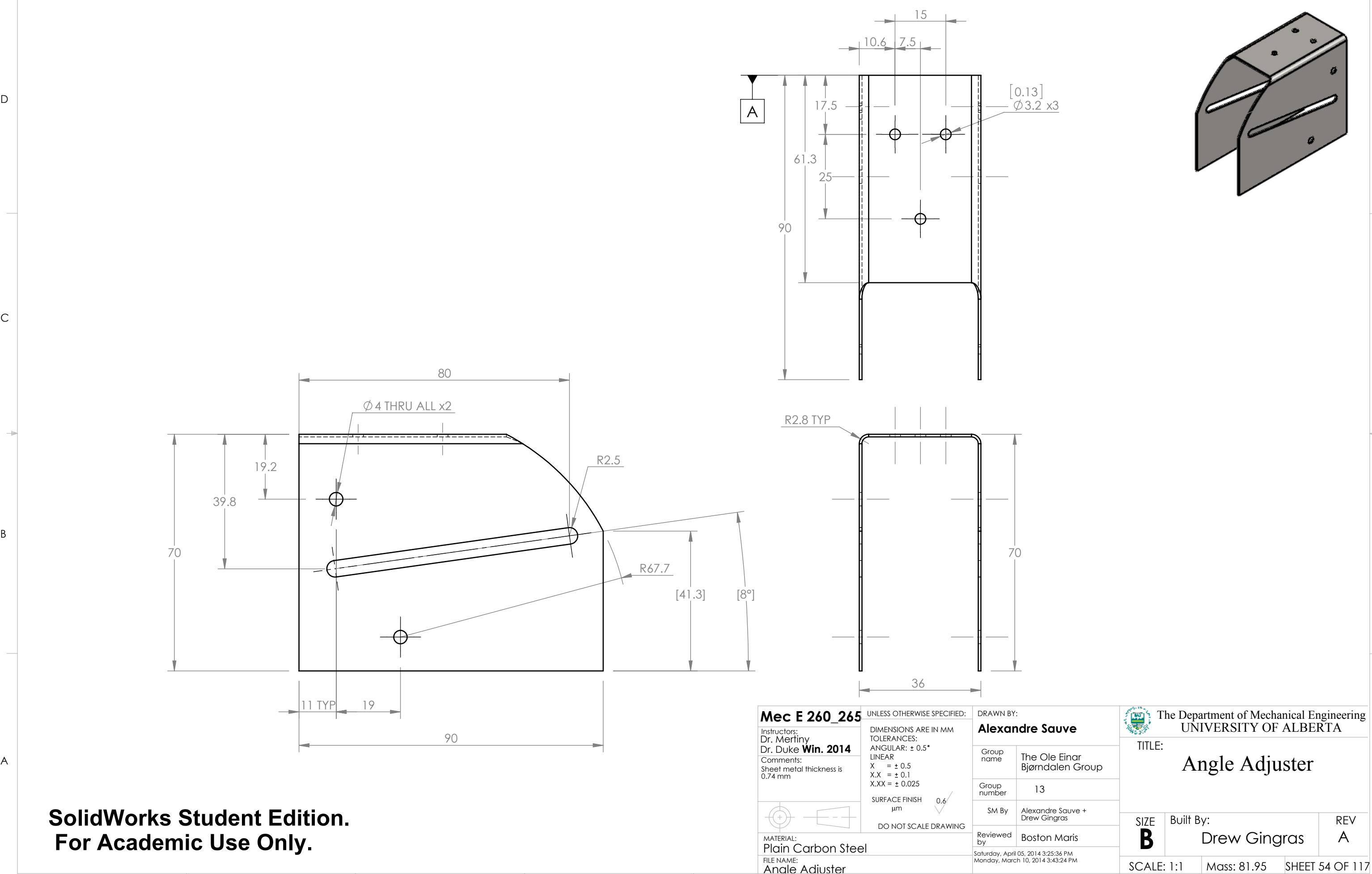
5

4

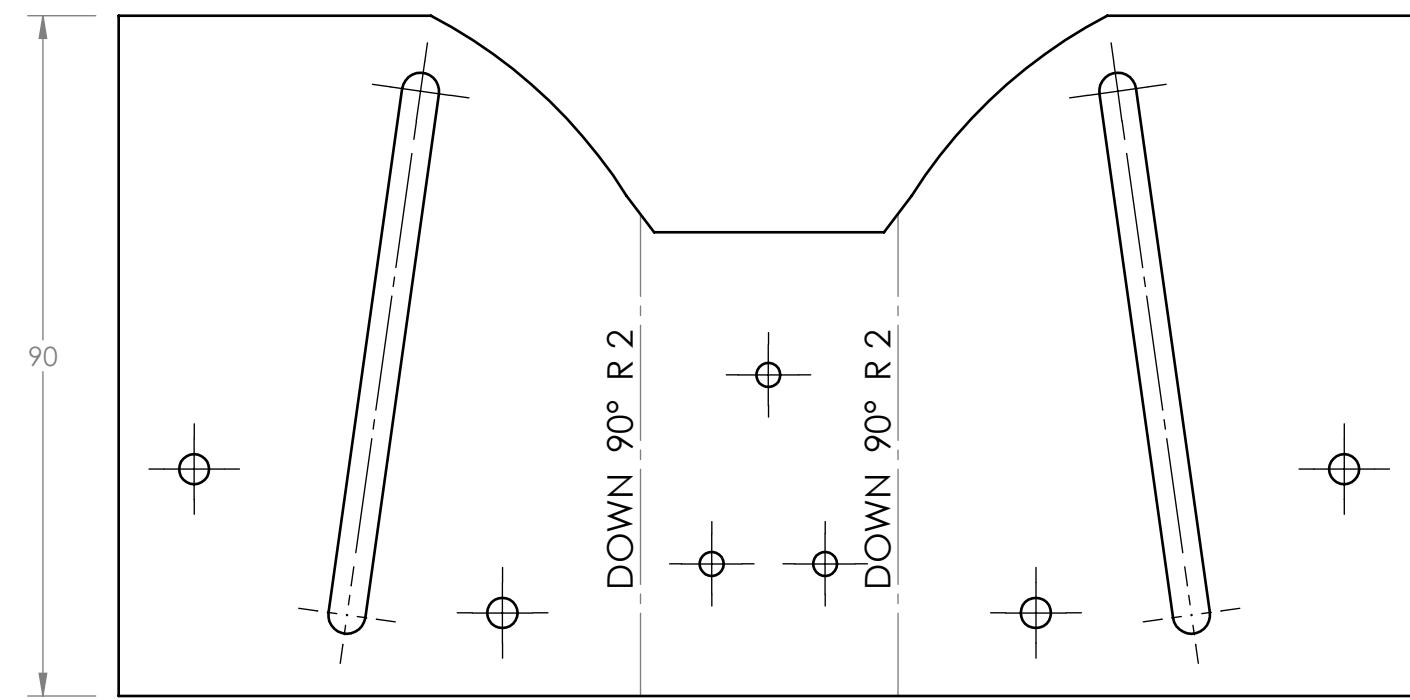
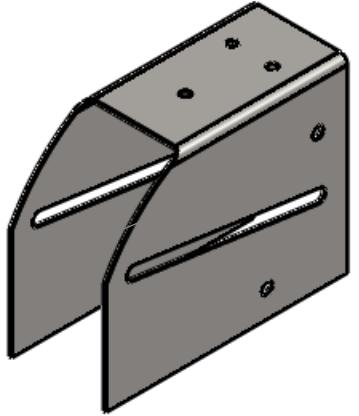
3

2

1



**SolidWorks Student Edition.
For Academic Use Only.**



A

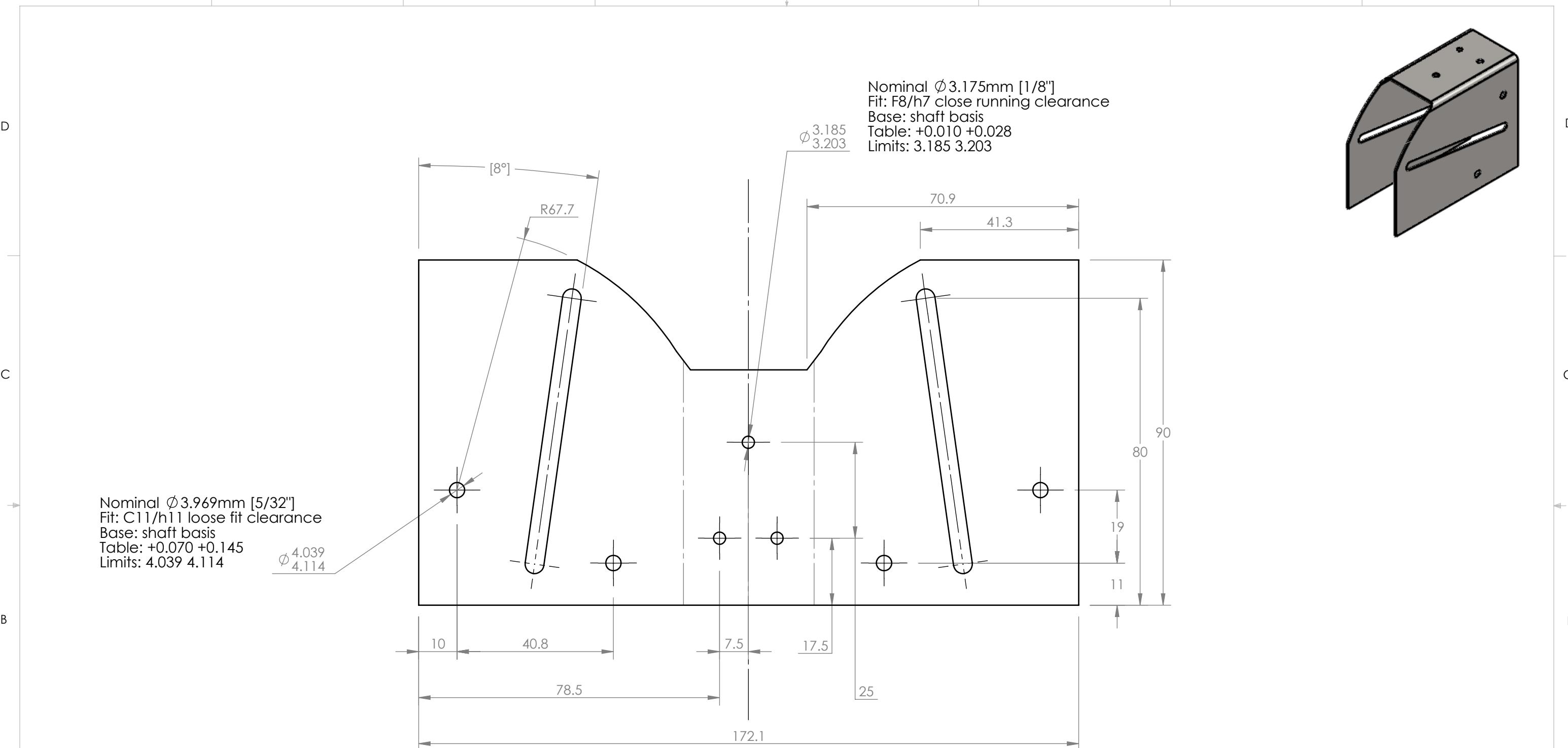
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY:
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Alexandre Sauve
Comments: Sheet metal thickness is 0.74 mm		SURFACE FINISH $0.6 \mu\text{m}$	
		DO NOT SCALE DRAWING	
		MATERIAL: Plain Carbon Steel	
		FILE NAME: Angle Adjuster	

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Angle Adjuster

SIZE **B** Built By: **Drew Gingras** REV **A**
SCALE: 1:1 Mass: 81.95 SHEET 55 OF 117



SolidWorks Student Edition. For Academic Use Only.

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY: Alexandre Sauve		The Department of Mechanical Engineering UNIVERSITY OF ALBERTA		
Instructors: Dr. Merifinny Dr. Duke Win. 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$		Group name	The Ole Einar Bjørndalen Group		TITLE: Angle Adjuster	
Comments: Sheet metal thickness is 0.74 mm	SURFACE FINISH $0.6 \mu\text{m}$		Group number	13			
	DO NOT SCALE DRAWING		SM By	Alexandre Sauve + Drew Gingras			
MATERIAL: Plain Carbon Steel	Reviewed by		Boston Maris		SIZE	Built By: Drew Gingras	REV A
FILE NAME: Angle Adjuster	Saturday, April 05, 2014 3:25:36 PM Monday, March 10, 2014 3:43:24 PM				SCALE: 1:1	Mass: 81.95	SHEET 56 OF 117

8 7 6 5 4 3 2 1

D

D

C

C

B

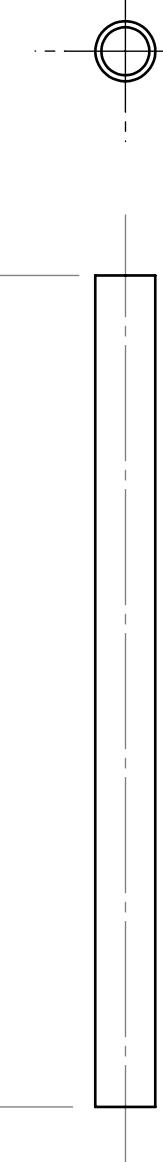
B

A

A

Base Material: $\phi 5/32"$
hollow brass tubing

55



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^{\circ}$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments: Edit in SM	Group name The Ole Einar Bjørndalen Group	
		Group number 13	
		SM By Alexandre Sauve	
		Reviewed by Boston Maris	
		Saturday, March 29, 2014 12:32:28 PM	
		Monday, March 17, 2014 6:58:05 PM	
	DO NOT SCALE DRAWING		FILE NAME: Trigger Rack Pin 5_32in hollow
SIZE	Built By: B Drew Gingras	REV	A
SCALE: 2:1	Mass: 2.08	SHEET 57 OF 117	

8

7

6

5

4

3

2

1

D

D

C

C

B

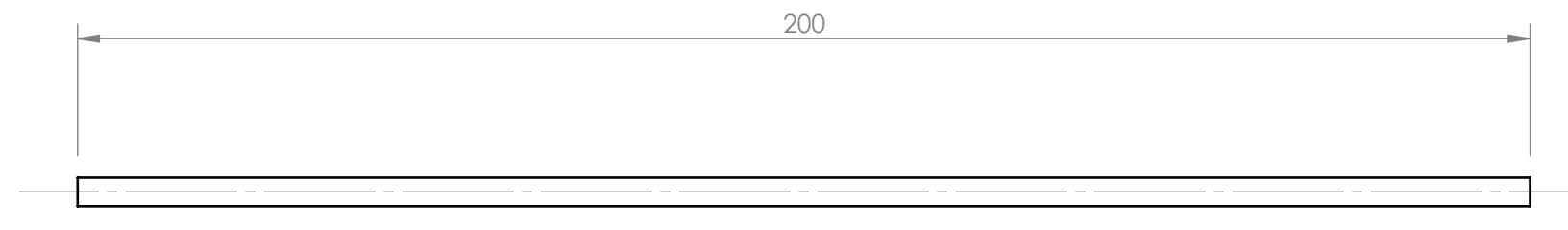
B

A

A



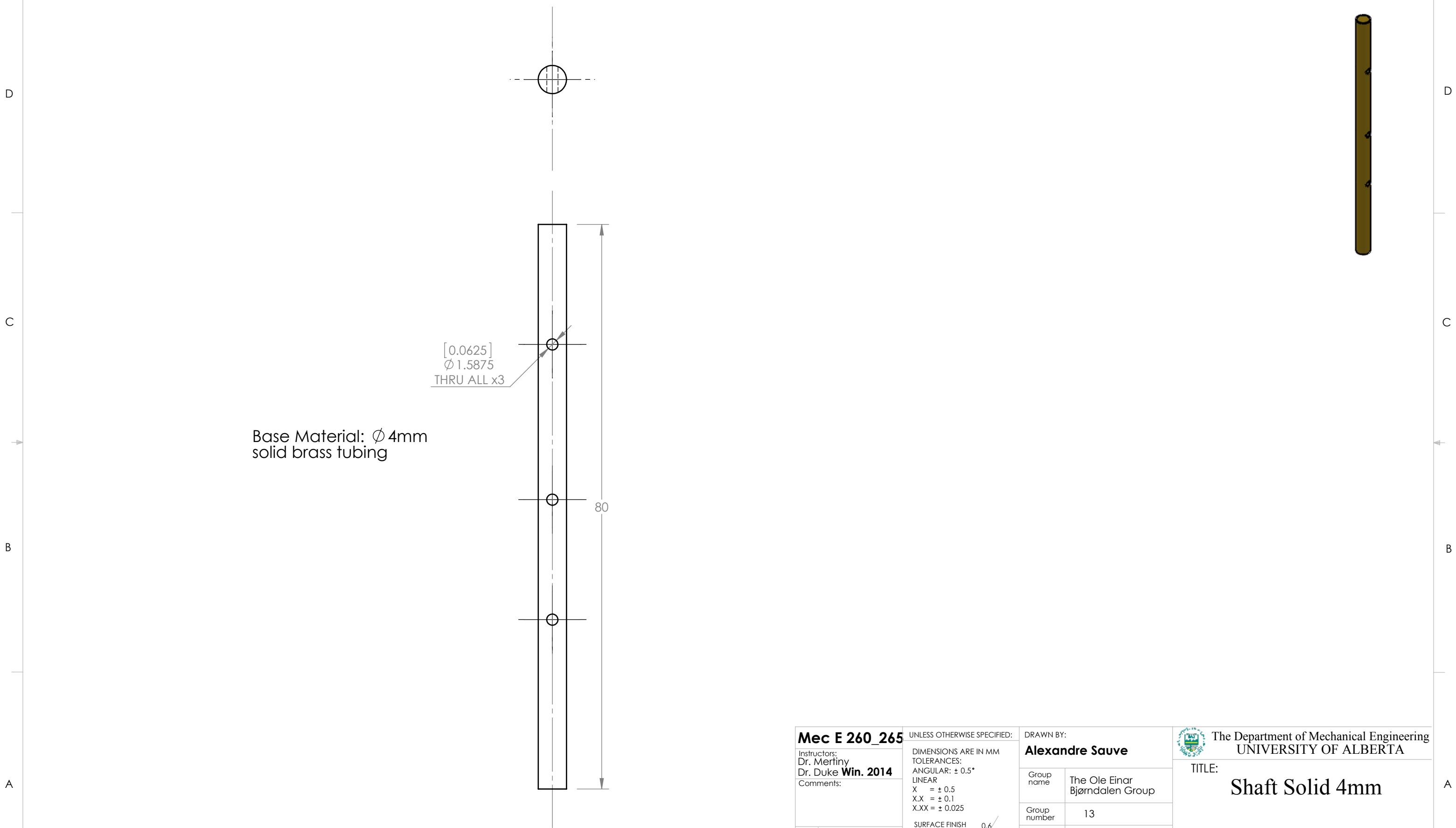
Base Material: $\phi 5/32''$
hollow brass tubing



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	TITLE: Shaft Hollow 5-32in
		Group number 13	
		SM By Alexandre Sauve	
		Reviewed by Boston Maris	
		Saturday, March 29, 2014 12:33:41 PM Thursday, March 06, 2014 2:58:00 PM	
	MATERIAL: Brass	SIZE B	Built By: Drew Gingras
	FILE NAME: Shaft Hollow 5-32in	REV A	SCALE: 1:1
		Mass:	SHEET 58 OF 117

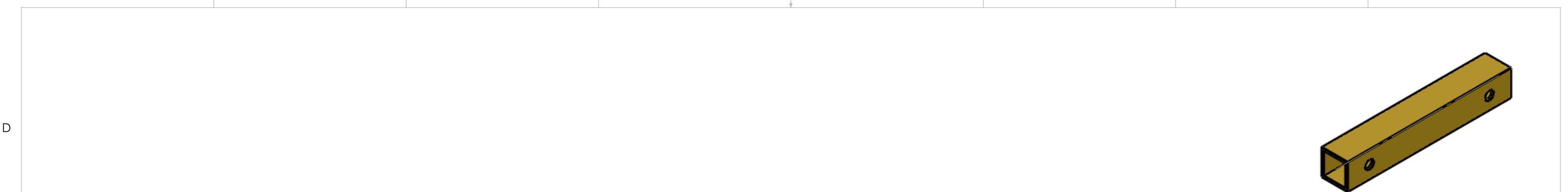
8 7 6 5 4 3 2 1



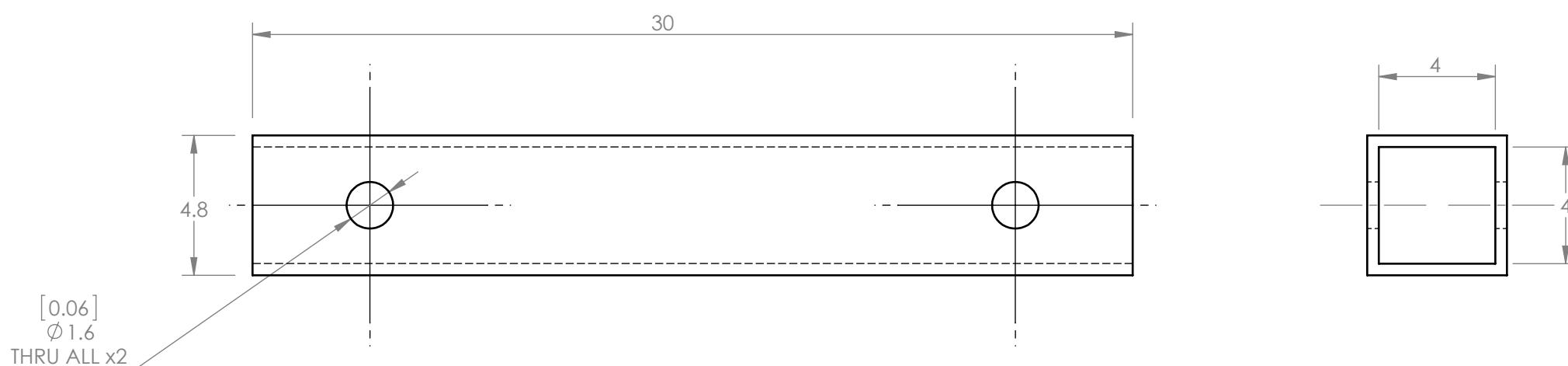
Mec E 260_265	UNLESS OTHERWISE SPECIFIED:	DRAWN BY:	The Department of Mechanical Engineering
Instructors: Dr. Mertiny Dr. Duke Win. 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Alexandre Sauve	UNIVERSITY OF ALBERTA
Comments:	SURFACE FINISH $0.6 \mu\text{m}$	Group name	The Ole Einar Bjørndalen Group
	DO NOT SCALE DRAWING	Group number	13
		SM By	Alexandre Sauve
		Reviewed by	Boston Maris
			Saturday, April 05, 2014 3:25:36 PM Monday, March 17, 2014 6:58:05 PM
SIZE B	Built By: Boston Maris	REV A	
SCALE: 2:1	Mass: 8.35	SHEET 59 OF 117	

SolidWorks Student Edition.
For Academic Use Only.

8 7 6 5 4 3 2 1



Base Material: 5/32" Square Brass tubing



Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	TITLE: tube segment 5-32 square
		Group number 13	
		SM By Ruby Nicholls	
		Reviewed by Boston Maris	
		Saturday, March 29, 2014 1:02:40 PM	
		Thursday, March 06, 2014 4:57:46 PM	
SIZE B	Built By: Boston Maris	REV A	
SCALE: 5:1	Mass:	SHEET 60 OF 117	

**SolidWorks Student Edition.
For Academic Use Only.**

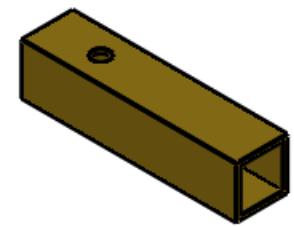
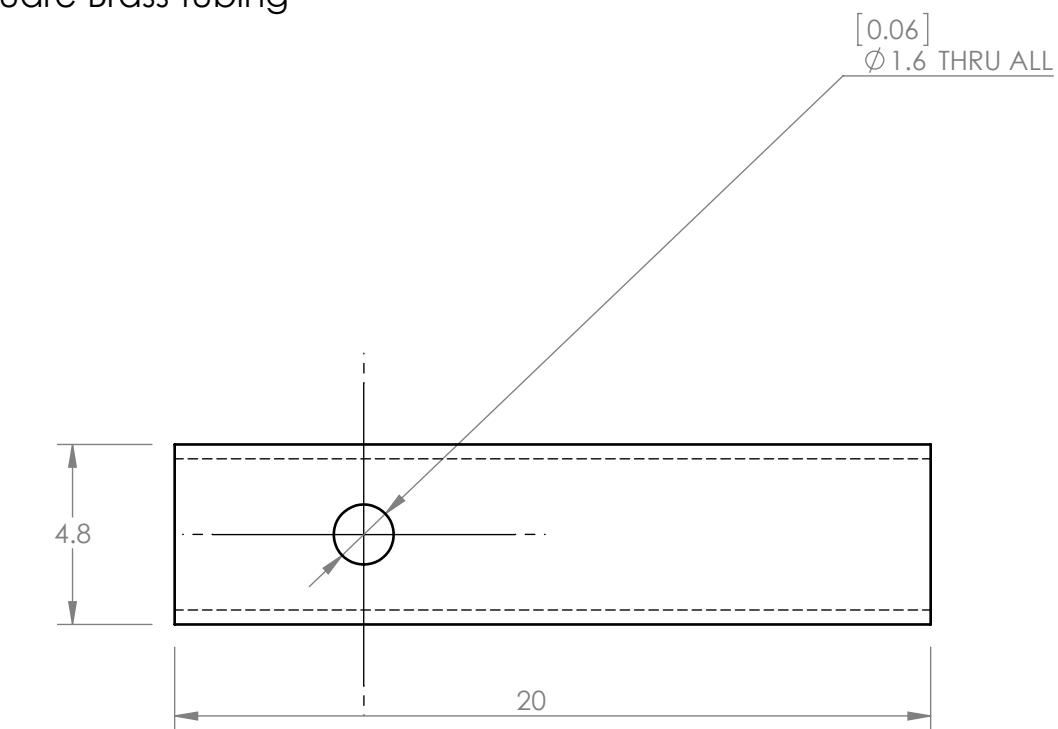
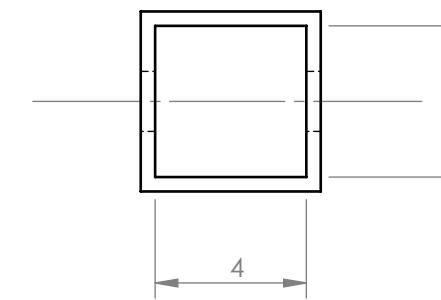
8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

D

D

Base Material: 5/32" Square Brass tubing



C

C

B

B

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	TITLE: Square tubing - big
		Group number 13	
		SM By Ruby Nicholls	
		Reviewed by Boston Maris	
		Saturday, March 29, 2014 6:01:36 PM	
		Saturday, March 29, 2014 12:21:26 PM	
SIZE B	Built By: Boston Maris	REV A	
SCALE: 5:1	Mass: 1.12	SHEET 61 OF 117	

8

7

6

5

4

3

2

1

D

D

C

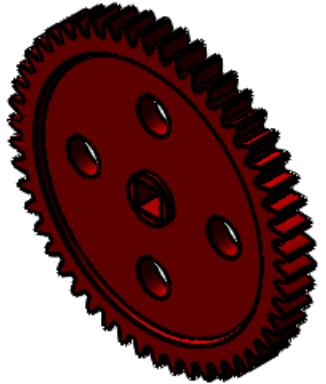
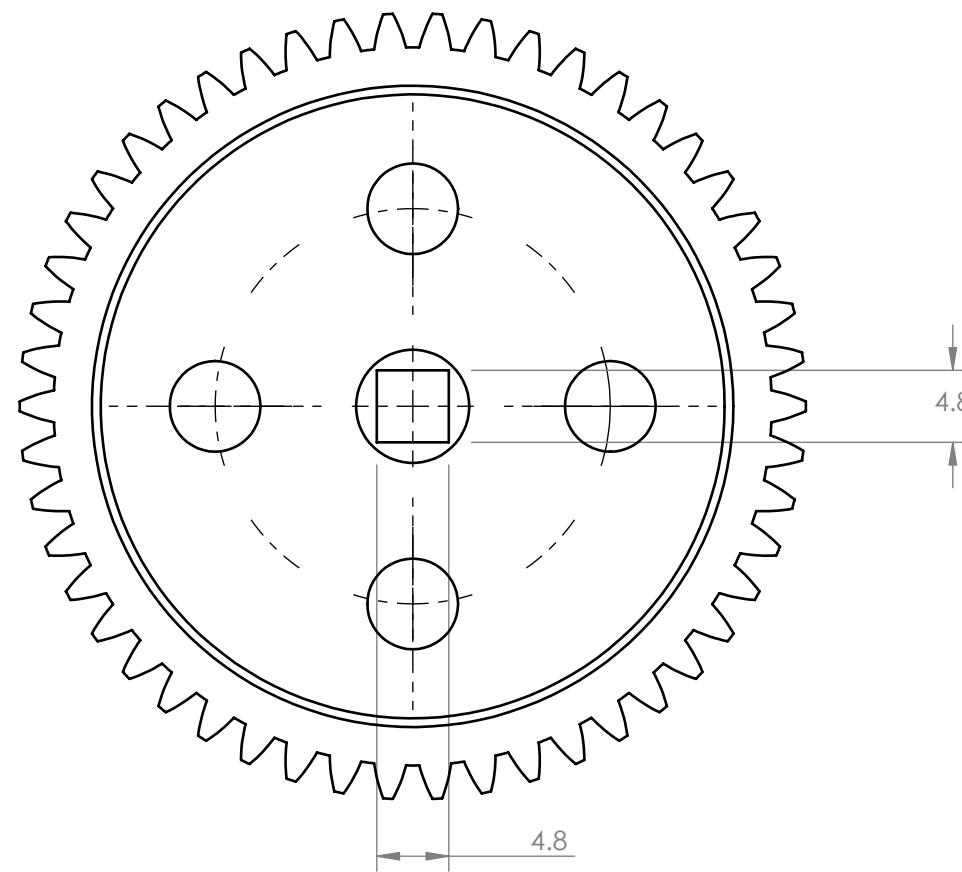
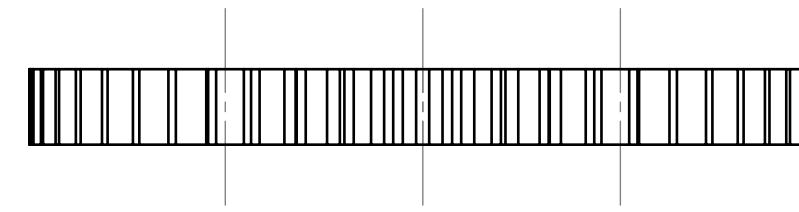
C

B

B

A

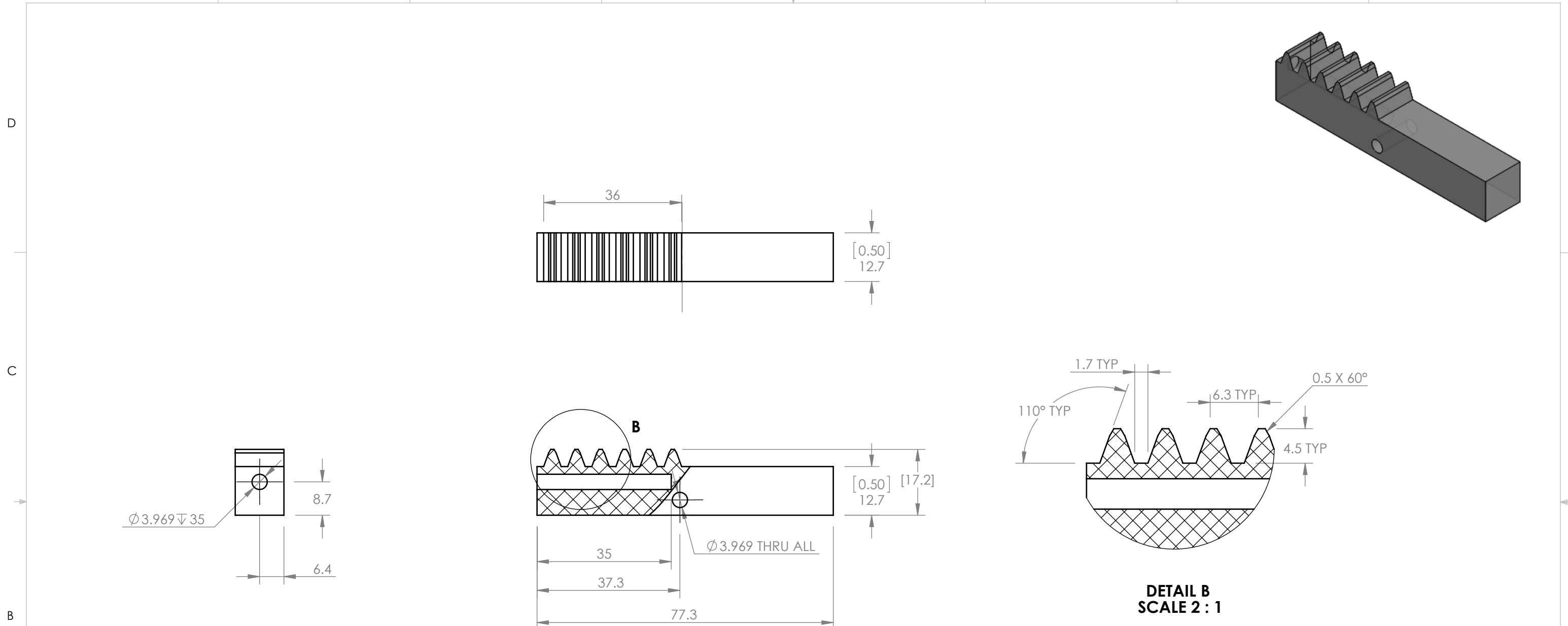
A



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke Win. 2014		Group name The Ole Einar Bjørndalen Group
Comments:		Group number 13
		SM By Solidworks Toolbox
		Reviewed by Boston Maris
	DO NOT SCALE DRAWING 	Saturday, March 29, 2014 10:30:13 AM Tuesday, February 08, 2000 9:41:59 AM
MATERIAL: ABS Plastic	FILE NAME: T50 Spur_ver2	

	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
TITLE:	T50 Spur_ver2
SIZE	Built By: Machined
B	REV A
SCALE: 2:1	Mass: 6.57
	SHEET 62 OF 117



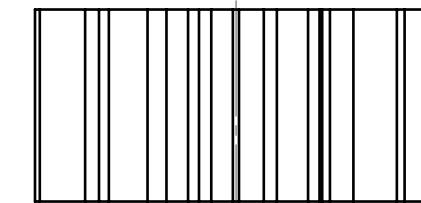
**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments: DO NOT SCALE DRAWING	Group name The Ole Einar Bjørndalen Group	TITLE: Trigger Rack
		Group number 13	
		SM By Alexandre Sauve	
		Reviewed by Boston Maris	
		Saturday, March 29, 2014 12:31:15 PM	
		Friday, March 07, 2014 1:33:00 PM	
SIZE B	Built By: Water Jet	REV A	
SCALE: 1:1	Mass: 12.24	SHEET 63 OF 117	

8 7 6 5 4 3 2 1

D

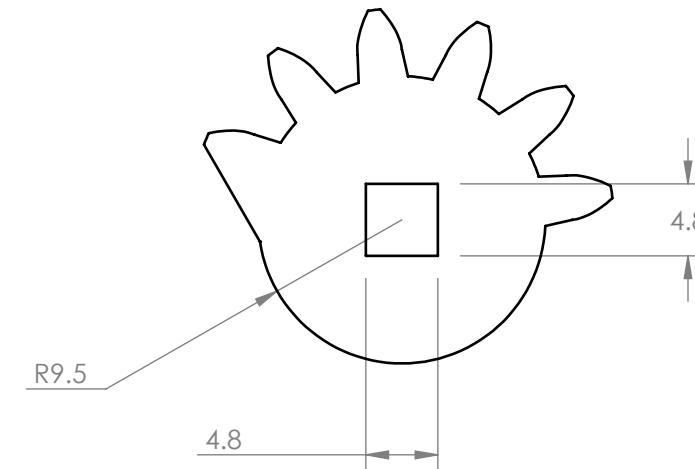
D



[0.50]
12.7

C

C



B

B

A

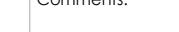
A

**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke
Win. 2014

Comments:



MATERIAL:

PE High Density

FILE NAME:

Trigger Gear

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR

X = ± 0.5
XX = ± 0.1
XXX = ± 0.025

SURFACE FINISH

0.6

DO NOT SCALE DRAWING

DRAWN BY:
Alexandre Sauve

Group name
The Ole Einar
Bjørndalen Group

Group number
13

SM By
Alexandre Sauve

Reviewed by
Boston Maris

Saturday, March 29, 2014 1:17:23 PM

Friday, March 07, 2014 2:32:52 PM

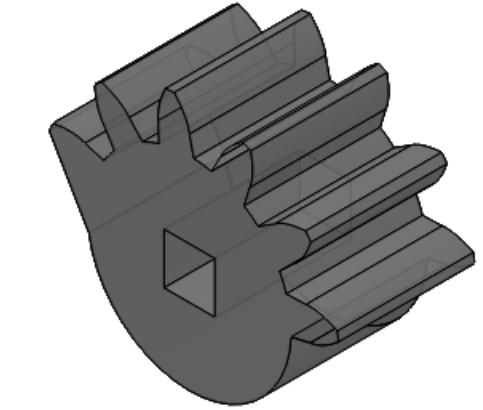
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

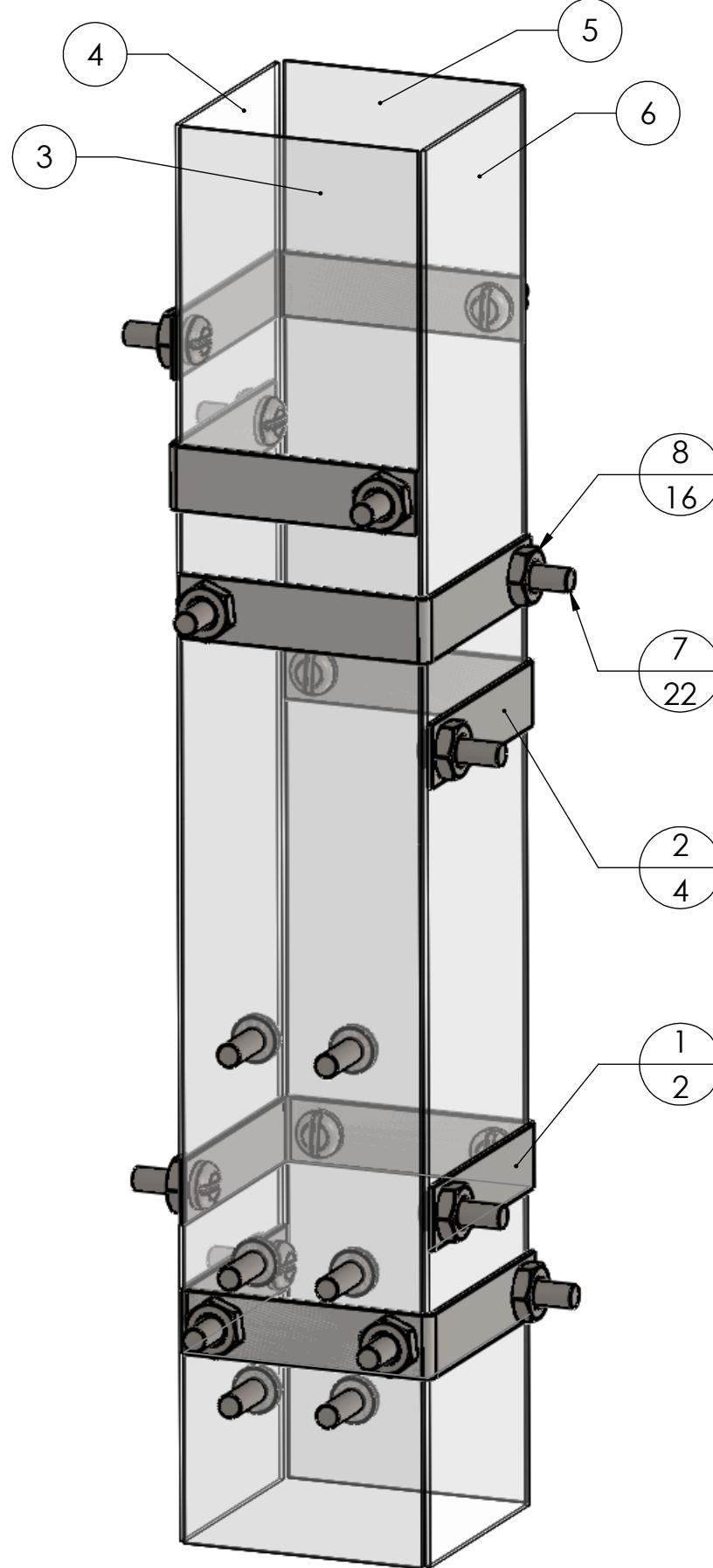
TITLE:

Trigger Gear

SIZE **B** Built By: Water Jet REV **A**

SCALE: 2:1 Mass: 4.06 SHEET 64 OF 117





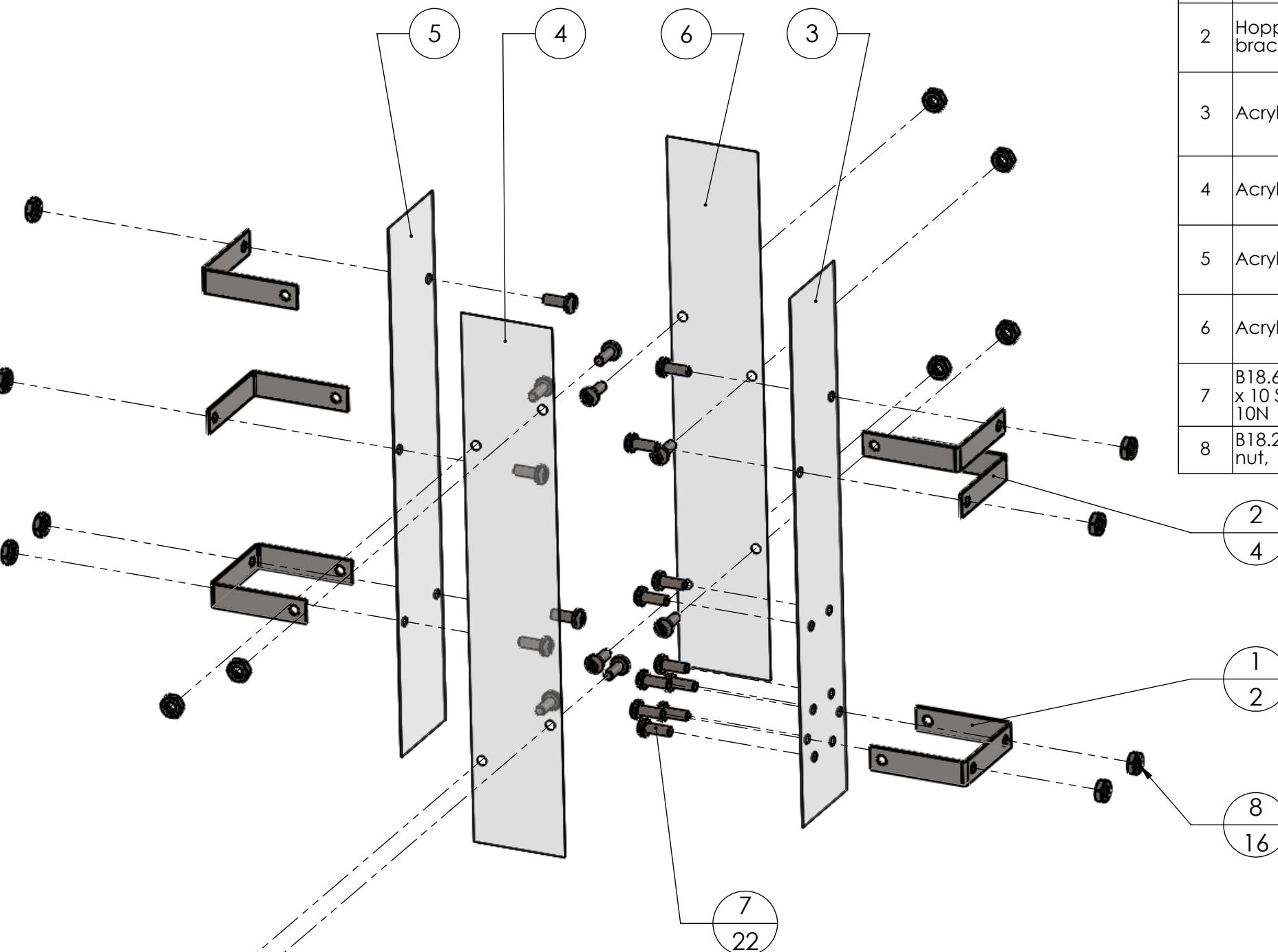
SolidWorks Student Edition. For Academic Use Only.

ITEM NO.	PART NUMBER	AUTHOR	MATERIAL	SHEET NO.	QTY.
1	Hopper U Bracket	Alexandre Sauve	Plain Carbon Steel	74, 75	2
2	Hopper corner bracket	Alexandre Sauve	Plain Carbon Steel	73, 72	4
3	Acrylic Panel 4	Alexandre Sauve	Acrylic (Medium-high impact)	71	1
4	Acrylic Panel 3	Alexandre Sauve	Acrylic (Medium-high impact)	70	1
5	Acrylic Panel 2	Alexandre Sauve	Acrylic (Medium-high impact)	69	1
6	Acrylic Panel 1	Alexandre Sauve	Acrylic (Medium-high impact)	68	1
7	B18.6.7M - M3.5 x 0.6 x 10 Slotted PHMS --10N	Solidworks Toolbox	Plain Carbon Steel	N/A	22
8	B18.2.4.5M - Hex jam nut, M5 x 0.8 --D-N	Solidworks Toolbox	Plain Carbon Steel	N/A	16

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
Instructors: Dr. Mertiny Dr. Duke Win. 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$		Group name The Ole Einar Bjørndalen Group	TITLE: Hopper Subassembly	
Comments:	SURFACE FINISH $0.6 \mu\text{m}$		Group number 13		
		DO NOT SCALE DRAWING	SM By Alexandre Sauve		
MATERIAL: As in B.O.M.		Reviewed by Boston Maris	SIZE B Built By: BM and DG		REV A
FILE NAME: Hopper Subassembly		Saturday, April 05, 2014 3:25:36 PM Saturday, March 29, 2014 1:26:47 PM	SCALE: 1:1		Sheet 65 of 117

8 7 6 5 4 3 2 1

ITEM NO.	PART NUMBER	AUTHOR	MATERIAL	SHEET NO.	QTY.
1	Hopper U Bracket	Alexandre Sauve	Plain Carbon Steel	74, 75	2
2	Hopper corner bracket	Alexandre Sauve	Plain Carbon Steel	72, 73	4
3	Acrylic Panel 4	Alexandre Sauve	Acrylic (Medium-high impact)	71	1
4	Acrylic Panel 3	Alexandre Sauve	Acrylic (Medium-high impact)	70	1
5	Acrylic Panel 2	Alexandre Sauve	Acrylic (Medium-high impact)	69	1
6	Acrylic Panel 1	Alexandre Sauve	Acrylic (Medium-high impact)	68	1
7	B18.6.7M - M3.5 x 0.6 x 10 Slotted PHMS -- 10N	Solidworks Toolbox	Plain Carbon Steel	N/A	22
8	B18.2.4.5M - Hex jam nut, M5 x 0.8 --D-N	Solidworks Toolbox	Plain Carbon Steel	N/A	16



Mec E 260_265	UNLESS OTHERWISE SPECIFIED:	DRAWN BY:
Instructors: Dr. Mertiny Dr. Duke	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Alexandre Sauve
Win. 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
Comments:	DO NOT SCALE DRAWING	Group number 13
		SM By Alexandre Sauve
		Reviewed by Boston Maris
		Saturday, April 05, 2014 3:25:36 PM Saturday, March 29, 2014 1:26:47 PM
	MATERIAL: As in B.O.M.	
	FILE NAME: Hopper Subassembly	

The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	TITLE: Hopper Subassembly	
SIZE B	Built By: BM and DG	REV A
SCALE: 1:1	Mass: 67.32	SHEET 66 OF 117

**SolidWorks Student Edition.
For Academic Use Only.**

8 7 6 5 4 3 2 1

D

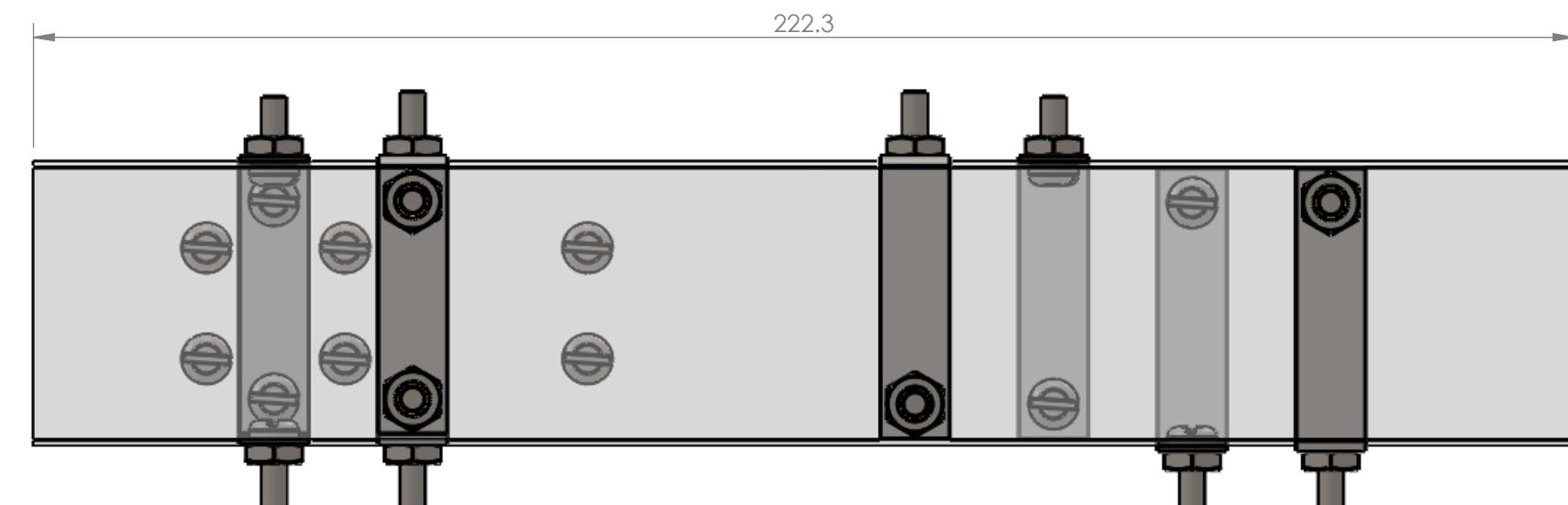
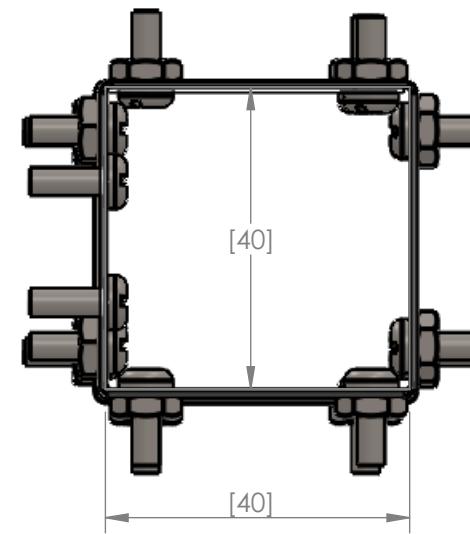
D

C

C

B

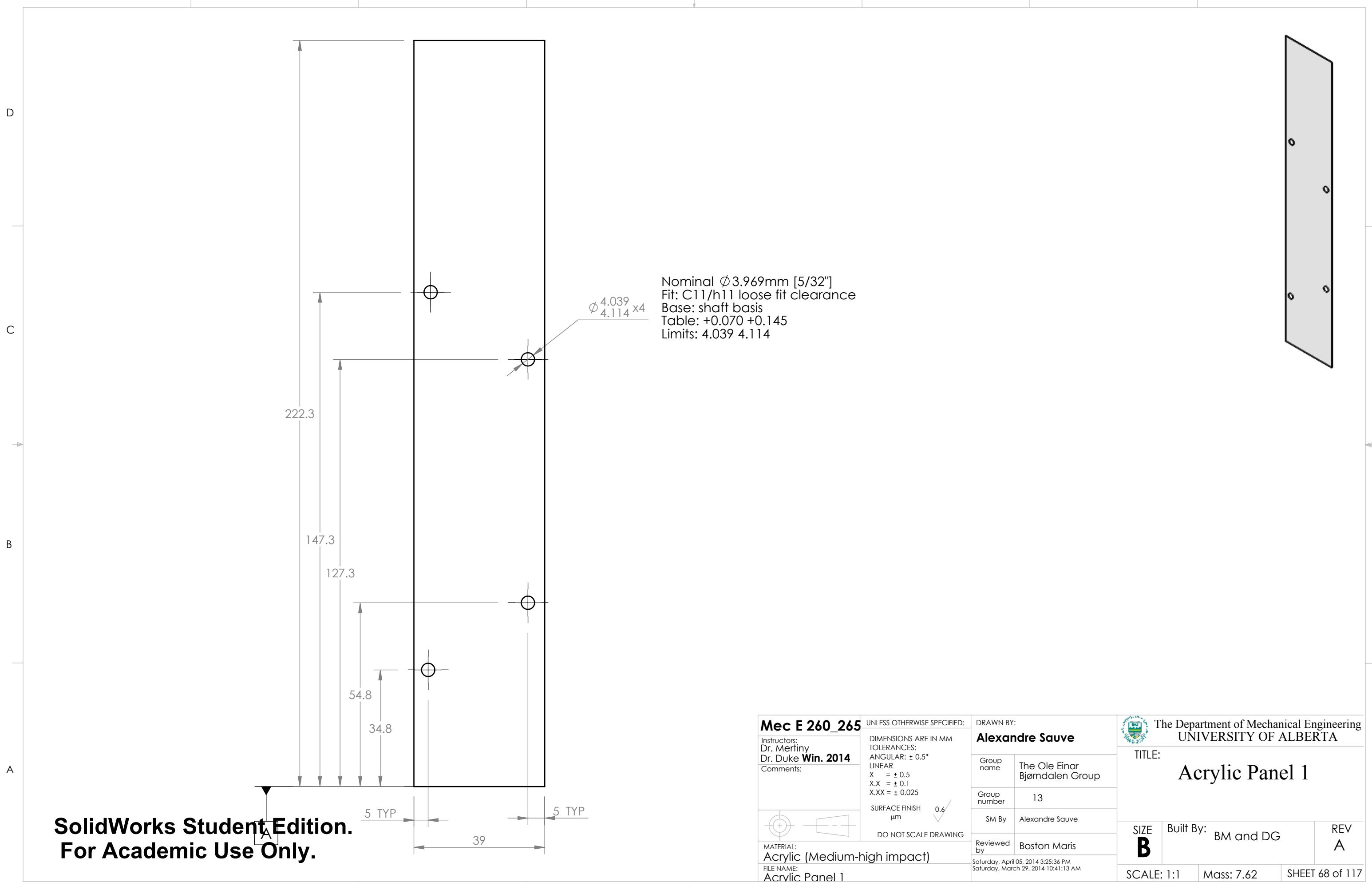
B



**SolidWorks Student Edition.
For Academic Use Only.**

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	TITLE: Hopper Subassembly
		Group number 13	SIZE B
		SM By Alexandre Sauve	Built By: BM and DG
		Reviewed by Boston Maris	REV A
		Saturday, April 05, 2014 3:25:36 PM Saturday, March 29, 2014 1:26:47 PM	SCALE: 1:1
			Mass: 67.32
			SHEET 67 OF 117

8 7 6 5 4 3 2 1



Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke Win. 2014		Comments:	Group name The Ole Einar Bjørndalen Group
			Group number 13
			SM By Alexandre Sauve
			Reviewed by Boston Maris
			Saturday, April 05, 2014 3:25:36 PM Saturday, March 29, 2014 10:41:13 AM
MATERIAL: Acrylic (Medium-high impact)		DO NOT SCALE DRAWING 	
FILE NAME: Acrylic Panel 1			
BUILT BY: BM and DG	SIZE B	REV A	
SCALE: 1:1	Mass: 7.62	SHEET 68 of 117	

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Acrylic Panel 1

SIZE
B

Built By: BM and DG

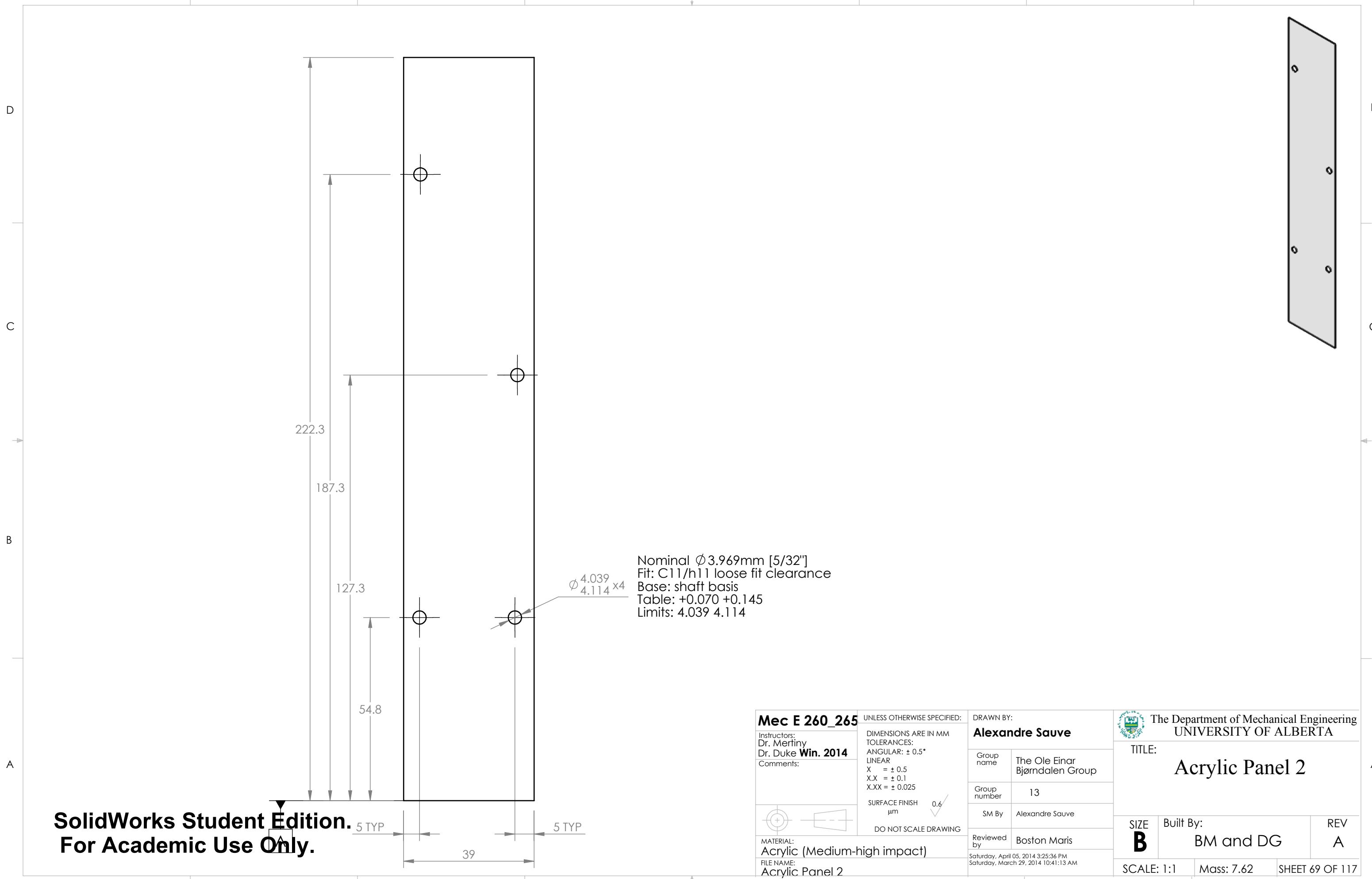
REV
A

SCALE: 1:1

Mass: 7.62

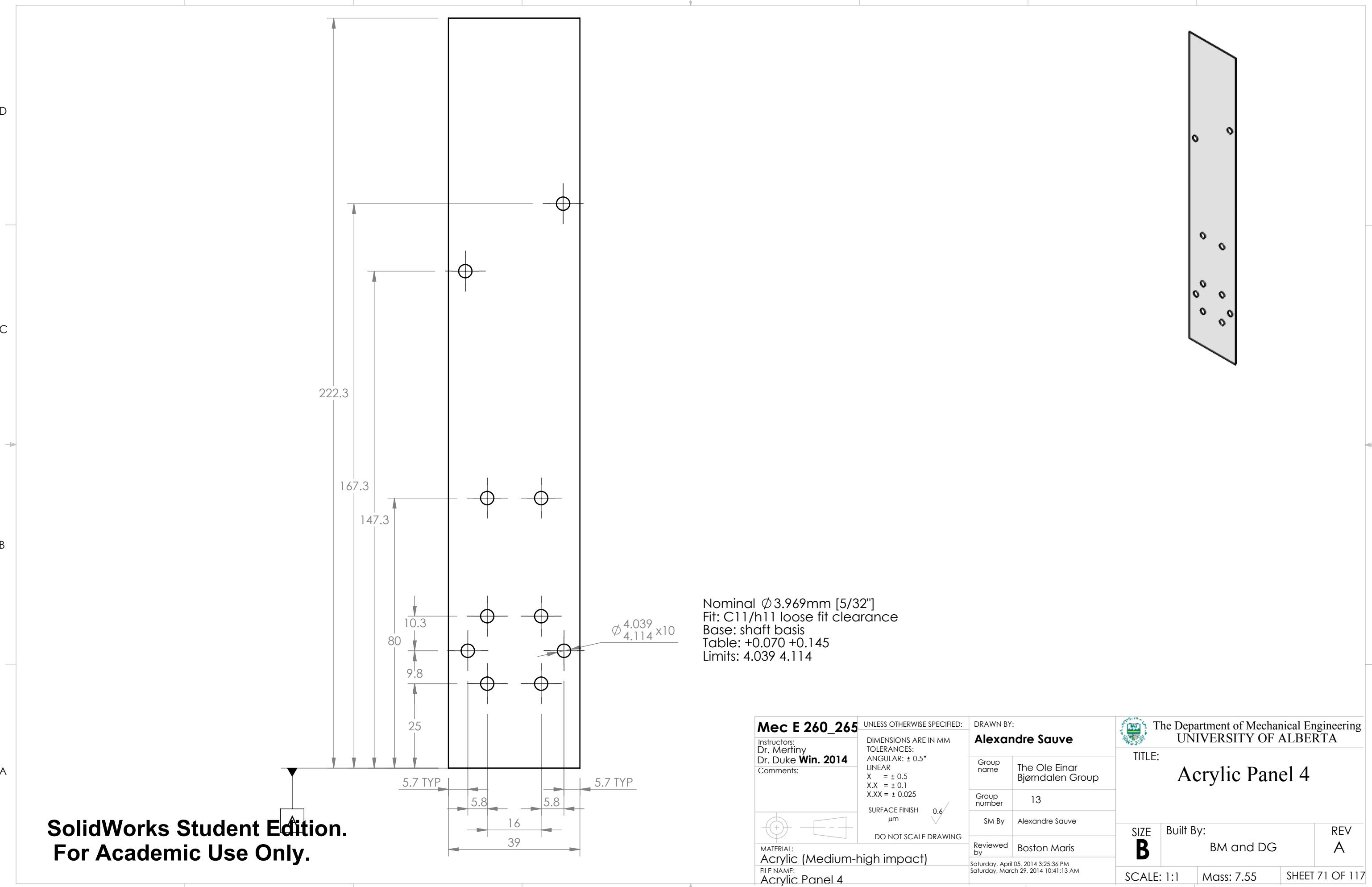
SHEET 68 of 117

8 7 6 5 4 3 2 1

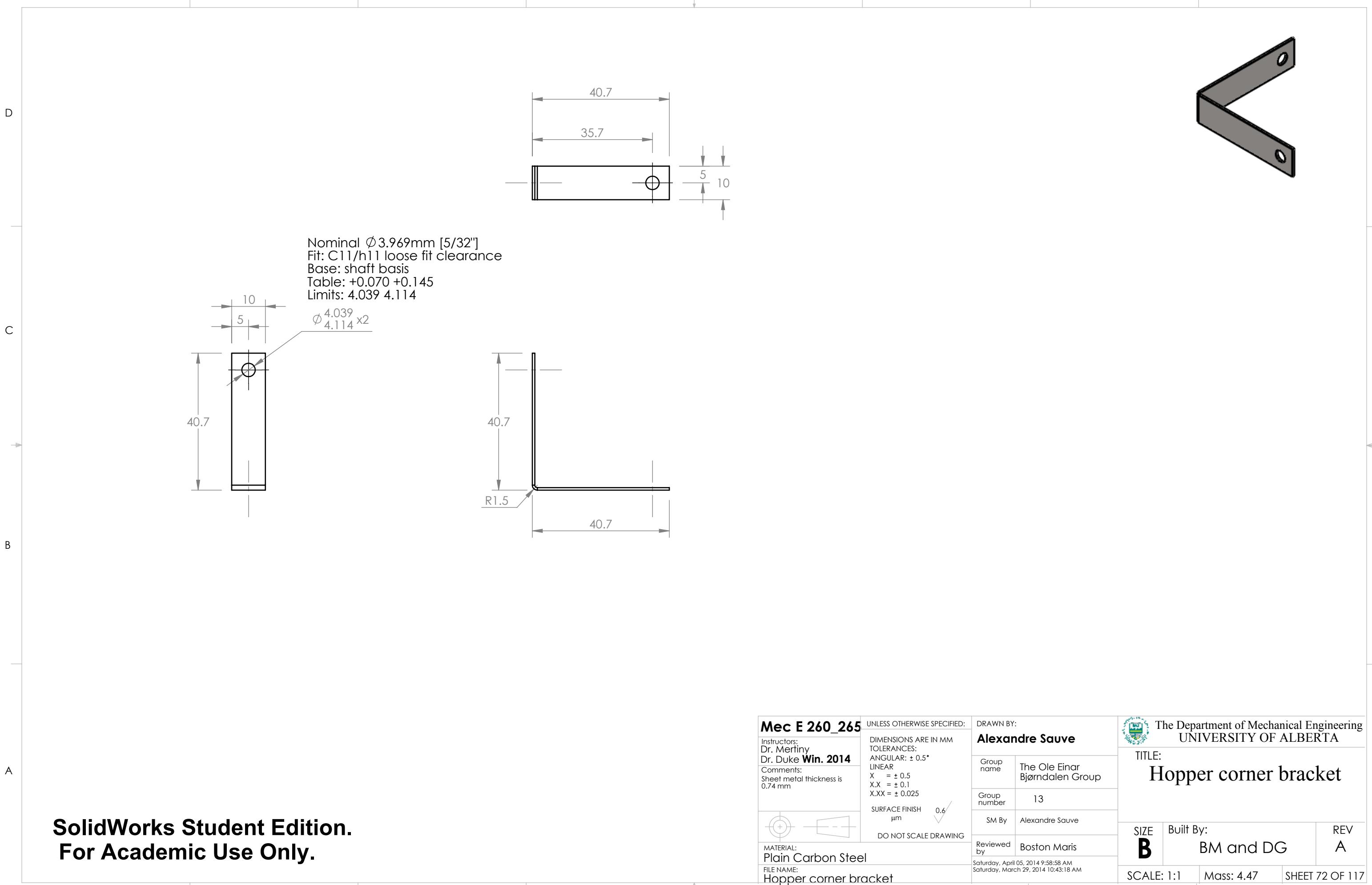


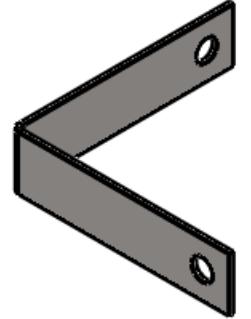
8 7 6 5 4 3 2 1



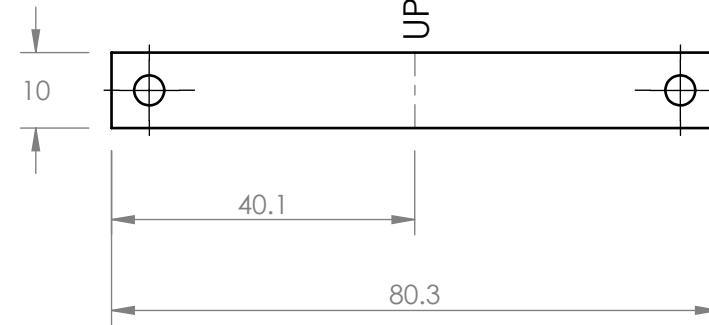


8 7 6 5 4 3 2 1

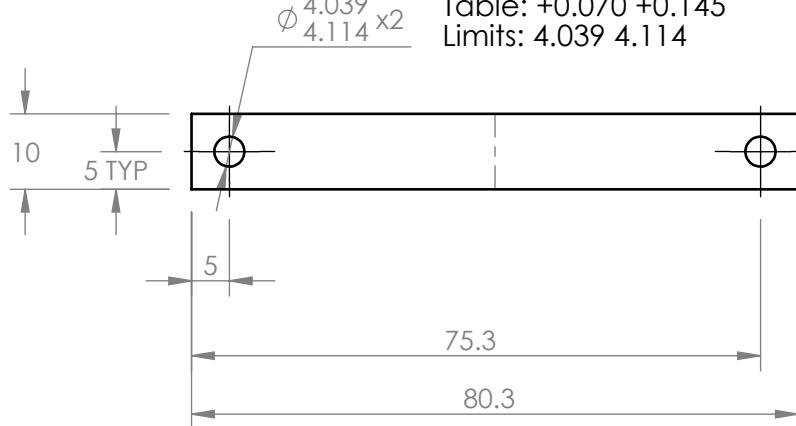




UP 90° R 0.74



Nominal $\phi 3.969\text{mm}$ [5/32"]
Fit: C11/h11 loose fit clearance
Base: shaft basis
Table: +0.070 +0.145
Limits: 4.039 4.114

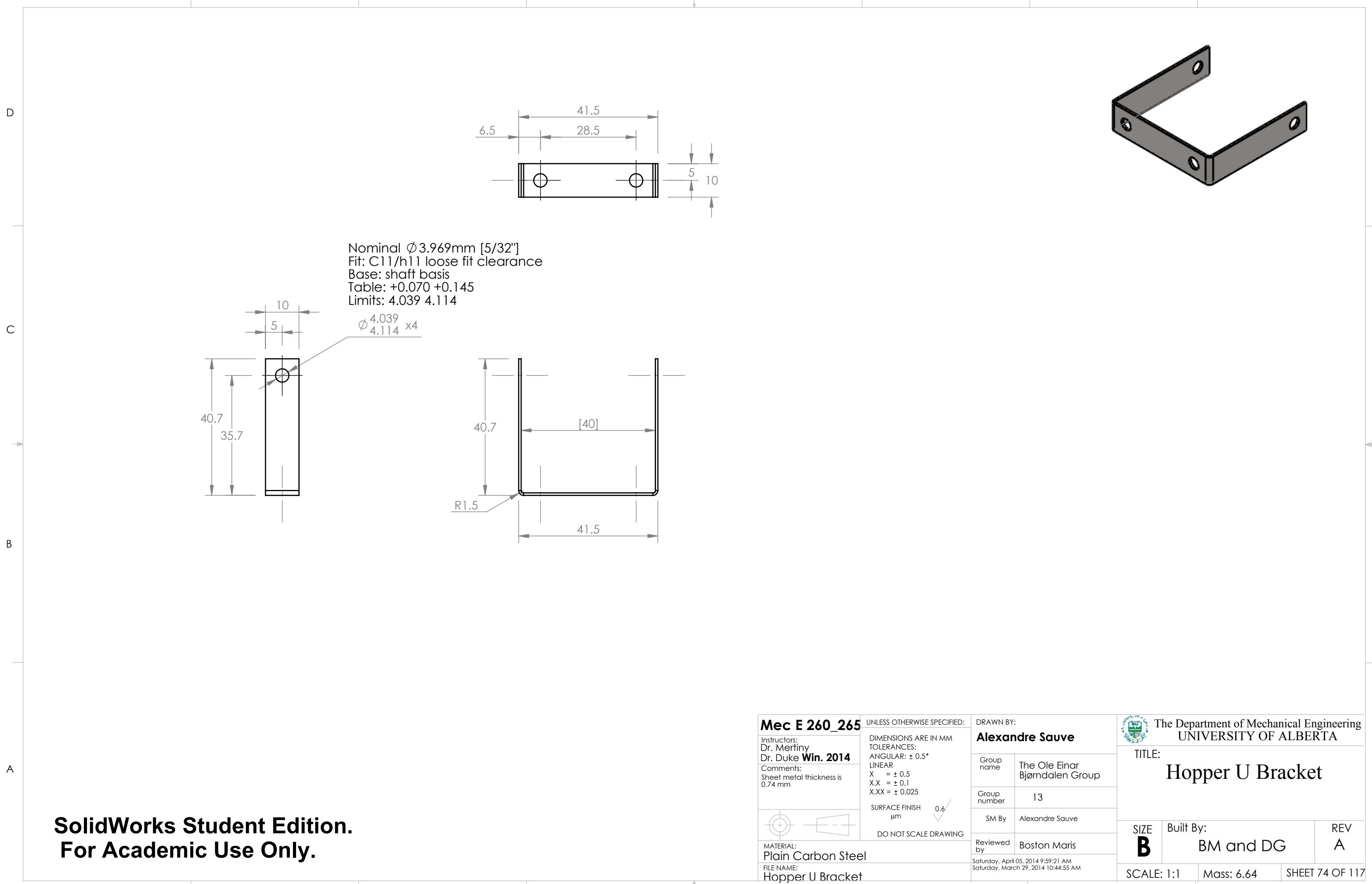


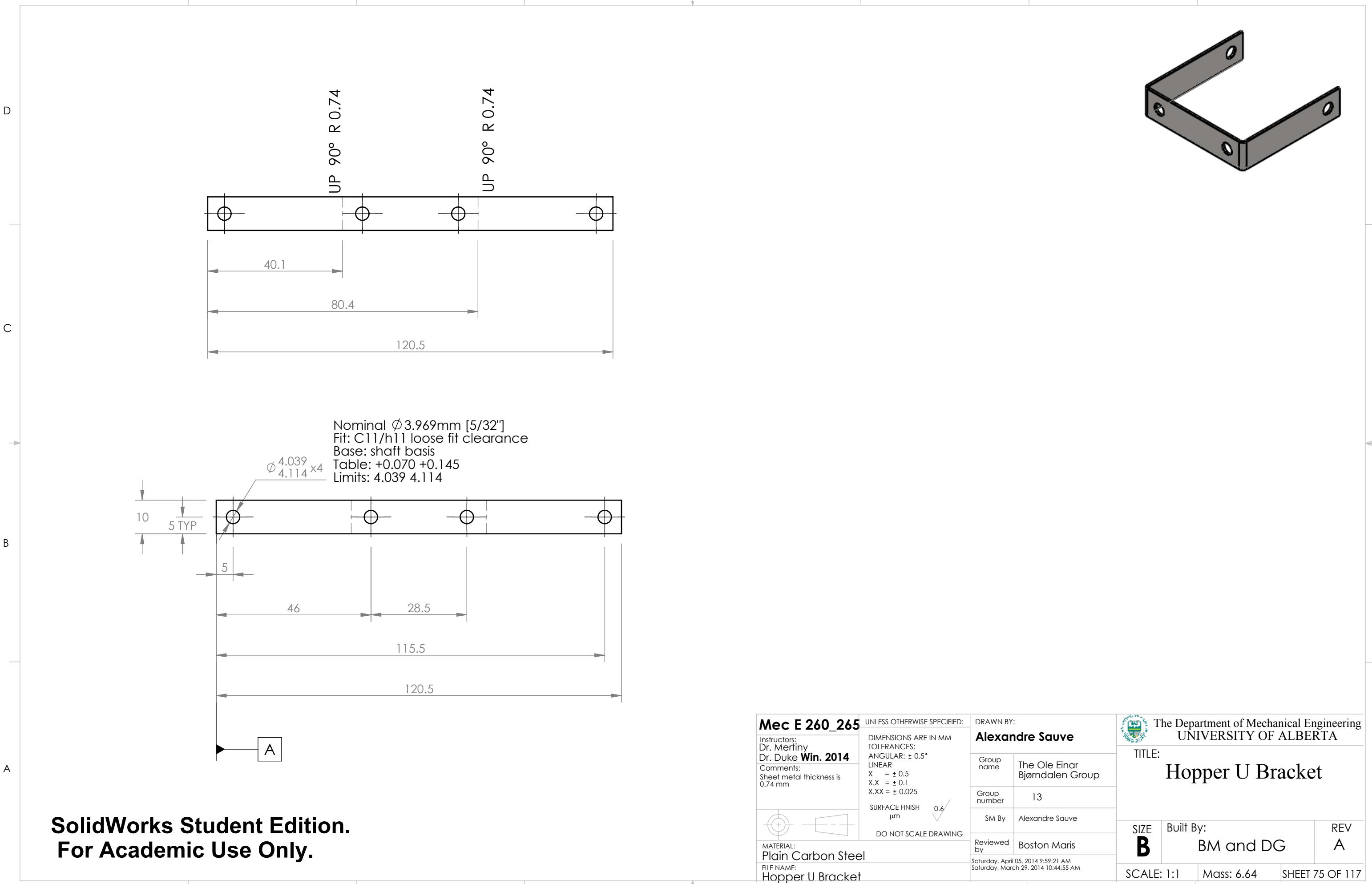
SolidWorks Student Edition.
For Academic Use Only.

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke Win. 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
Comments: Sheet metal thickness is 0.74 mm	DO NOT SCALE DRAWING	Group number 13
		SM By Alexandre Sauve
		Reviewed by Boston Maris
		Saturday, April 05, 2014 9:58:58 AM Saturday, March 29, 2014 10:43:18 AM
MATERIAL: Plain Carbon Steel	FILE NAME: Hopper corner bracket	

The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	TITLE: Hopper corner bracket	
SIZE B	Built By: BM and DG	REV A
SCALE: 1:1	Mass: 4.47	SHEET 73 OF 117

8 7 6 5 4 3 2 1

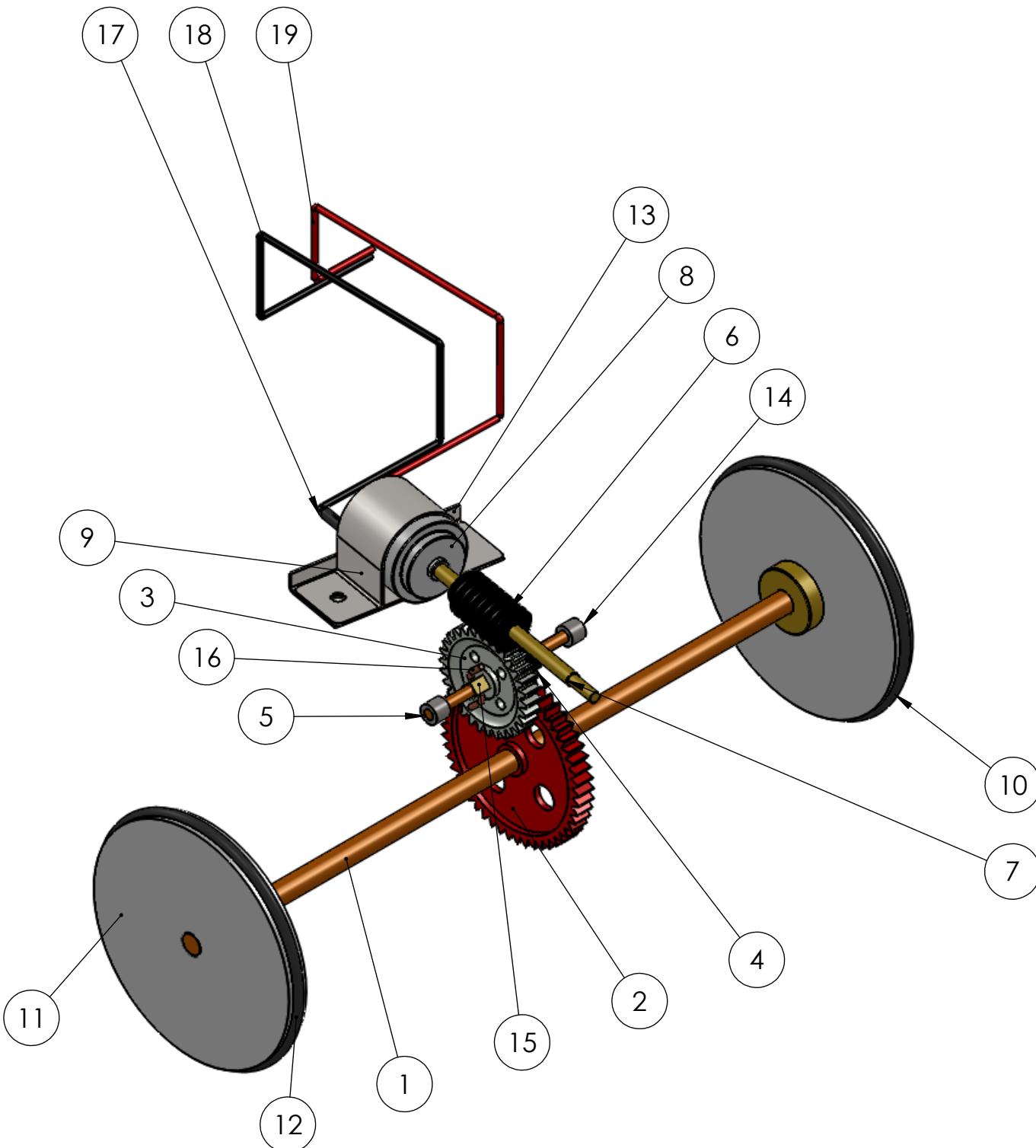




Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Alexandre Sauve
Instructors: Dr. Mertiny Dr. Duke Win. 2014		SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
Comments: Sheet metal thickness is 0.74 mm		Group number 13	Group number 13
		SM By Alexandre Sauve	SM By Alexandre Sauve
Reviewed by Boston Maris		Reviewed by Boston Maris	Reviewed by Boston Maris
Saturday, April 05, 2014 9:59:21 AM Saturday, March 29, 2014 10:44:55 AM		SIZE B Built By: BM and DG REV A	
SCALE: 1:1 Mass: 6.64		SHEET 75 OF 117	

**SolidWorks Student Edition.
For Academic Use Only.**

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA
TITLE:
Hopper U Bracket



Please Mark: Drawn by Boston Maris
Reviewed by Drew Gingras

Note: Each wire has a length of 6"

ITEM NO.	PART NUMBER	MATERIAL	SW Author	Sheet Number	QTY
1	Drive Shaft	Plain Carbon Steel	Boston Maris	82	1
2	T50 Spur_ver3	ABS	G. Gearloose	81	1
3	T30 Spur	Nylon 101	D.S. Nobes	79	1
4	T10 Spur	ABS	G. Gearloose	117	1
5	Drive Shaft Connecting Rod	Plain Carbon Steel	Boston Maris	80	1
6	Worm_Gear_Single_Start (1)	ABS	D.S. Nobes	110	1
7	Motor 1 step shaft	Brass	Boston Maris	89	1
8	Motor	AISI 1020	Kevin O'Rourke	N/A	1
9	Motor 1 Bracket	Plain Carbon Steel	Boston Maris	83,84,85	1
10	Driven Wheel Sub-Assembly		Kevin O'Rourke	91	1
11	Driven Wheels	Polybutadiene (PB)	Kevin O'Rourke	N/A	1
12	Driven Wheel Rubber Ring	HYPALON	Kevin O'Rourke	92	1
13	Motor 1 Bracket Bottom	Plain Carbon Steel	Boston Maris	86,87,88	1
14	Collar_0.125	AISI 316 Stainless Steel Sheet (SS)	A. Drafter	N/A	2
15	Drive Shaft Connecting Square Tubing	Brass	Boston Maris	90	1
16	Axle to Tubing Locking S Bend	Copper	Boston Maris	114	1
17	Heat Shrink Wrap	Rubber	Boston Maris	N/A	2
18	Black Wire Motor 1	Copper	Boston Maris	N/A	1
19	Red Wire Motor 1	Copper	Boston Maris	N/A	1

Mec E 260_265		UNLESS OTHERWISE SPECIFIED
Instructors: Dr. Merfiny Dr. Duke Win. 2014	DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	
Comments:	SURFACE FINISH μm	
 		DO NOT SCALE DRAWING
MATERIAL: As Stated in B.O.M.		
FILE NAME: Driving Assembly		

	DRAWN BY:
Boston Maris	
Group name	The Ole Einar Bjørndalen Group
Group number	13
SM By	Boston Maris
Reviewed by	Drew Gingras
Saturday, April 05, 2014 3:25:36 PM	
Tuesday, March 18, 2014 4:11:17 PM	

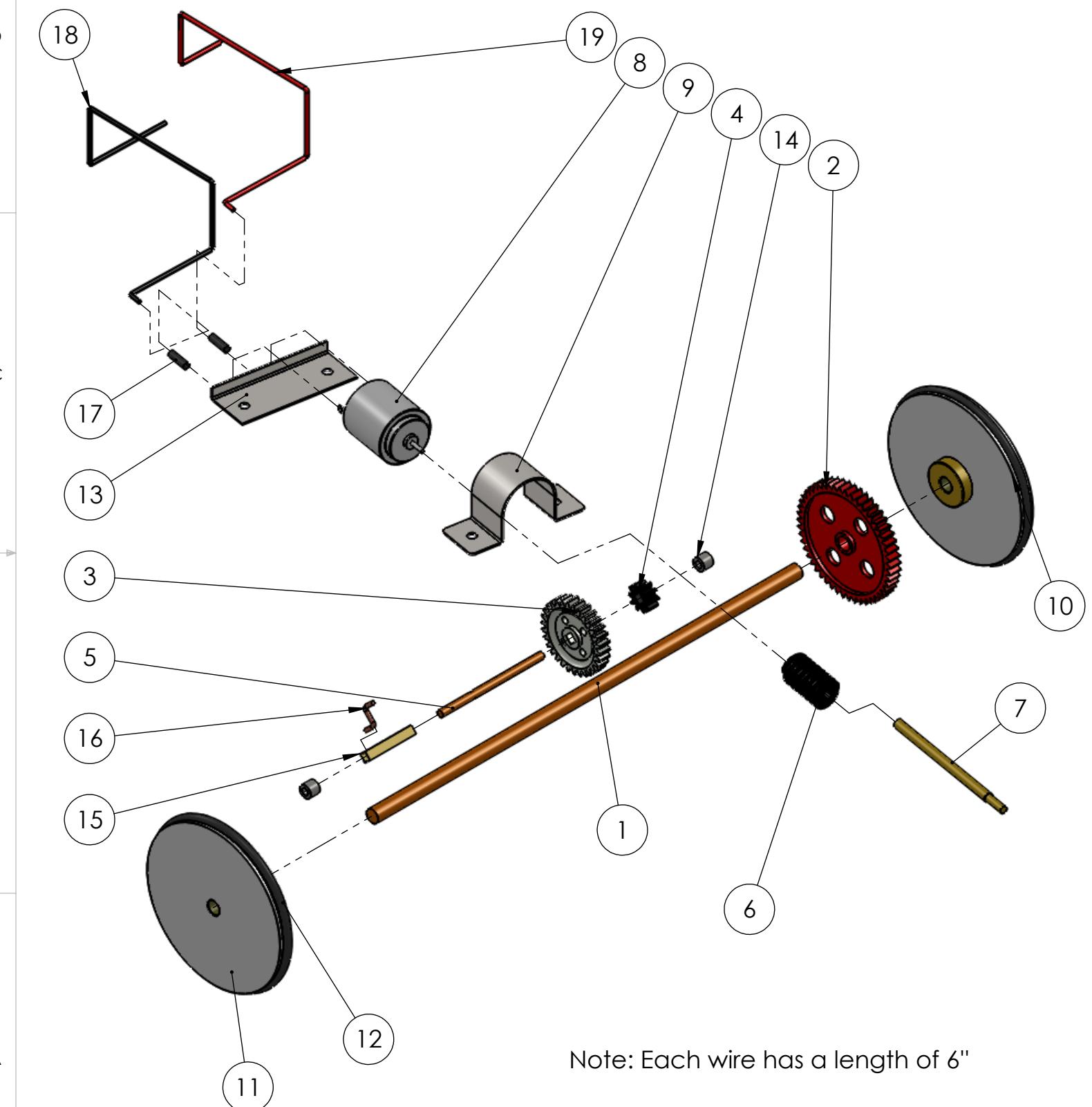
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Driving Assembly (M)
ISO. View

SIZE B	Built By: Group 13	REV A
SCALE: 1:1.5 Mass: 252.49		SHEET 76 OF 117

8 7 6 5 4 3 2 1

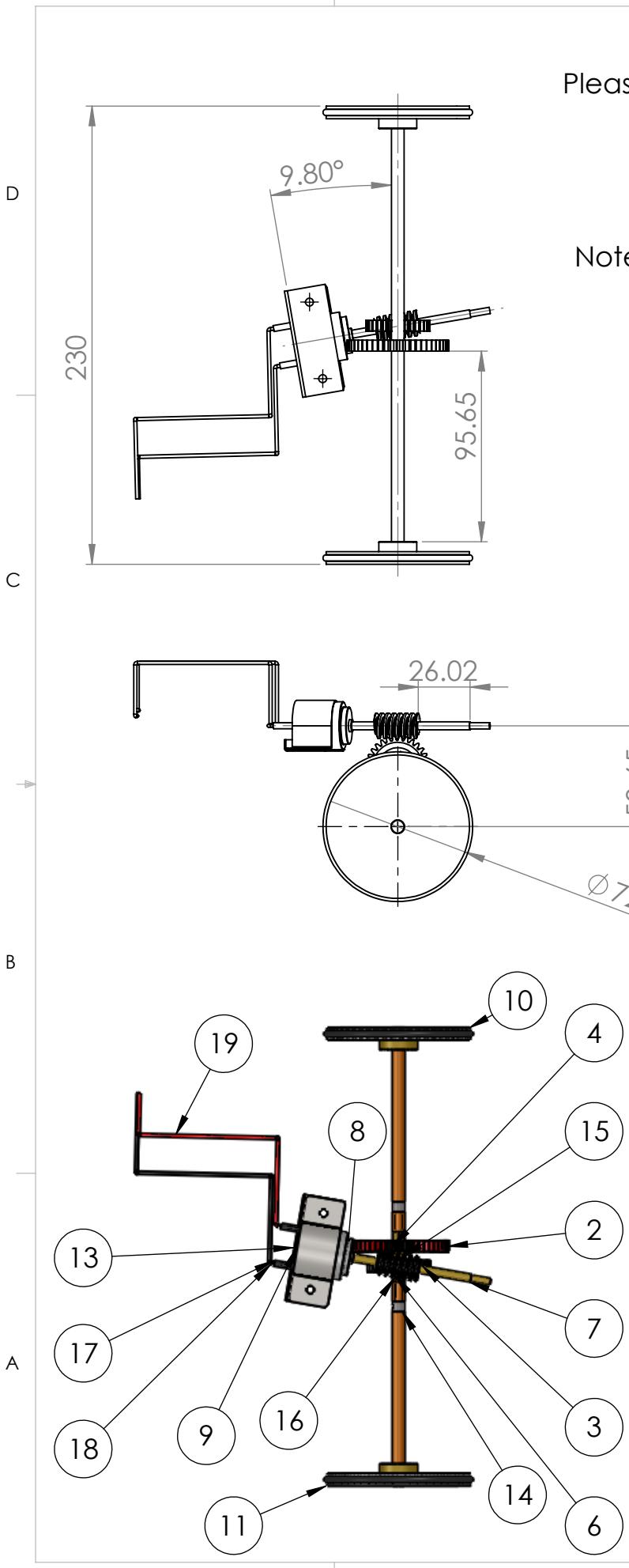
Please Mark: Drawn by Boston Maris
Reviewed by Drew Gingras



ITEM NO.	PART NUMBER	Material	SW-Author(Author)	Sheet Number	QTY.
1	Drive Shaft	Plain Carbon Steel	Boston Maris	82	1
2	T50 Spur_ver3	ABS	G. Gearloose	81	1
3	T30 Spur	Nylon 101	D.S. Nobes	79	1
4	T10 Spur	ABS	G. Gearloose	117	1
5	Drive Shaft Connecting Rod	Plain Carbon Steel	Boston Maris	80	1
6	Worm_Gear_Single_Start (1)	ABS	D.S. Nobes	110	1
7	Motor 1 step shaft	Brass	Boston Maris	89	1
8	Motor	AISI 1020	Kevin O'Rourke	N/A	1
9	Motor 1 Bracket	Plain Carbon Steel	Boston Maris	83,84,85	1
10	Driven Wheel Sub-Assembly		Kevin O'Rourke	91	1
11	Driven Wheels	Polybutadiene (PB)	Kevin O'Rourke	N/A	1
12	Driven Wheel Rubber Ring	HYPALON	Kevin O'Rourke	92	1
13	Motor 1 Bracket Bottom	Plain Carbon Steel	Boston Maris	86,87,88	1
14	Collar_0.125	AISI 316 Stainless Steel Sheet (SS)	A. Drafter	N/A	2
15	Drive Shaft Connecting Square Tubing	Brass	Boston Maris	90	1
16	Axle to Tubing Locking S Bend	Copper	Boston Maris	114	1
17	Heat Shrink Wrap	Rubber	Boston Maris	N/A	2
18	Black Wire Motor 1	Copper	Boston Maris	N/A	1
19	Red Wire Motor 1	Copper	Boston Maris	N/A	1

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY: Boston Maris	
Instructors: Dr. Mertiny Dr. Duke		DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Comments: Win. 2014	
		Group name The Ole Einar Bjørndalen Group		
		Group number 13		
		SM By Boston Maris		
		Reviewed by Drew Gingras		
		Saturday, April 05, 2014 3:25:34 PM Tuesday, March 18, 2014 4:11:17 PM		
SIZE	Built By: Group 13		REV	
B			A	
SCALE: 1:2		Mass: 252.49	SHEET 77 OF 117	

Note: Each wire has a length of 6"

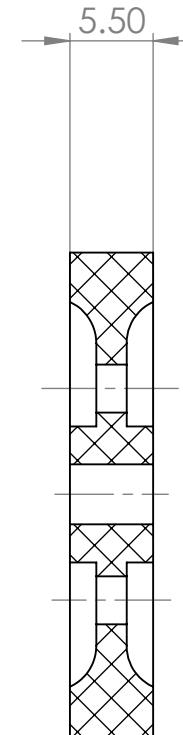
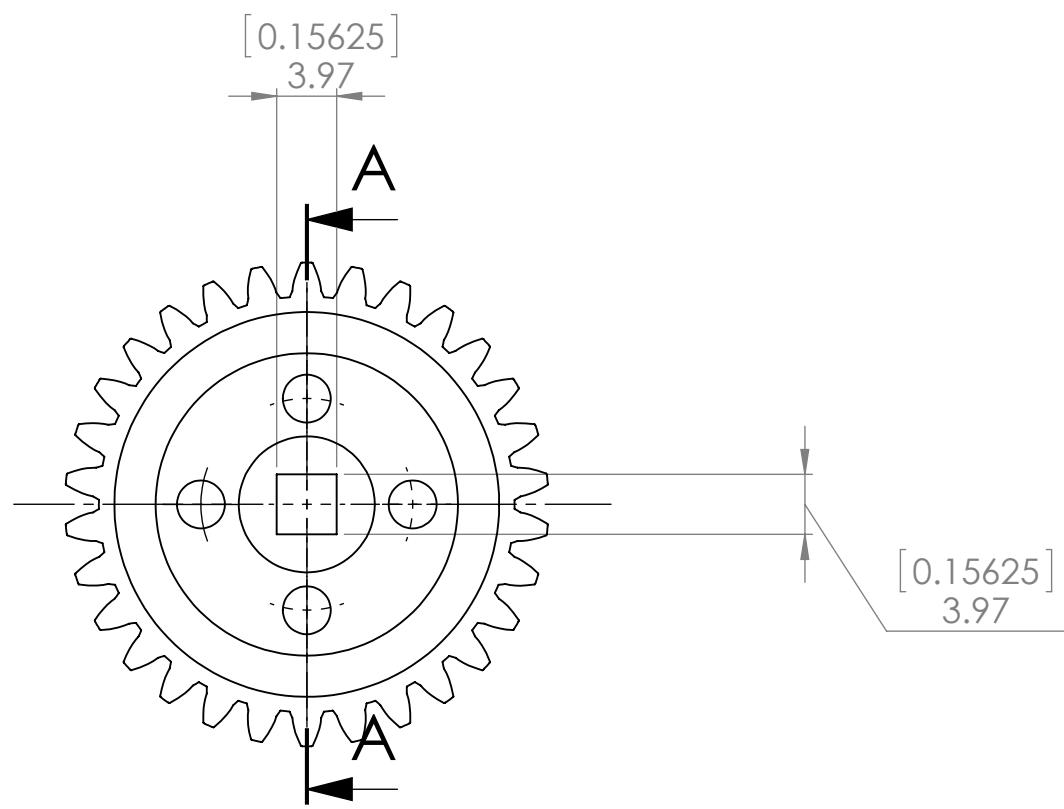
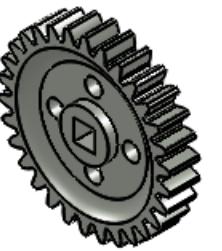


ITEM NO.	PART NUMBER	MATERIAL	SW Author	Sheet Number	QTY.
1	Drive Shaft	Plain Carbon Steel	Boston Maris	82	1
2	T50 Spur_ver3	ABS	G. Gearloose	81	1
3	T30 Spur	Nylon 101	D.S. Nobes	79	1
4	T10 Spur	ABS	G.Gearloose	117	1
5	Drive Shaft Connecting Rod	Plain Carbon Steel	Boston Maris	80	1
6	Worm_Gear_Single_Start (1)	ABS	D.S. Nobes	110	1
7	Motor 1 step shaft	Brass	Boston Maris	89	1
8	Motor	AISI 1020	Kevin ORourke	N/A	1
9	Motor 1 Bracket	Plain Carbon Steel	Boston Maris	83,84,85	1
10	Driven Wheel Sub-Assembly		Kevin ORourke	91	1
11	Driven Wheels	Polybutadiene (PB)	Kevin ORourke	N/A	1
12	Driven Wheel Rubber Ring	HYPALON	Kevin ORourke	92	1
13	Motor 1 Bracket Bottom	Plain Carbon Steel	Boston Maris	86,87,88	1
14	Collar_0.125	AISI 316 Stainless Steel Sheet (SS)	A. Drafter	N/A	2
15	Drive Shaft Connecting Square Tubing	Brass	Boston Maris	90	1
16	Axle to Tubing Locking S Bend	Copper	Boston Maris	114	1
17	Heat Shrink Wrap	Rubber	Boston Maris	N/A	2
18	Black Wire Motor 1	Copper	Boston Maris	N/A	1
19	Red Wire Motor 1	Copper	Boston Maris	N/A	1

Mec E 260_265		UNLESS OTHERWISE SPECIFIED:	DRAWN BY: Boston Maris	
Instructors: Dr. Mertiny Dr. Duke		DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	Comments: The Ole Einar Bjørndalen Group	
		SURFACE FINISH $0.6 \mu\text{m}$	Group name Group number SM By	
		DO NOT SCALE DRAWING	13 Boston Maris	
MATERIAL: As Stated in B.O.M.		Reviewed by	Drew Gingras	
FILE NAME: Driving Assembly		Saturday, April 05, 2014 3:25:34 PM Tuesday, March 18, 2014 4:11:17 PM		REV A
SIZE B	Built By: Group13		SCALE: 1:3 Mass: 252.49 SHEET 78 OF 117	

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
**Driving Assembly (M)
Ortho. View**



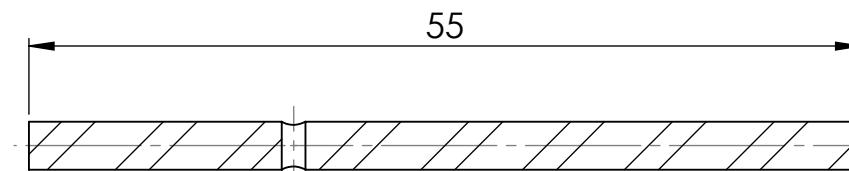
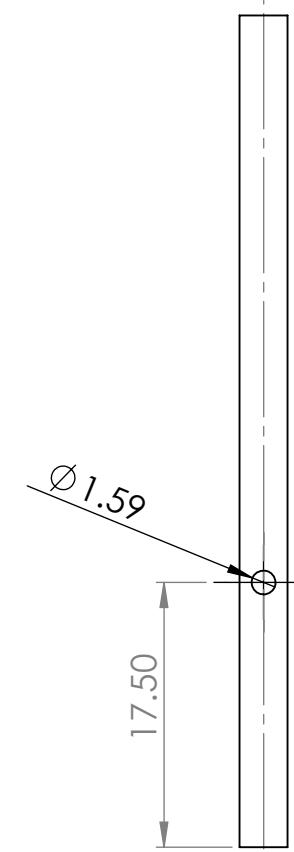
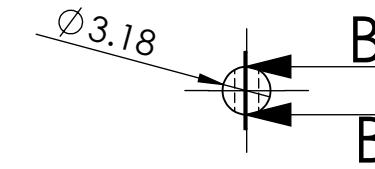
SECTION A-A
SCALE 2 : 1

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Boston Maris	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	TITLE: T30 Spur
		Group number 13	
		SM By D.S. Nobes	
		Reviewed by Drew Gingras	
		Saturday, March 29, 2014 11:03:01 AM Thursday, September 30, 2010 8:53:46 AM	
MATERIAL: Nylon 101	DO NOT SCALE DRAWING	Built By: Machinist	REV A
FILE NAME: T30 Spur		SIZE B	
		SCALE: 1:1	Mass:
			SHEET 79 OF 117

8 7 6 5 4 3 2 1

D

D



SECTION B-B
SCALE 2 : 1

C

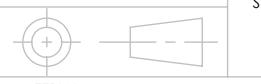
C

B

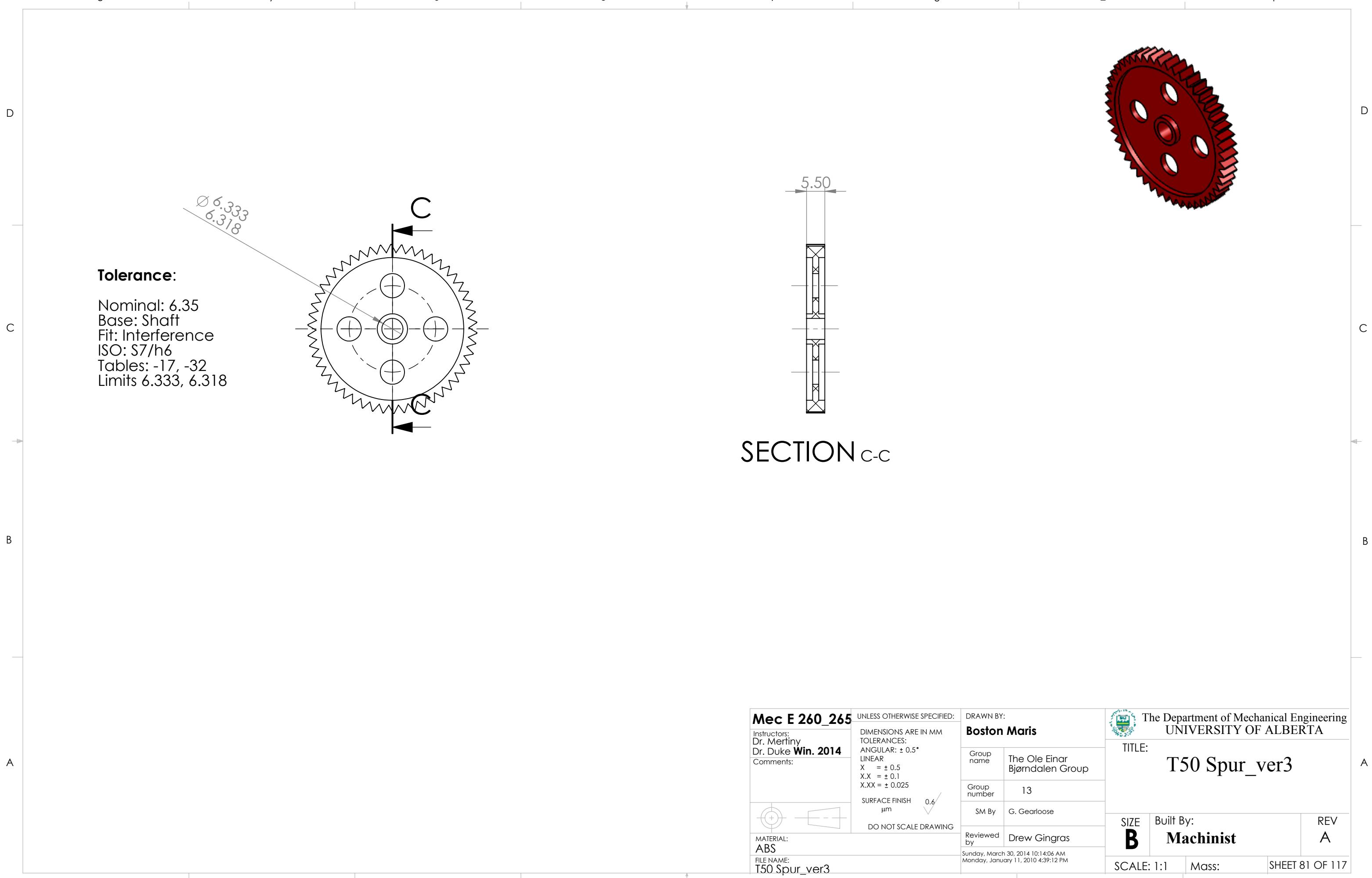
B

A

A

Mec E 260_265 Instructors: Dr. Mertiny Dr. Duke Win. 2014 Comments: 		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$ SURFACE FINISH $0.6 \mu\text{m}$  DO NOT SCALE DRAWING	DRAWN BY: Boston Maris Group name The Ole Einar Bjørndalen Group Group number 13 SM By Boston Maris Reviewed by Drew Gingras <small>Thursday, April 03, 2014 5:49:46 PM Friday, March 07, 2014 4:54:44 PM</small>	 The Department of Mechanical Engineering UNIVERSITY OF ALBERTA TITLE: Drive Shaft Connecting Rod SIZE B Built By: RN and KO REV A SCALE: 2:1 Mass: 3.35 SHEET 80 OF 117
		MATERIAL: Plain Carbon Steel FILE NAME: Drive Shaft Connecting Rod		

8 7 6 5 4 3 2 1



8

7

6

5

4

3

2

1

D

D

C

C

B

B

A

A

**Mec E 260_265**Instructors:
Dr. Mertiny
Dr. Duke Win. 2014

Comments:



DO NOT SCALE DRAWING

MATERIAL:

Plain Carbon Steel

FILE NAME:

Drive Shaft

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN MM

TOLERANCES:

ANGULAR: $\pm 0.5^\circ$

LINEAR

 $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$

SURFACE FINISH

 $0.6 \mu\text{m}$

V

DO NOT SCALE DRAWING

DRAWN BY:

Boston Maris

Group name

The Ole Einar
Bjørndalen Group

Group number

13

SM By

Boston Maris

Reviewed by

Drew Gingras

Thursday, April 03, 2014 5:48:04 PM

Friday, March 07, 2014 2:33:10 PM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:

Drive Shaft

SIZE

BBuilt By:
Boston Maris

REV

A

SCALE: 1:1

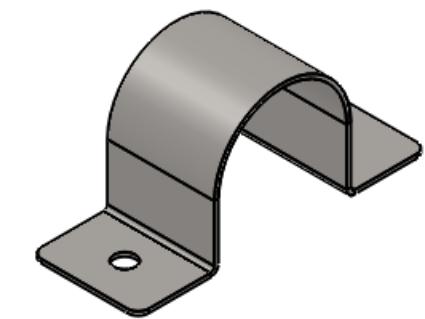
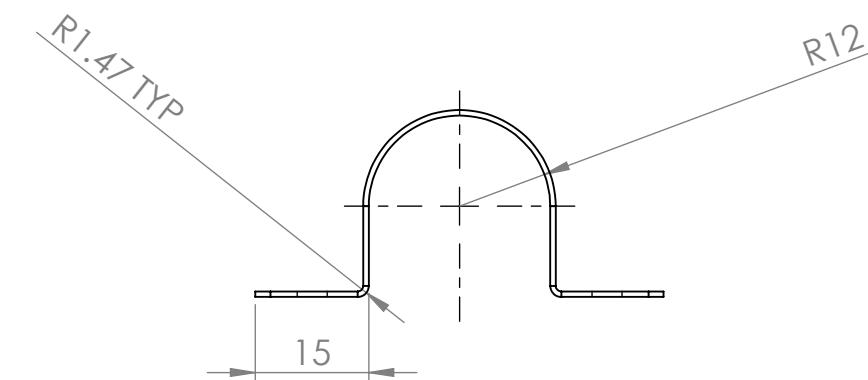
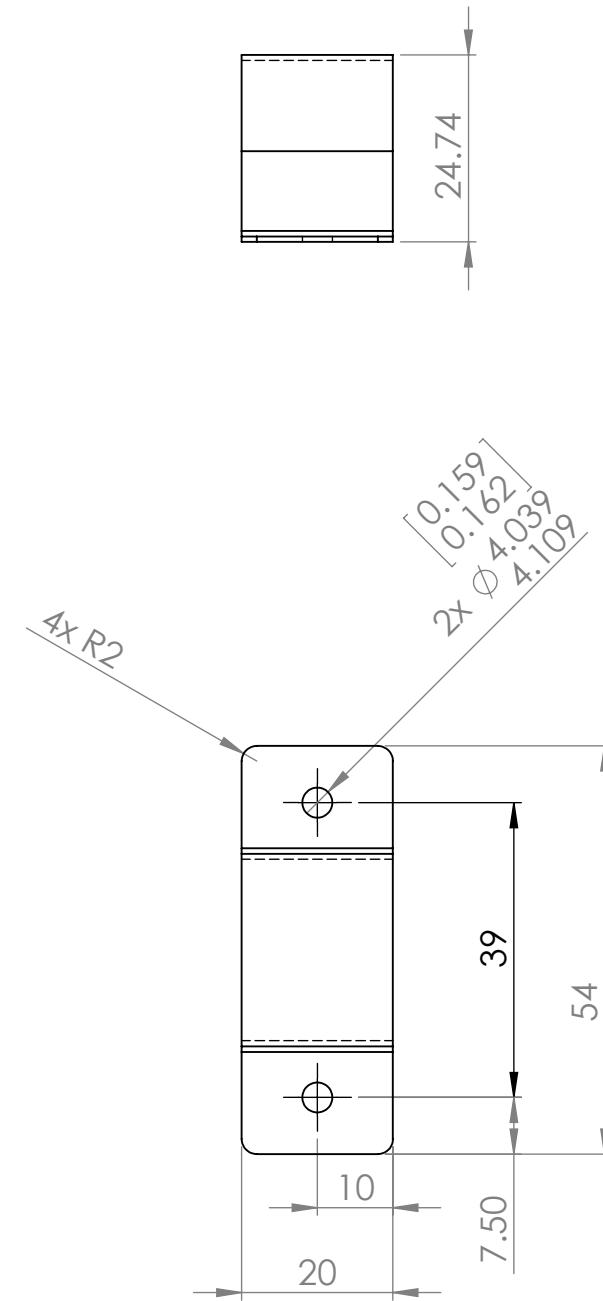
Mass: 56.81

SHEET 82 OF 117

Please Mark: Drawn by Boston Maris
Reviewed by Drew Gingras

D

D



C

C

Tolerance:

Nominal: 3.970
Base: Shaft
Fit: Clearance
ISO: D11/h11
Tables: +70, +145
Limits 4.039, 4.109

B

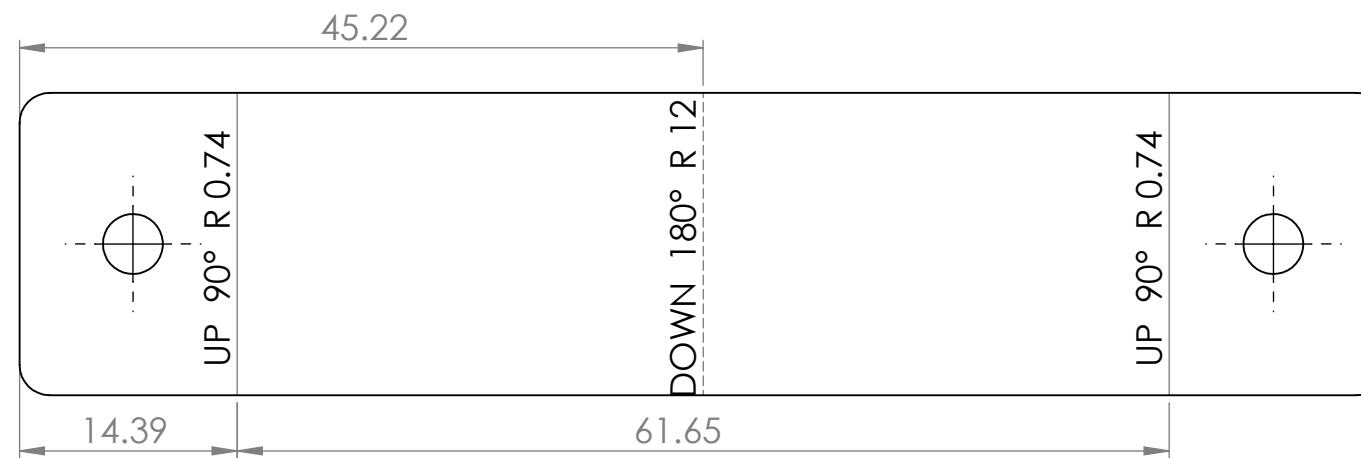
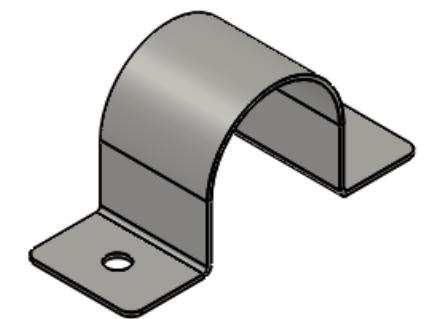
B

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Boston Maris
Instructors: Dr. Mertiny Dr. Duke Win. 2014		SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
Comments: Sheet Metal Thickness is 0.74mm		DO NOT SCALE DRAWING	Group number 13
			SM By Boston Maris
MATERIAL: Plain Carbon Steel		Reviewed by Drew Gingras	TITLE: Motor 1 Bracket (M)
FILE NAME: Motor 1 Bracket		Saturday, April 05, 2014 9:54:04 AM Sunday, March 09, 2014 1:52:33 PM	SIZE B Built By: Boston Maris REV A
SCALE: 1:1 Mass: 10.23		SHEET 83 OF 117	

8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

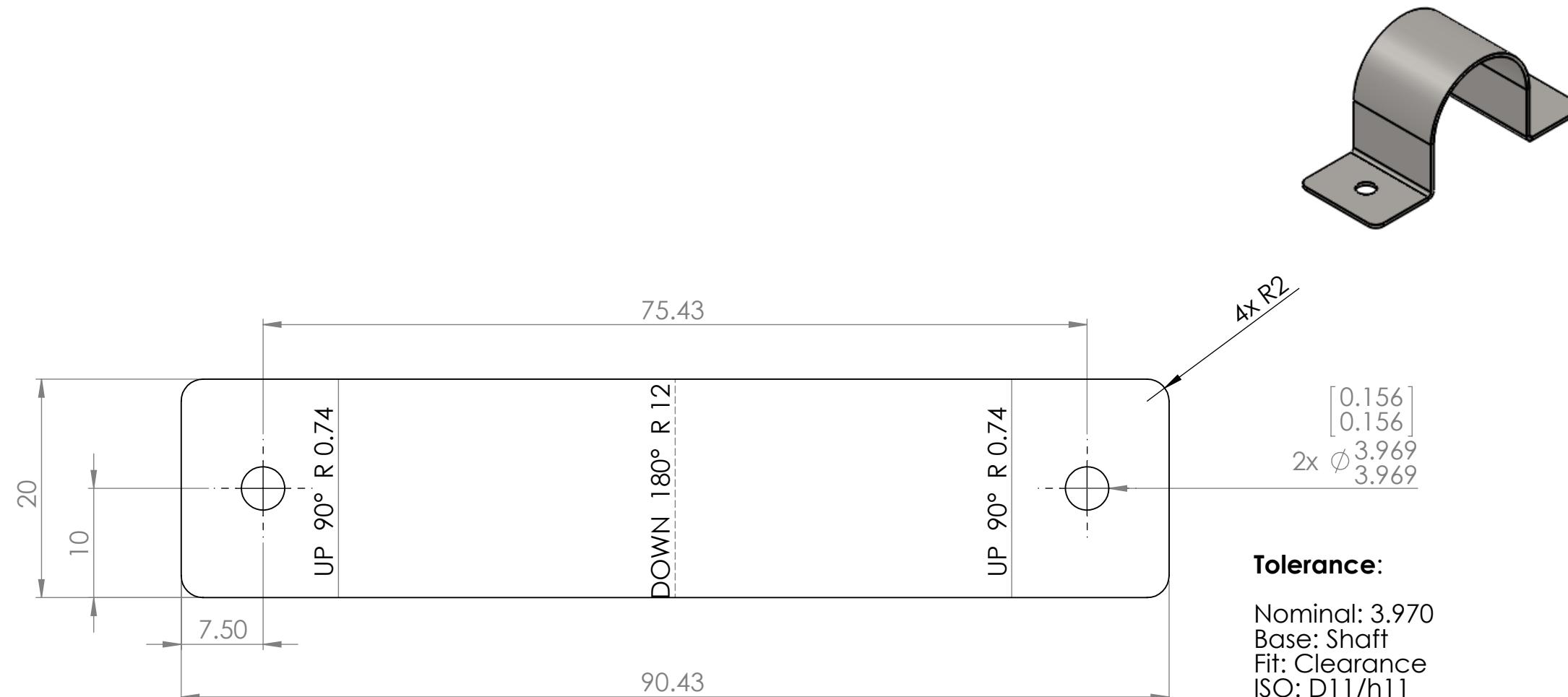
Please Mark: Drawn by Boston Maris
Reviewed by Drew Gingras



Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Boston Maris
Instructors: Dr. Mertiny Dr. Duke Win. 2014		SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
Comments: Sheet Metal Thickness is 0.74mm		Group number 13	SM By Boston Maris
		Reviewed by Drew Gingras	SATURDAY, APRIL 05, 2014 9:54:04 AM SUNDAY, MARCH 09, 2014 1:52:33 PM
MATERIAL: Plain Carbon Steel		DO NOT SCALE DRAWING	BUILT BY: Boston Maris
FILE NAME: Motor 1 Bracket			REV A
SIZE B	BUILT BY: Boston Maris	SCALE: 2:1	
Mass: 10.23	SHEET 84 OF 117	REV A	

8 7 6 5 4 3 2 1

Please Mark: Drawn by Boston Maris
Reviewed by Drew Gingras



Tolerance:

Nominal: 3.970
Base: Shaft
Fit: Clearance
ISO: D11/h11
Tables: +70, +145
Limits 4.039, 4.109

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Boston Maris	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	Comments: 	Group name The Ole Einar Bjørndalen Group	TITLE: Motor 1 Bracket (M)	
			Group number 13		
			SM By Boston Maris		
			Reviewed by Drew Gingras		
			Saturday, April 05, 2014 9:54:04 AM Sunday, March 09, 2014 1:52:33 PM		
SIZE B		Built By: Boston Maris	REV A		
SCALE: 2:1		Mass: 10.23	SHEET 85 OF 117		

8 7 6 5 4 3 2 1

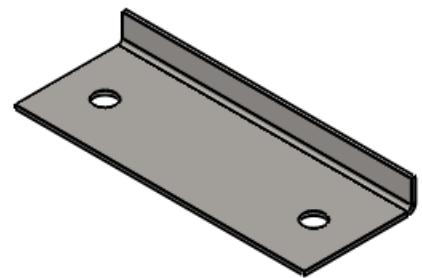
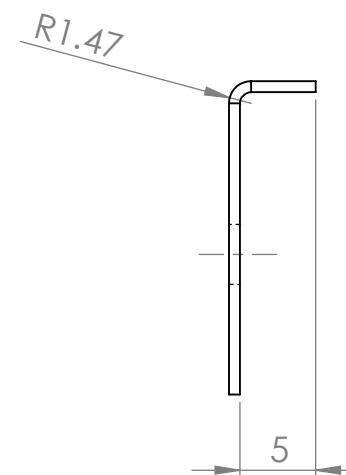
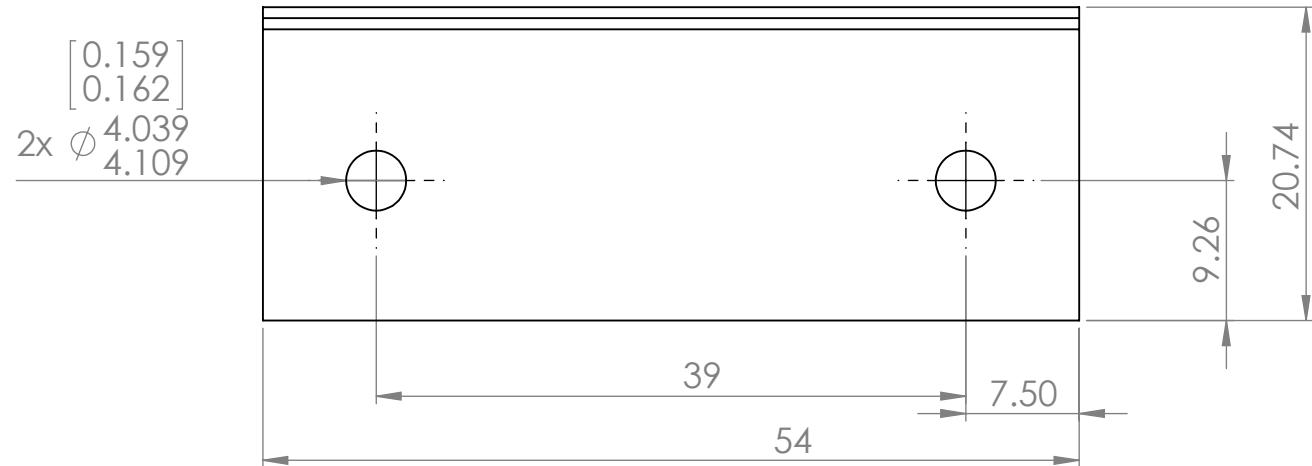
8 7 6 5 4 3 2 1

D

D

Tolerance:

Nominal: 3.969
Base: Shaft
Fit: Clearance
ISO: D11/h11
Tables: +70, +145
Limits 4.039, 4.109



Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Boston Maris	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	SHEET METAL THICKNESS = 0.74mm	Group name The Ole Einar Bjørndalen Group	TITLE: Motor 1 Bracket Bottom
Comments: Sheet Metal Thickness = 0.74mm	SURFACE FINISH $0.6 \mu\text{m}$	Group number 13	SIZE B
	DO NOT SCALE DRAWING	SM By Boston Maris	Built By: Boston Maris
	MATERIAL: Plain Carbon Steel	Reviewed by Drew Gingras	REV A
	FILE NAME: Motor 1 Bracket Bottom	Saturday, April 05, 2014 9:57:11 AM Saturday, March 29, 2014 10:11:02 AM	SCALE: 1:1 Mass: 7.70 SHEET 86 OF 117

8 7 6 5 4 3 2 1

A

A

8

7

6

5

4

3

2

1

D

D

C

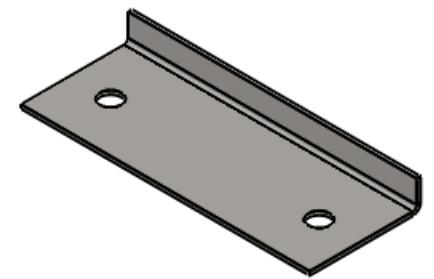
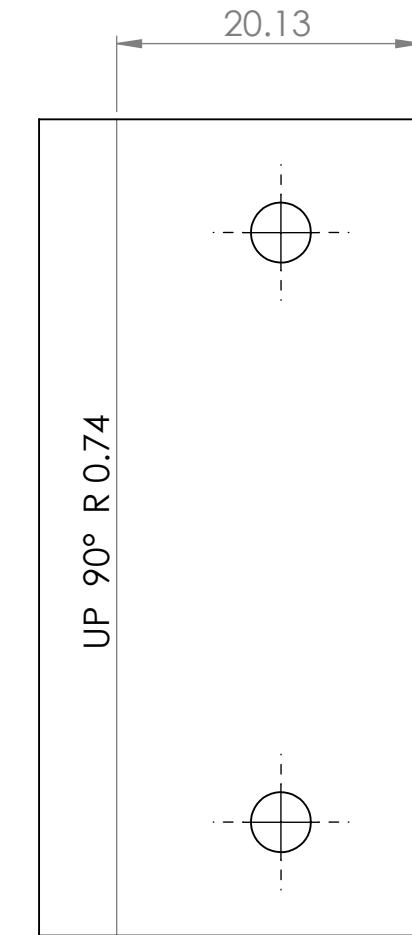
C

B

B

A

A


Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke **Win. 2014**

Comments:
Sheet Metal Thickness
= 0.74mm



MATERIAL:
Plain Carbon Steel

FILE NAME:
Motor 1 Bracket Bottom

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM

TOLERANCES:
ANGULAR: $\pm 0.5^\circ$

LINEAR

$X = \pm 0.5$

$X.X = \pm 0.1$

$X.XX = \pm 0.025$

SURFACE FINISH

$0.6 \mu\text{m}$

DO NOT SCALE DRAWING

DRAWN BY:
Boston Maris

Group name
The Ole Einar
Bjørndalen Group

Group number
13

SM By
Boston Maris

Reviewed by
Drew Gingras

Saturday, April 05, 2014 9:57:11 AM
Saturday, March 29, 2014 10:11:02 AM

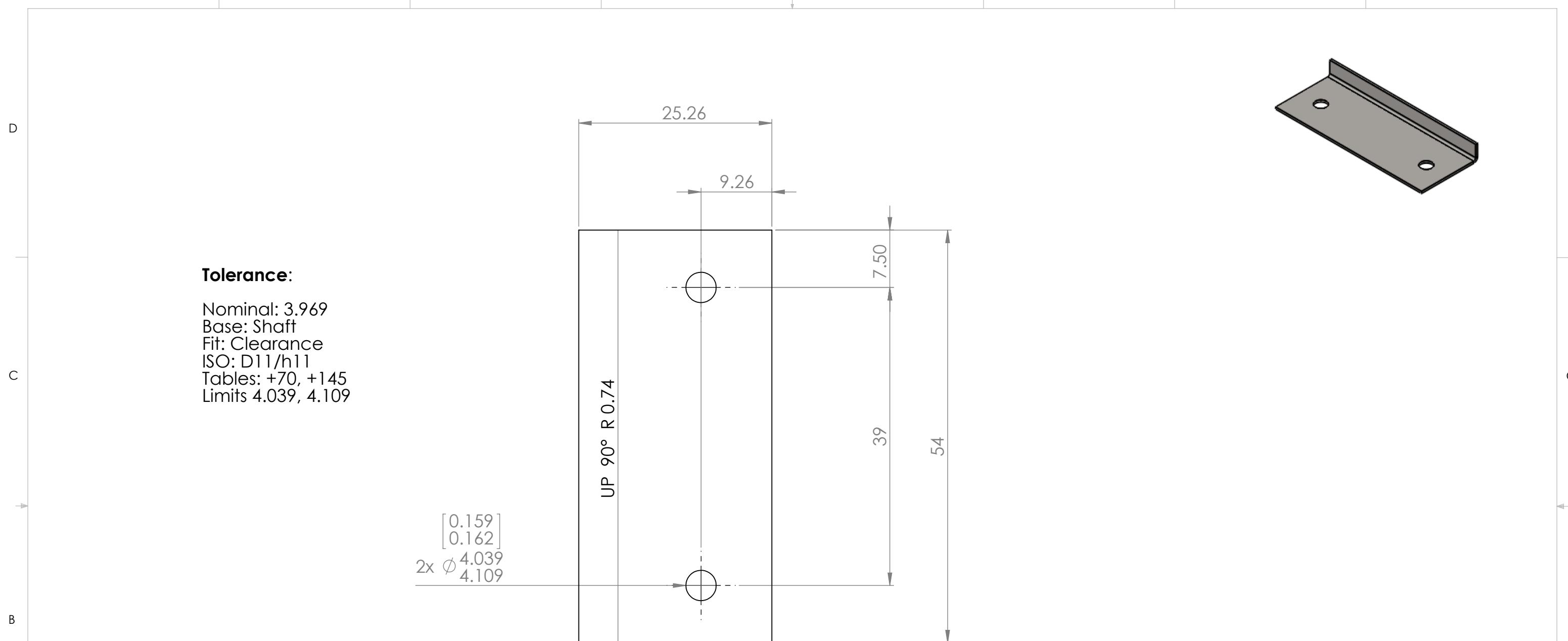
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Motor 1 Bracket Bottom

SIZE **B** Built By:
Boston Maris REV **A**

SCALE: 2:1 Mass: 7.70 SHEET 87 OF 117

8 7 6 5 4 3 2 1



Tolerance:

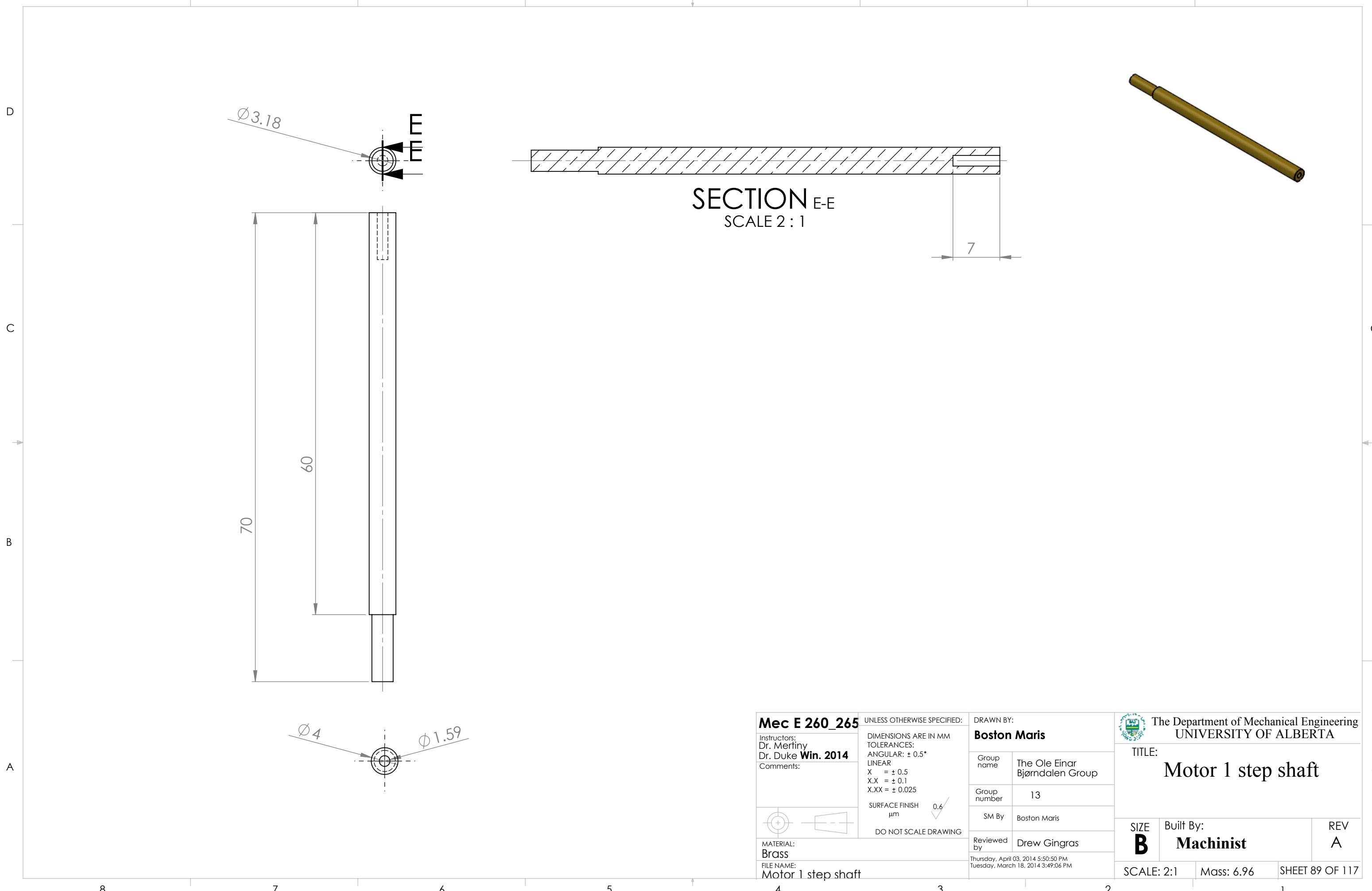
Nominal: 3.969
Base: Shaft
Fit: Clearance
ISO: D11/h11
Tables: +70, +145
Limits 4.039, 4.109

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Boston Maris
Instructors: Dr. Mertiny Dr. Duke Win. 2014		SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group
Comments: Sheet Metal Thickness = 0.74mm		Group number 13	SM By Boston Maris
		Reviewed by Drew Gingras	Reviewed by Drew Gingras
MATERIAL: Plain Carbon Steel		Saturday, April 05, 2014 9:57:11 AM	SIZE B Built By: Boston Maris REV A
FILE NAME: Motor 1 Bracket Bottom		Saturday, March 29, 2014 10:11:02 AM	SCALE: 2:1 Mass: 7.70 SHEET 88 OF 117

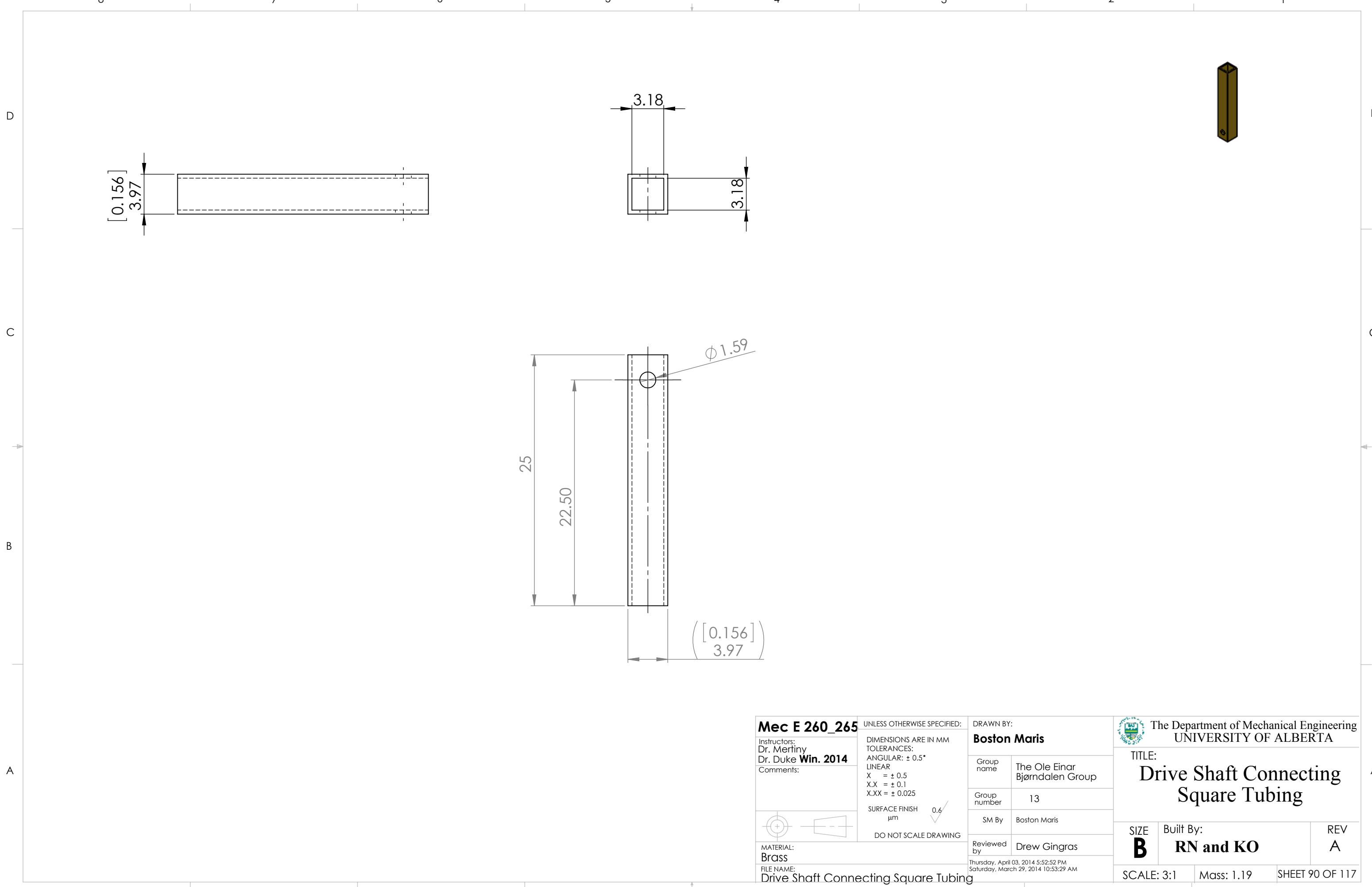
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Motor 1 Bracket Bottom

SIZE **B** Built By:
Boston Maris REV **A**
SCALE: 2:1 Mass: 7.70 SHEET 88 OF 117



8 7 6 5 4 3 2 1



8 7 6 5 4 3 2 1

ITEM NO.	PART NUMBER	Material	SW-Author(Author)	Sheet No.	QTY.
1	Driven Wheels	Polybutadiene (PB)	Boston Maris	N/A	1
2	Driven Wheel Rubber Ring	HYPALON	Boston Maris	92	1

D

D

C

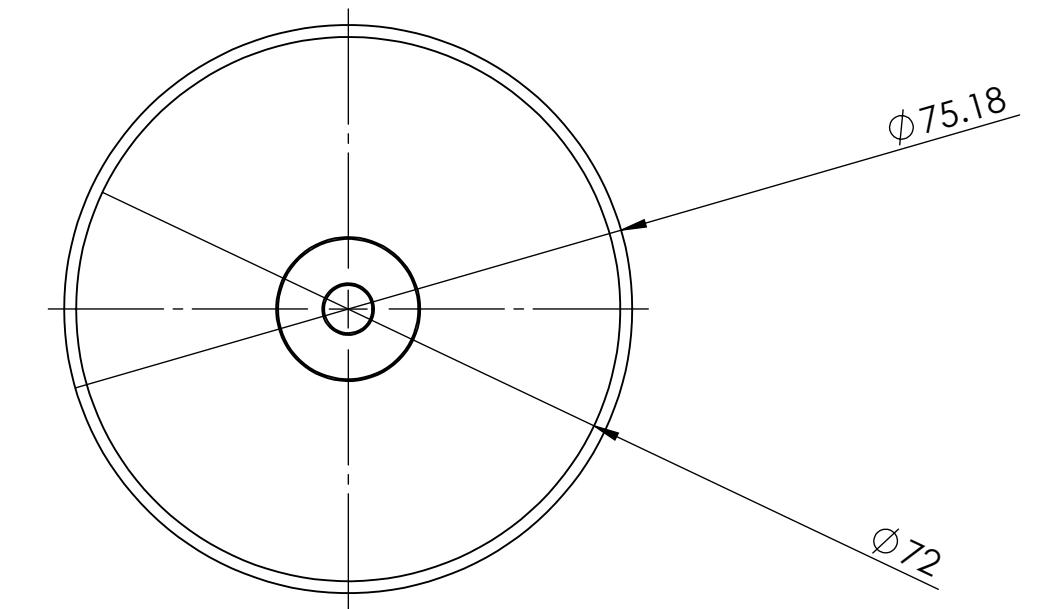
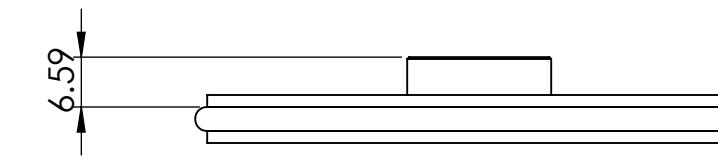
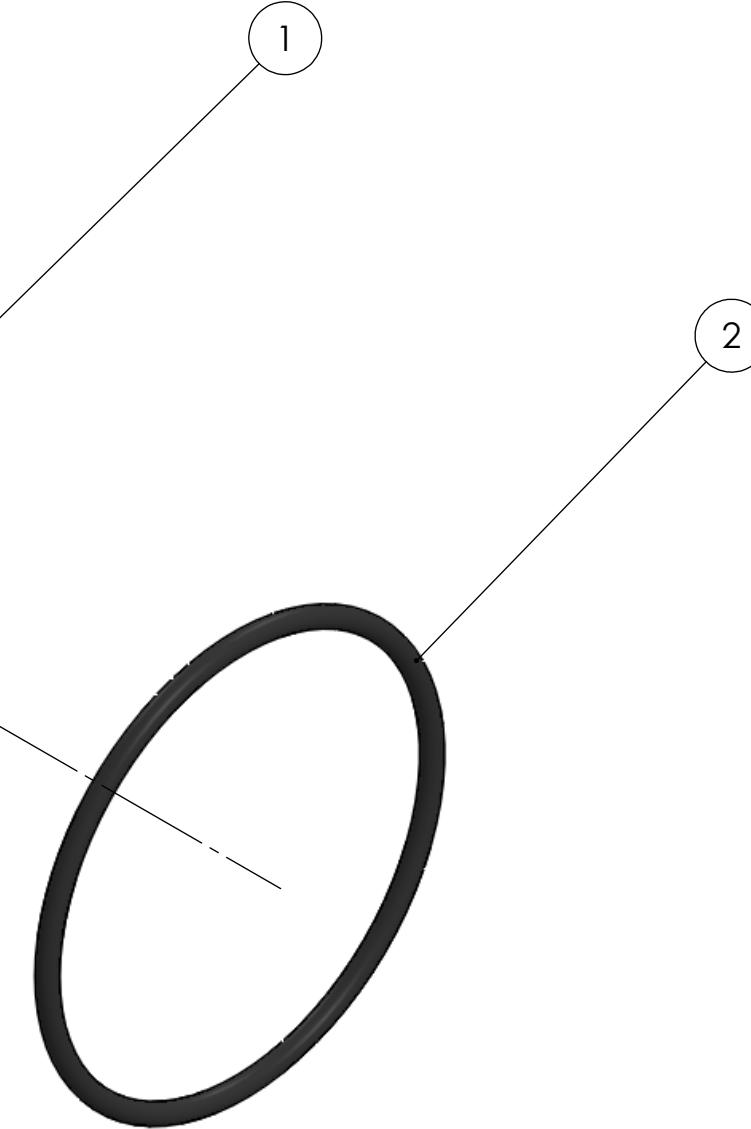
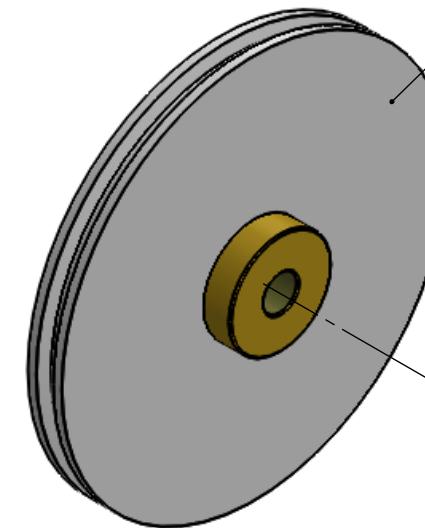
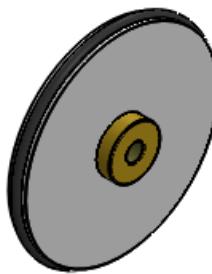
C

B

B

A

A



Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke
Win. 2014

Comments:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR
 $X = \pm 0.5$
 $X.X = \pm 0.1$
 $X.XX = \pm 0.025$
SURFACE FINISH
 $0.6 \mu\text{m}$
DO NOT SCALE DRAWING
MATERIAL: As stated in B.O.M.
FILE NAME: Driven Wheel Sub-Assembly.SLDASM

DRAWN BY:
Kevin O'Rourke

Group name
The Ole Einar Bjørndalen Group

Group number
13

SM By
Kevin O'Rourke

Reviewed by
Drew Gingras

Saturday, April 05, 2014 3:25:34 PM
Friday, March 07, 2014 2:49:26 PM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Driven Wheel Sub Assembly

SIZE **B** Built By:
Boston Maris REV **A**
SCALE: 1:1 Mass: SHEET 91 OF 117

8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

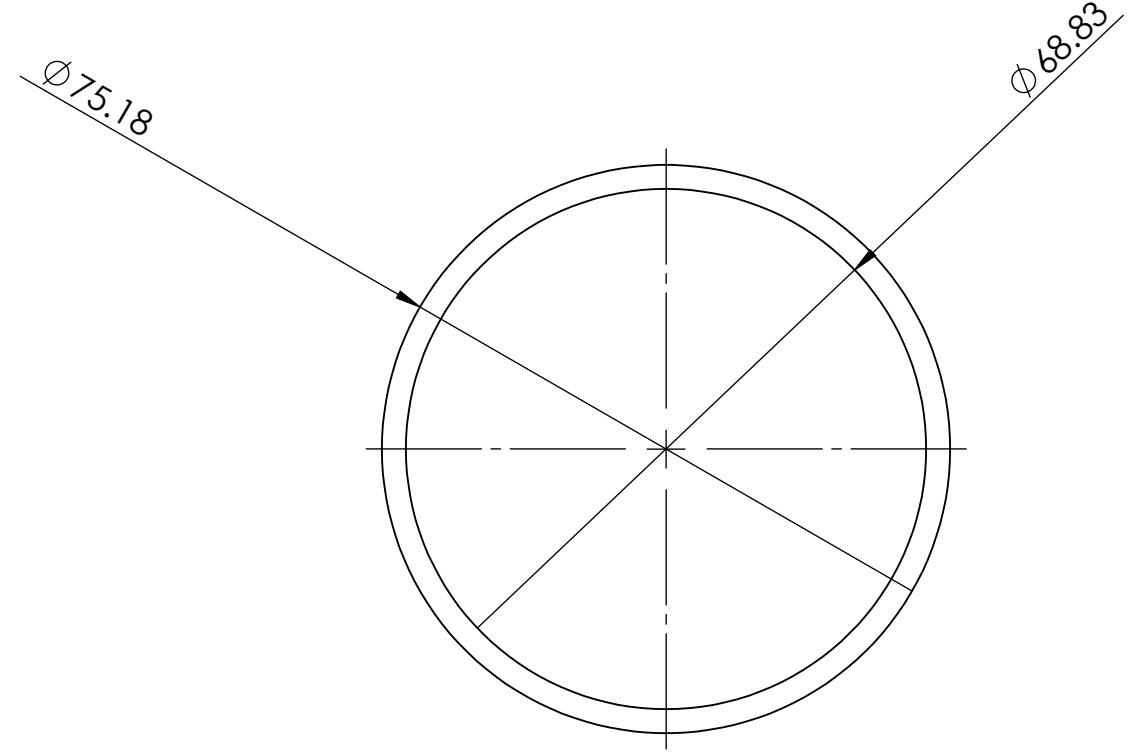
D

D

Note: Rubber is attached to itself using standard Super Glue

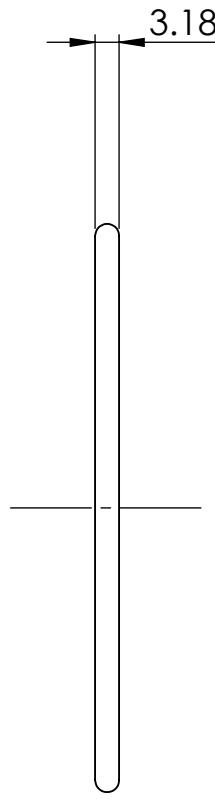
C

C



B

B



A

A

Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke
Win. 2014

Comments:

MATERIAL:
HYPALON
FILE NAME:
Driven Wheel Rubber Ring

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR

X = ± 0.5
X.X = ± 0.1
X.XX = ± 0.025
SURFACE FINISH
 $0.6 \mu\text{m}$

DO NOT SCALE DRAWING

REV
A

DRAWN BY:
Kevin O'Rourke

Group name
The Ole Einar
Bjørndalen Group

Group number
13

SM By
Kevin O'Rourke

Reviewed by
Drew Gingras

Friday, March 07, 2014 2:51:26 PM
Thursday, March 06, 2014 5:14:31 PM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Driven Wheel Rubber
Ring

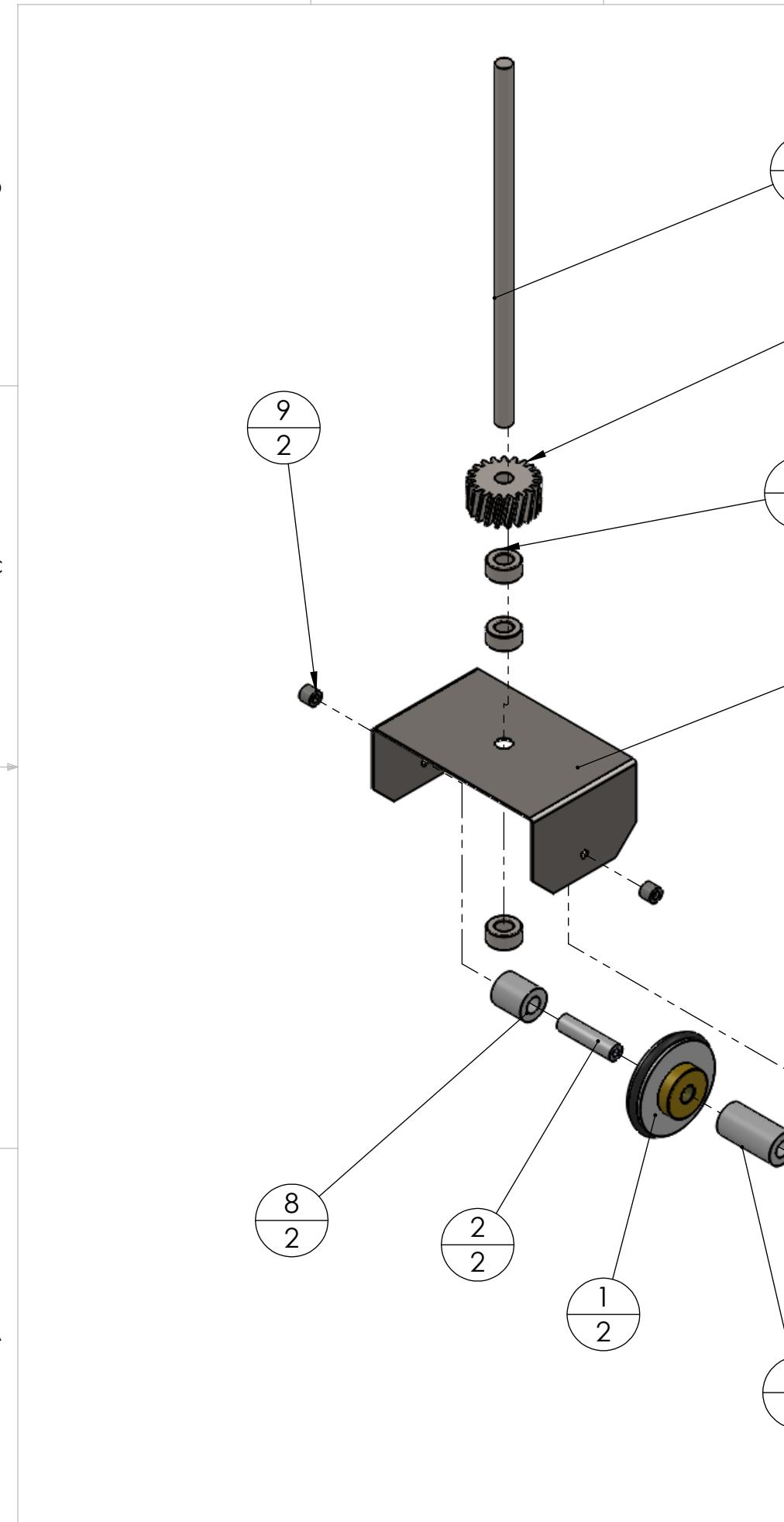
SIZE B Built By:
Boston Maris REV A

SCALE: 1:1 Mass: 2.36 SHEET 92 OF 117

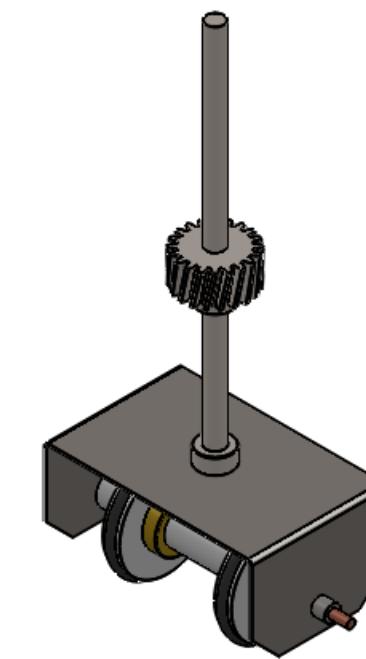


8 7 6 5 4 3 2 1

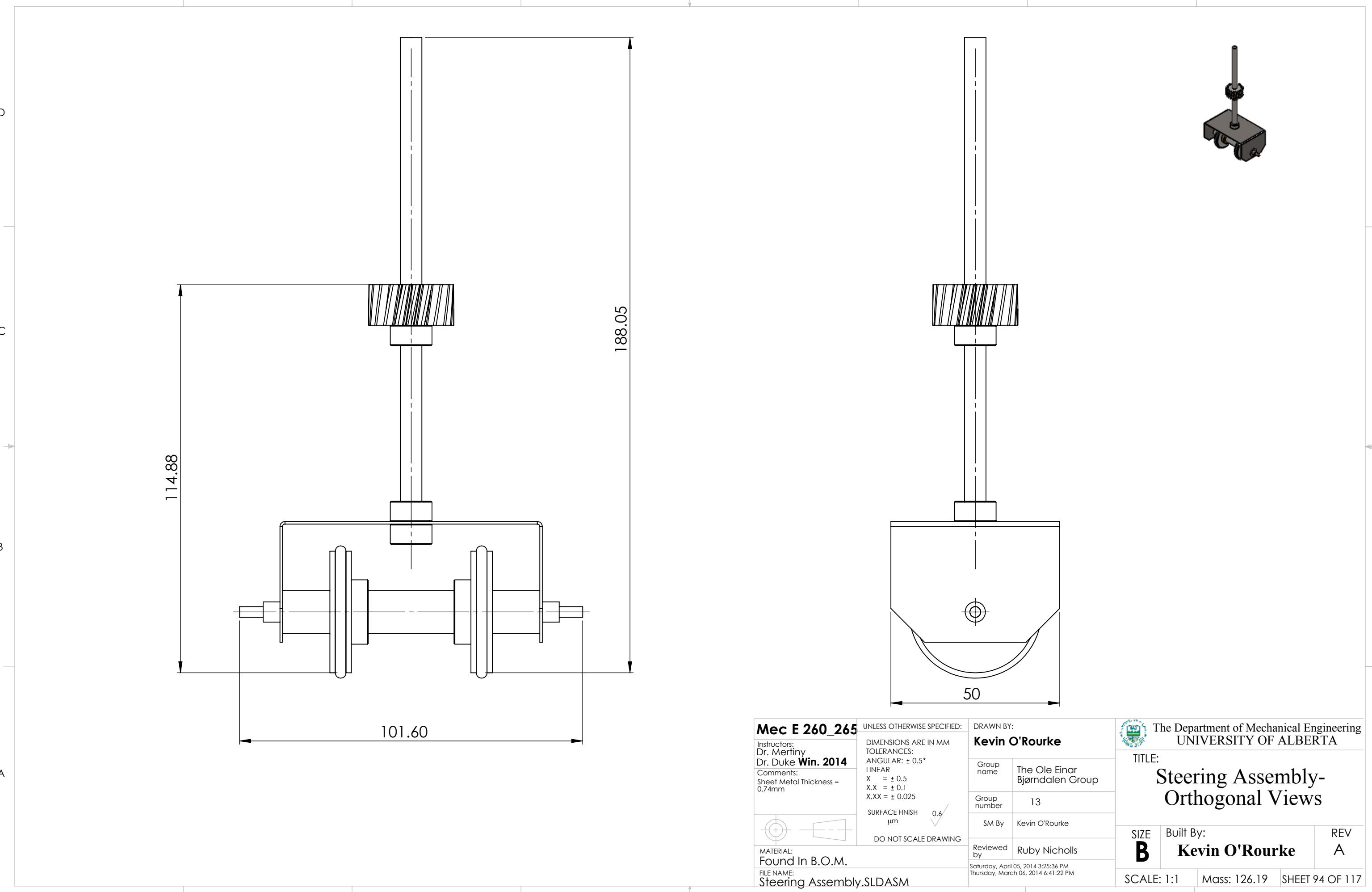
1



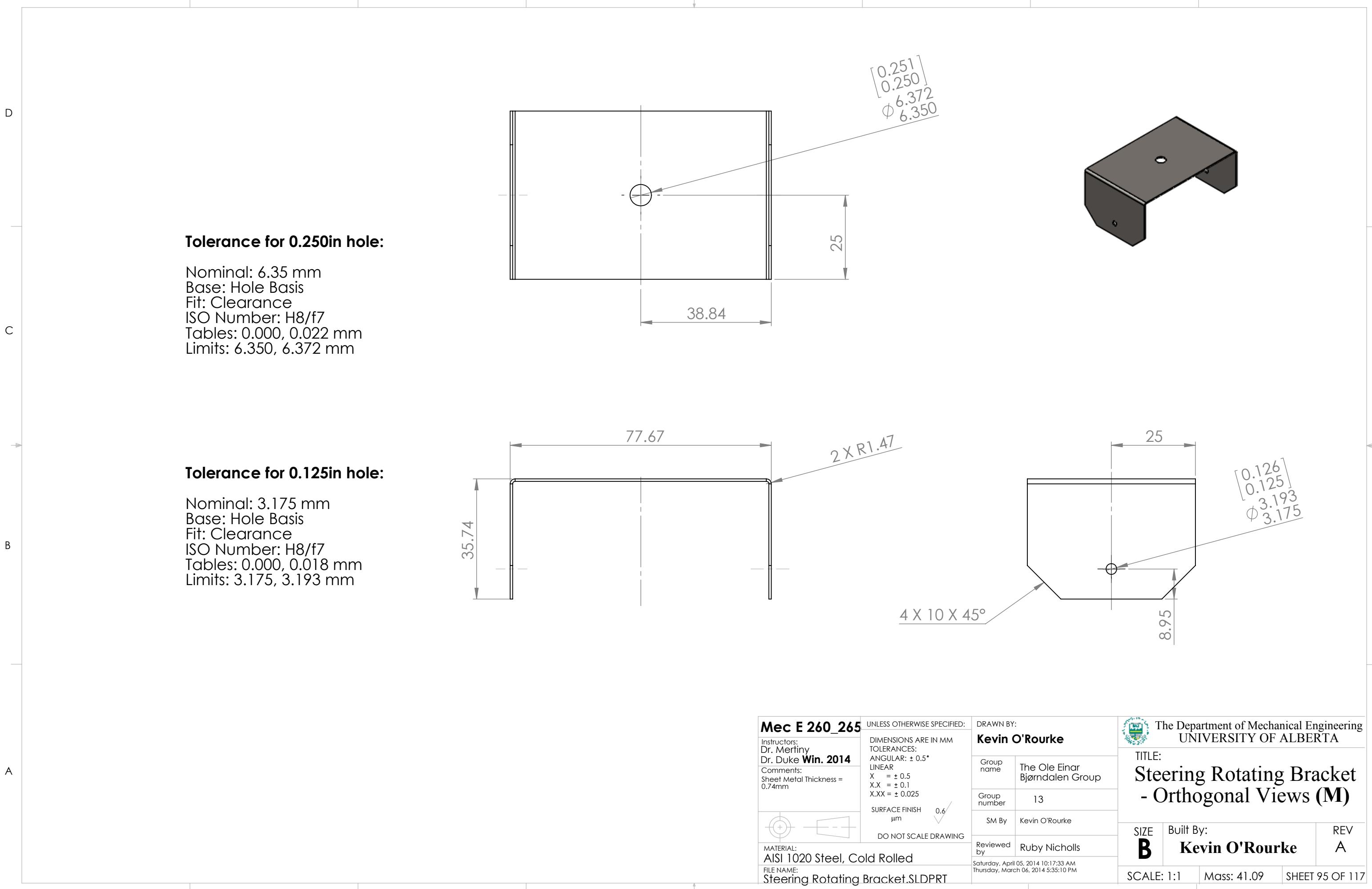
ITEM NO.	PART NUMBER	Material	SW-Author(Author)	Sheet Number	QTY.
1	Steering Wheel Sub-Assembly	Various Material	Kevin O'Rourke	100	2
2	Nylon Spacer_0.125	Nylon 101	Kevin O'Rourke	N/A	2
3	Nylon Spacer_0.250	Nylon 101	Kevin O'Rourke	N/A	1
4	Steering Axle	Copper	Kevin O'Rourke	97	1
5	Steering Rotating Bracket	AISI 1020 Steel, Cold Rolled	Kevin O'Rourke	95,96	1
6	Steering-Helical Gear Shaft	Alloy Steel	Kevin O'Rourke	99	1
7	Steering Wheel Collar	Alloy Steel	A. Drafter	N/A	3
8	Nylon Spacer_0.5_0.250	Nylon 101	Kevin O'Rourke	102	2
9	Collar_0.125	AISI 316 Stainless Steel Sheet (SS)	A. Drafter	N/A	2
10	Helical Gear 20T - metric	Specialty Plastic	Toolbox	98	1

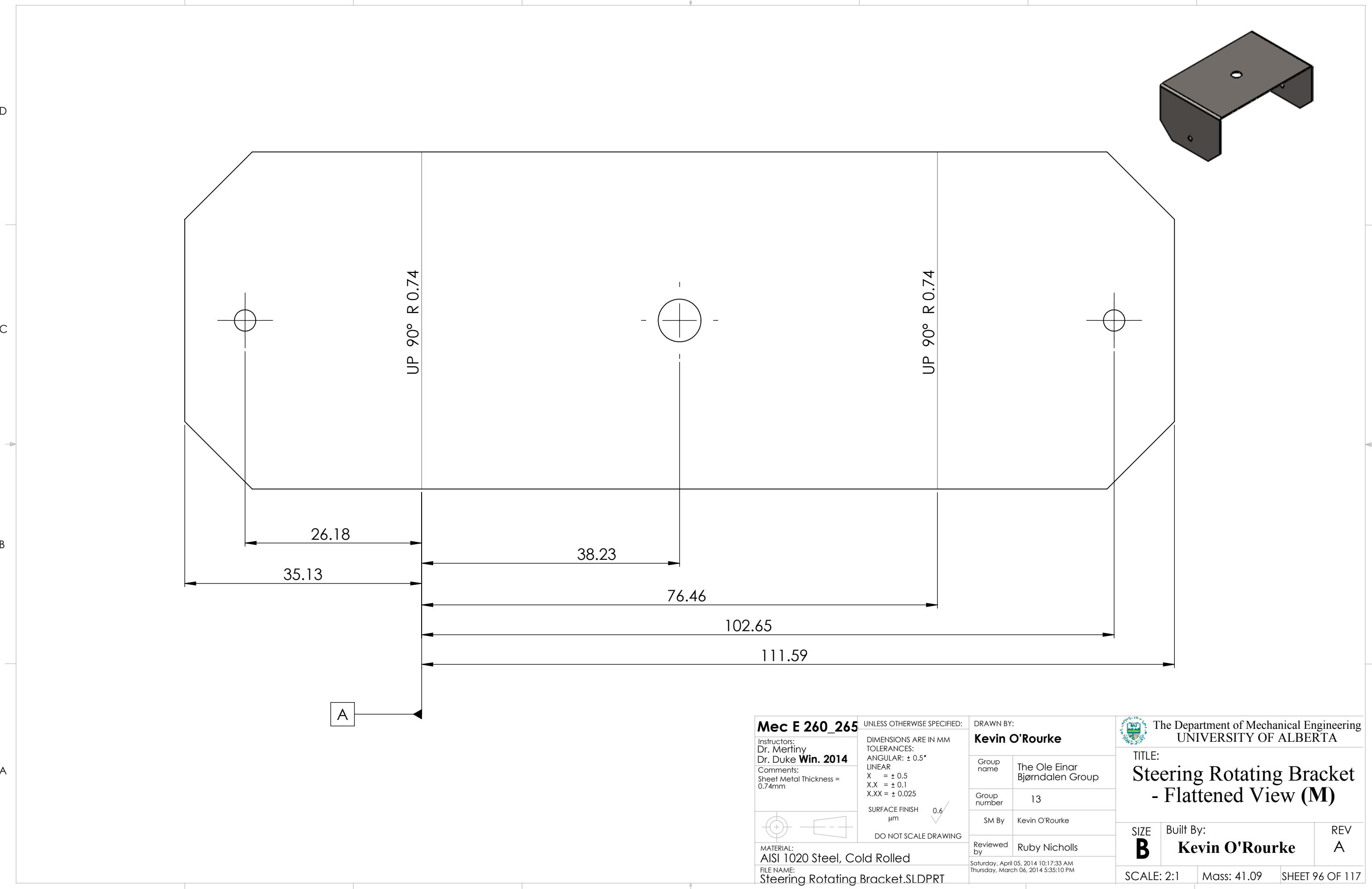


Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Kevin O'Rourke
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	Group name The Ole Einar Bjørndalen Group	
Comments: Sheet Metal Thickness = 0.74mm		Group number 13	
		SM By Kevin O'Rourke	
		Reviewed by Ruby Nicholls	
		Saturday, April 05, 2014 3:25:36 PM Thursday, March 06, 2014 6:41:22 PM	
Steering Assembly - Exploded View		The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
SIZE B	Built By: Kevin O'Rourke	REV A	
SCALE: 1:2		Mass: 126.19	
FILE NAME: Steering Assembly.SLDASM		SHEET 93 OF 117	



8 7 6 5 4 3 2 1





8

7

6

5

4

3

2

1

D

D

C

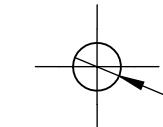
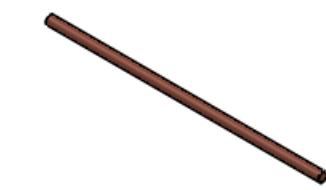
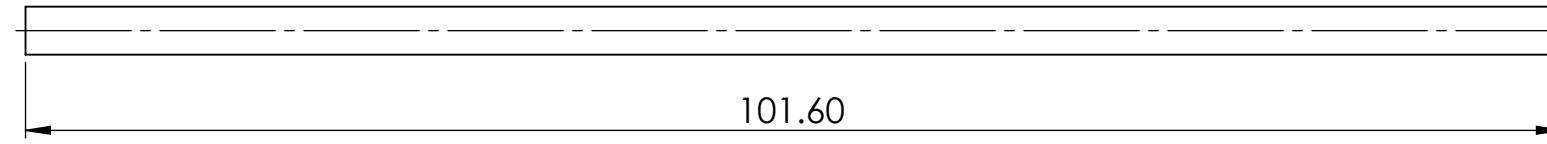
C

B

B

A

A



$\phi 0.125$
 $\phi 3.18$

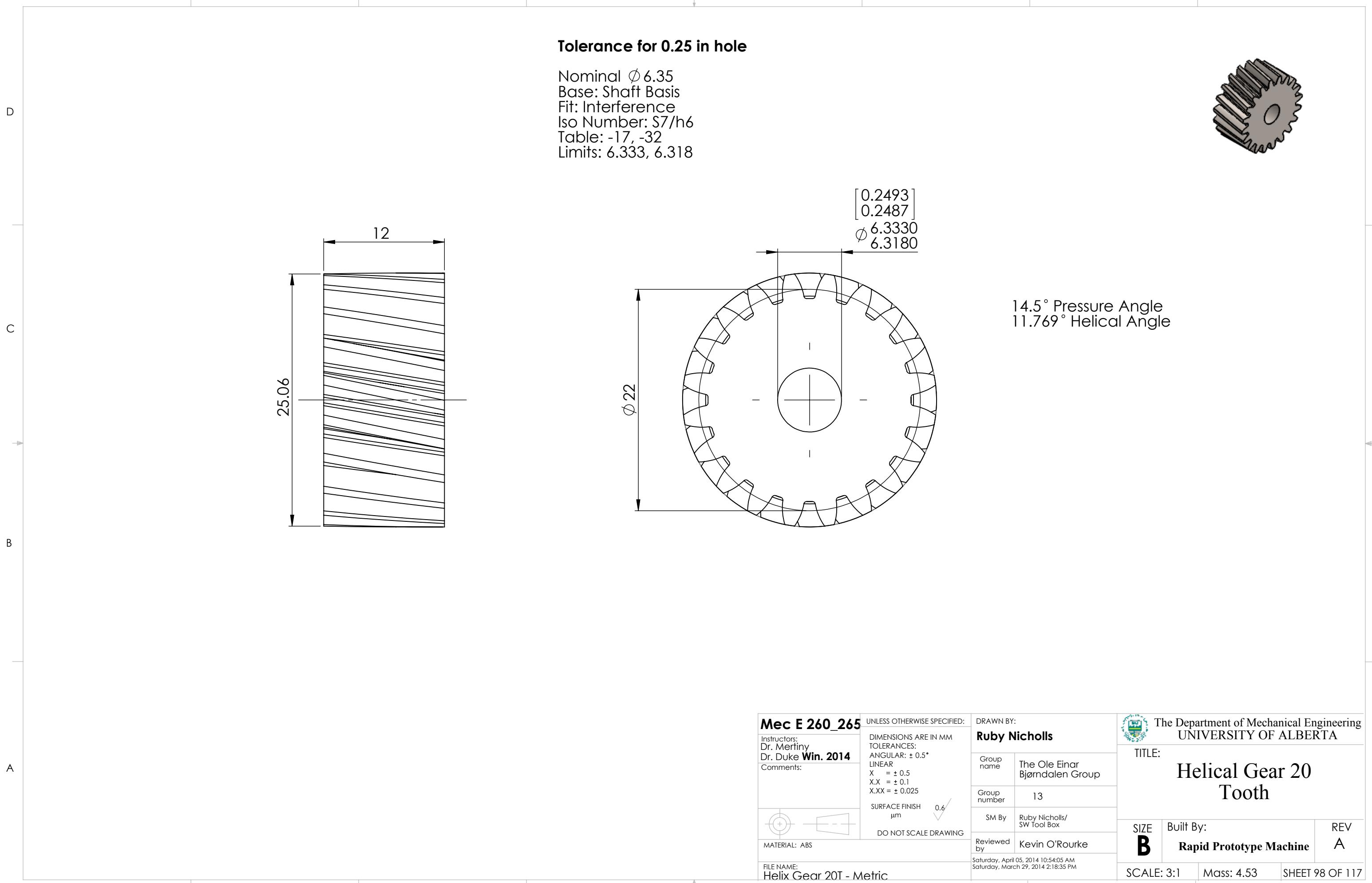
Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Kevin O'Rourke
Instructors: Dr. Mertiny Dr. Duke Win. 2014		Comments:	Group name The Ole Einar Bjørndalen Group
			Group number 13
			SM By Kevin O'Rourke
			Reviewed by Ruby Nicholls
MATERIAL: Copper		SURFACE FINISH $0.6 \mu\text{m}$	
FILE NAME: Steering Axle.SLDprt		DO NOT SCALE DRAWING	
		Friday, March 07, 2014 2:26:15 PM	
		Thursday, March 06, 2014 4:50:41 PM	
B	Built By: Kevin O'Rourke	REV A	
SCALE: 2:1		Mass: 7.16	
SHEET 97 OF 117			

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
Steering Axle

SIZE **B** Built By:
Kevin O'Rourke REV **A**
SCALE: 2:1 Mass: 7.16 SHEET 97 OF 117

8 7 6 5 4 3 2 1



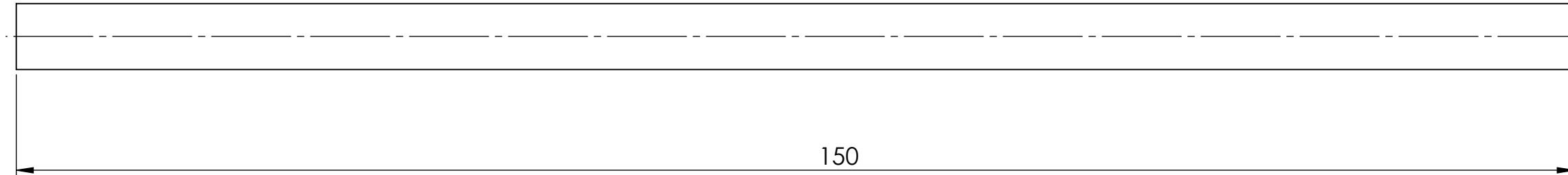
8 7 6 5 4 3 2 1

D

D

C

C



B

B

A

A

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Kevin O'Rourke	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	TITLE: Steering Helical Gear Shaft	
		SURFACE FINISH $0.6 \mu\text{m}$	Group number 13	SIZE B	
		DO NOT SCALE DRAWING	SM By Kevin O'Rourke	Built By: Kevin O'Rourke	
		MATERIAL: Alloy Steel	Reviewed by Ruby Nicholls	REV A	
		FILE NAME: Steering-Helical Gear Shaft.SLDPRT	Thursday, March 06, 2014 5:35:00 PM Thursday, March 06, 2014 5:33:18 PM	SCALE: 2:1 Mass: 36.58 SHEET 99 OF 117	

8

7

6

5

4

3

2

1

8

7

6

5

4

3

2

1

ITEM NO.	PART NUMBER	Material	SW-Author(Author)	Sheet Number	QTY.
1	Steering Wheels	Polybutadiene (PB)	Kevin O'Rourke	N/A	1
2	Steering Wheel Rubber Ring	HYPALON	Kevin O'Rourke	101	1

D

D

C

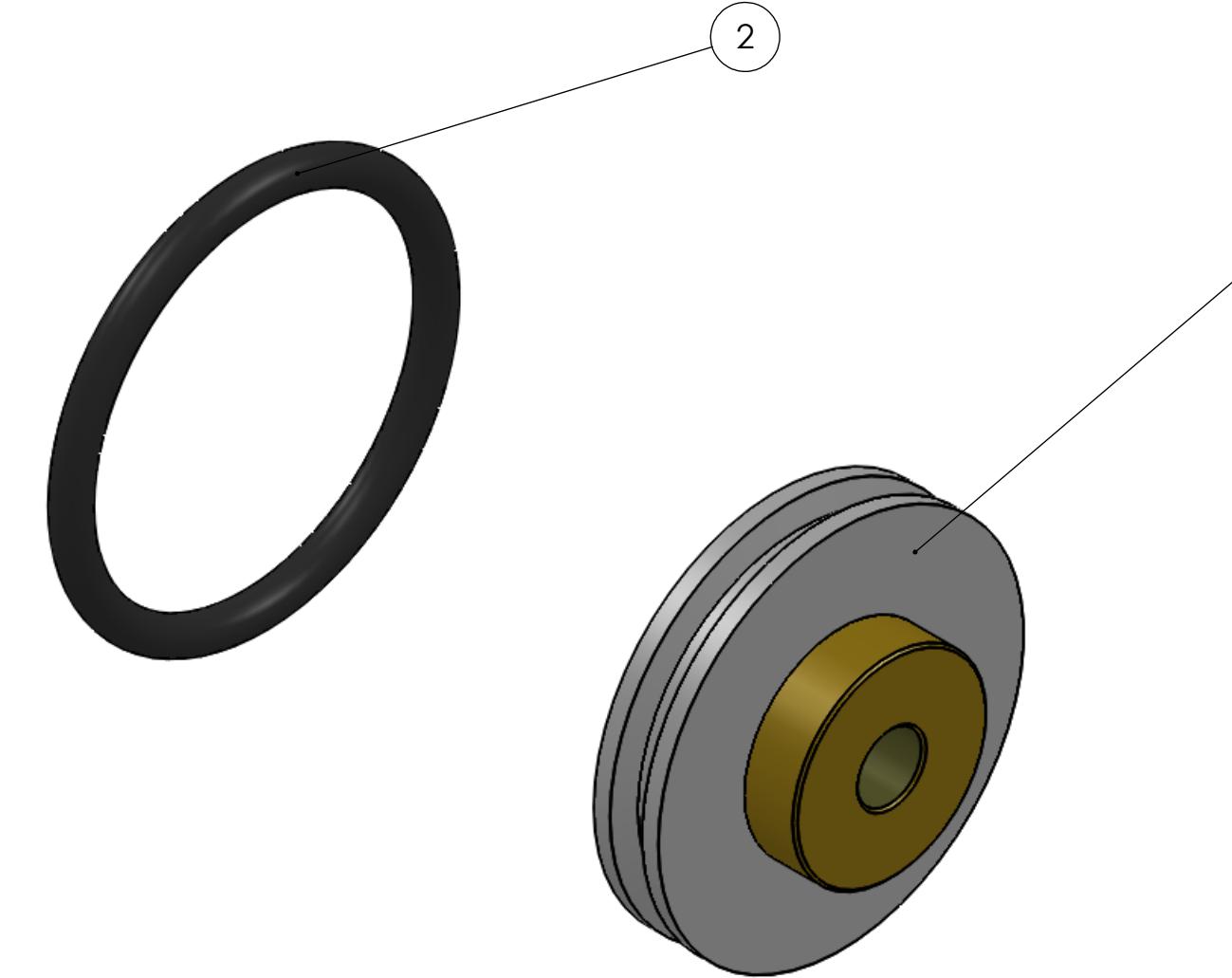
C

B

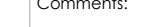
B

A

A

**Mec E 260_265**Instructors:
Dr. Mertiny
Dr. Duke Win. 2014

Comments:



DO NOT SCALE DRAWING

MATERIAL:

As in BOM

FILE NAME:

Steering Wheel Sub-Assembly.SLDASM

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR $X = \pm 0.5$ $XX = \pm 0.1$ $X.XX = \pm 0.025$

SURFACE FINISH

 $0.6 \mu\text{m}$

V

DO NOT SCALE DRAWING

REV

Reviewed by

Ruby Nicholls

Saturday, April 05, 2014 3:25:36 PM

Thursday, March 06, 2014 5:21:09 PM

DRAWN BY:
Kevin O'Rourke

Group name

The Ole Einar
Bjørndalen Group

Group number

13

SM By

Kevin O'Rourke

Reviewed by

Ruby Nicholls

Saturday, April 05, 2014 3:25:36 PM

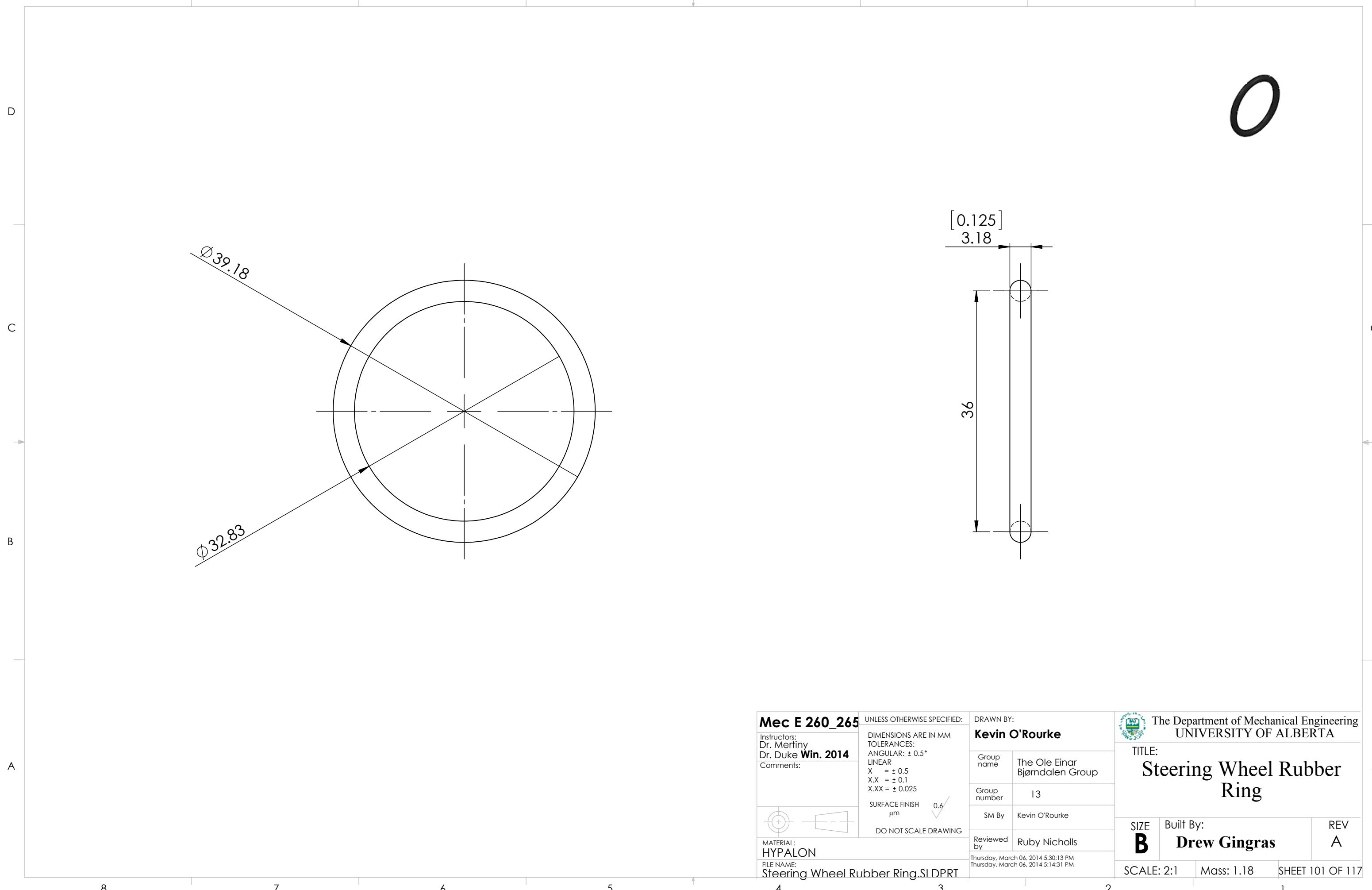
Thursday, March 06, 2014 5:21:09 PM

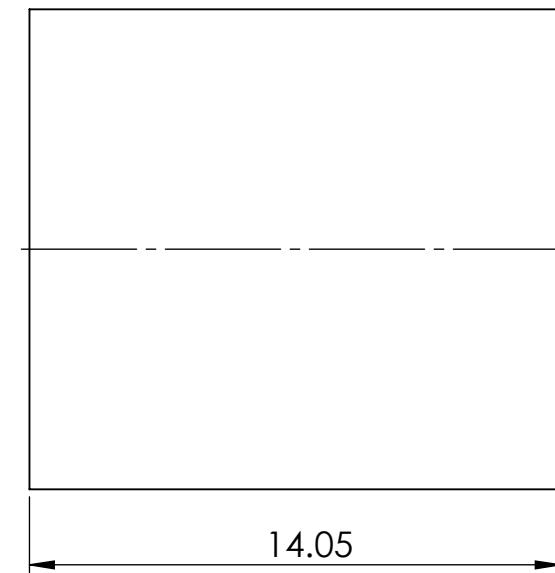
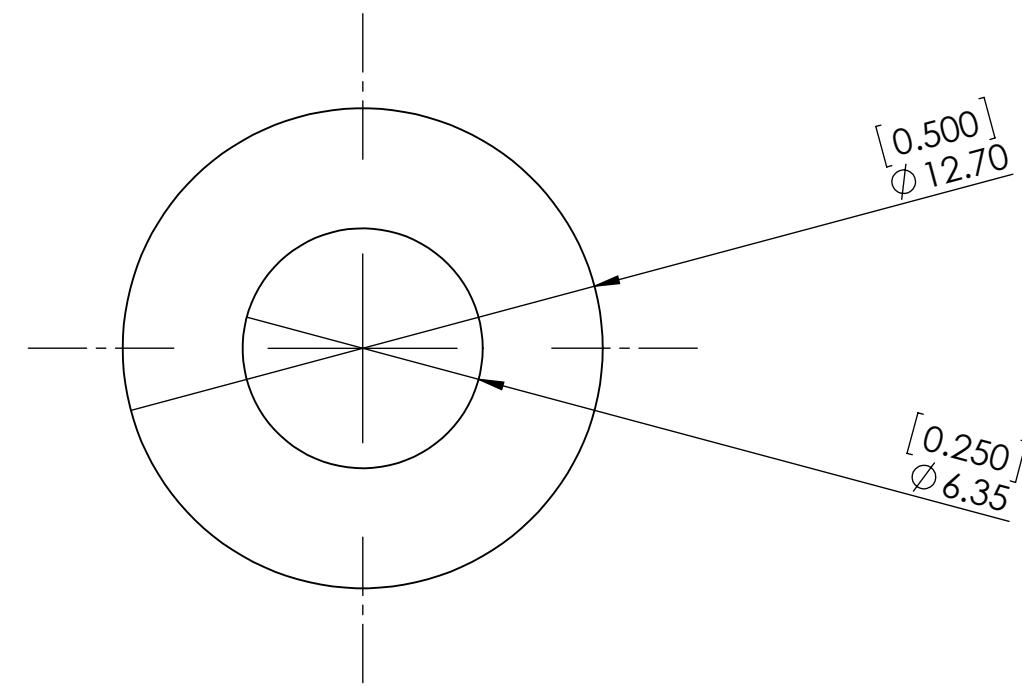
 The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:

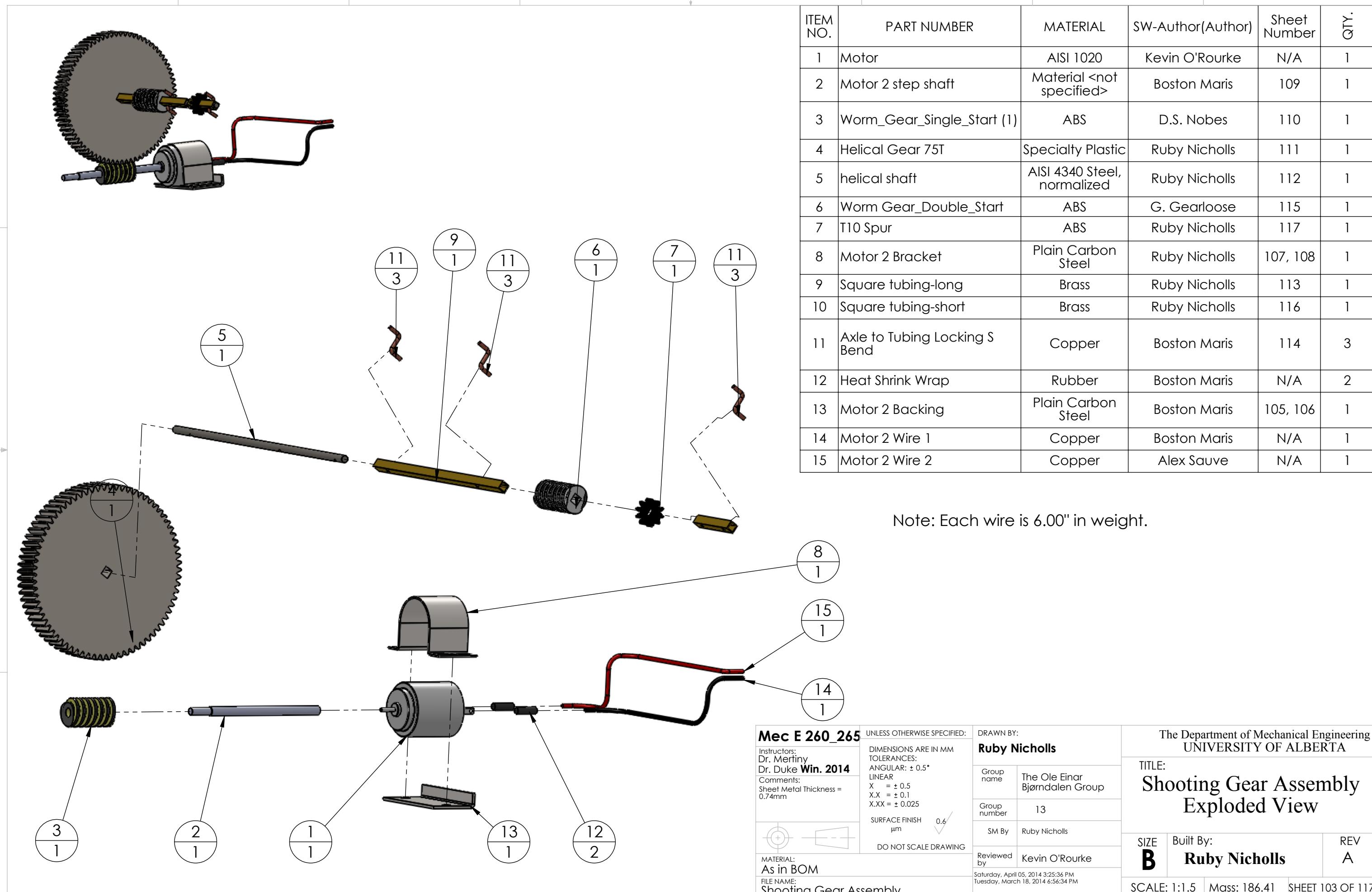
**Steering Wheel -
Exploded View**SIZE **B** Built By: **Boston Maris** REV **A**

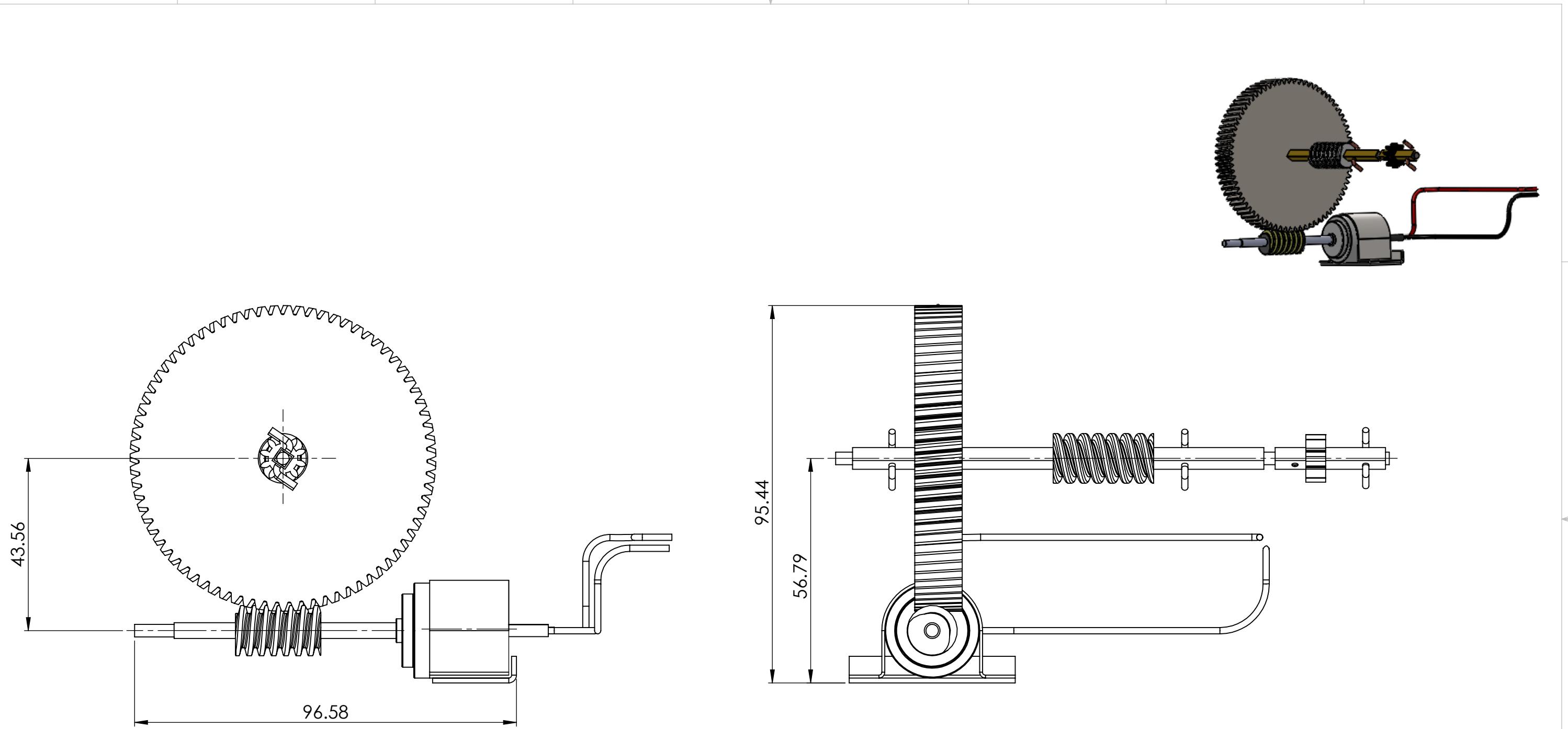
SCALE: 2:1 Mass: 7.98 SHEET 100 OF 117





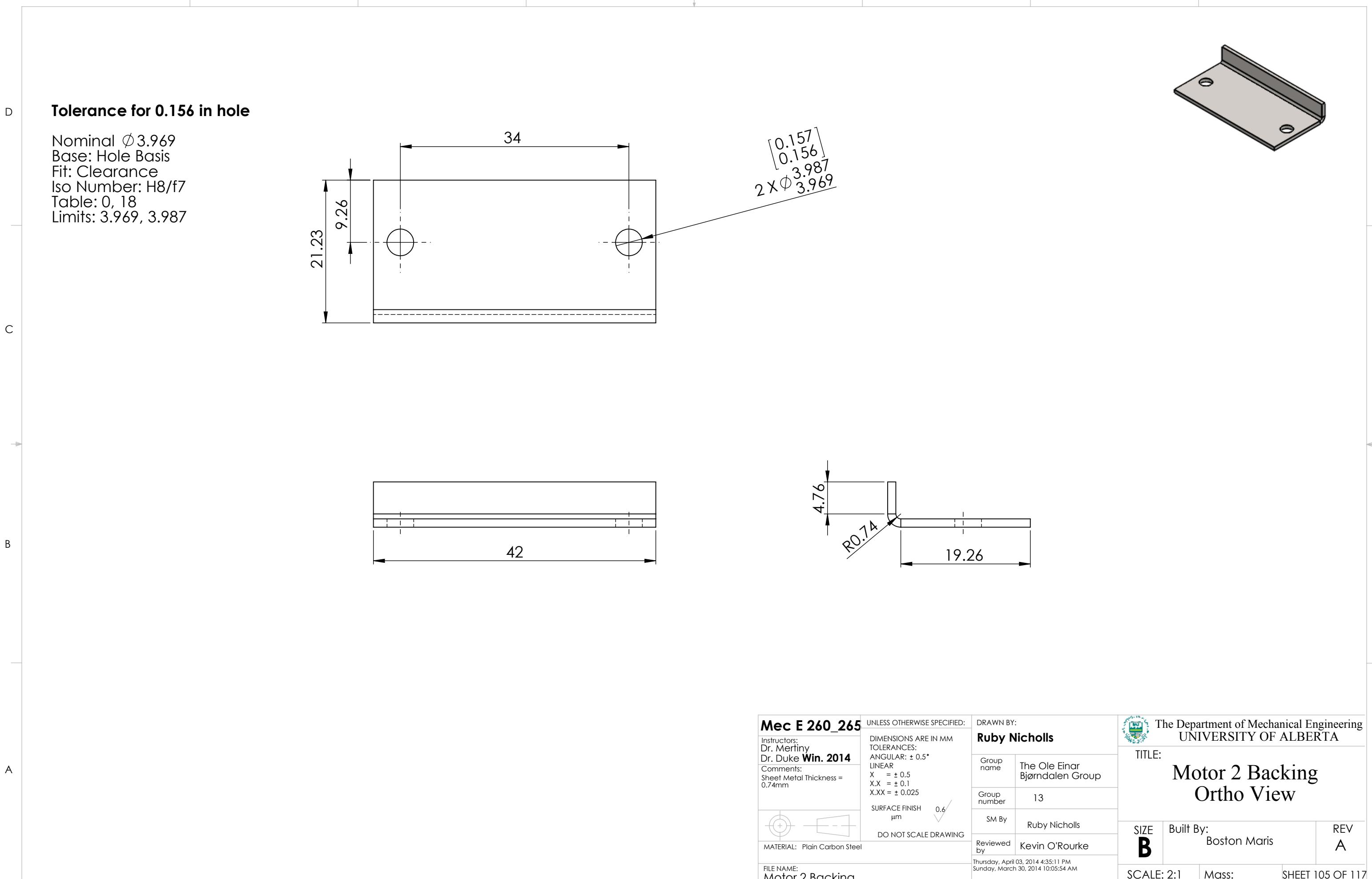
Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Kevin O'Rourke
Instructors: Dr. Mertiny Dr. Duke	Comments:	Group name The Ole Einar Bjørndalen Group	
Win. 2014		Group number 13	
		SM By Kevin O'Rourke	
		Reviewed by Ruby Nicholls	
		Thursday, March 06, 2014 7:34:38 PM	
		Thursday, March 06, 2014 6:37:24 PM	
MATERIAL: Nylon 101		SURFACE FINISH $0.6 \mu\text{m}$	
FILE NAME: Nylon Spacer_0.5_0.250.SLDPRT		DO NOT SCALE DRAWING	
SIZE B		Built By: Modified from 260 Kit by: Kevin O'Rourke	
		REV A	
SCALE: 5:1		Mass: 1.54	
		SHEET 102 OF 117	





Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group	TITLE: Shooting Gear Assembly
Comments: Sheet Metal Thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13	SIZE B Built By: Ruby Nicholls REV A
MATERIAL: Various Materials	MATERIAL: Various Materials	SM By Ruby Nicholls	SCALE: 1:1 Mass: 186.41 SHEET 104 OF 117
FILE NAME: Shooting Gear Assembly	FILE NAME: Shooting Gear Assembly	Reviewed by Kevin O'Rourke	Saturday, April 05, 2014 3:25:36 PM Tuesday, March 18, 2014 6:56:34 PM

8 7 6 5 4 3 2 1



8 7 6 5 4 3 2 1

D

D

C

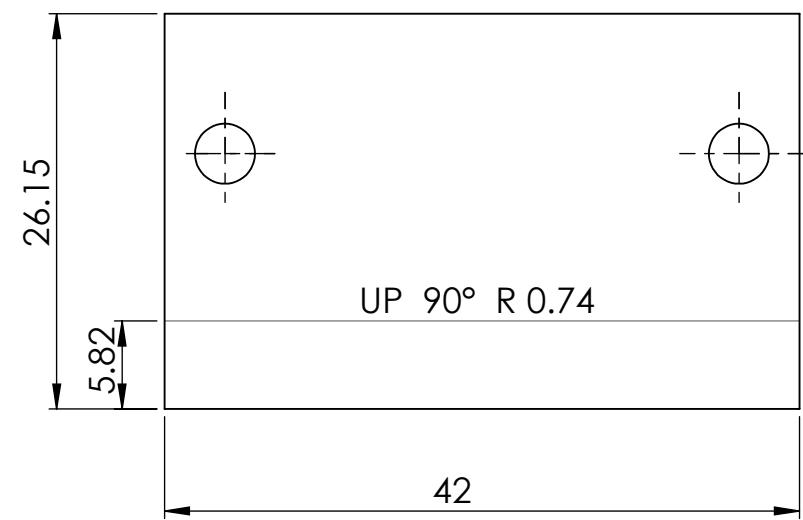
C

B

B

A

A



Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke **Win. 2014**

Comments:
Sheet Metal Thickness =
0.74mm



MATERIAL: Plain Carbon Steel

FILE NAME:
Motor 2 Backing

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR

X = ± 0.5
X.X = ± 0.1
X.XX = ± 0.025

SURFACE FINISH
 $0.6 \mu\text{m}$

DO NOT SCALE DRAWING

Thursday, April 03, 2014 4:35:11 PM

Sunday, March 30, 2014 10:05:54 AM

DRAWN BY:
Ruby Nicholls

Group name
The Ole Einar
Bjørndalen Group

Group number
13

SM By
Ruby Nicholls

Reviewed by
Kevin O'Rourke

Thursday, April 03, 2014 4:35:11 PM

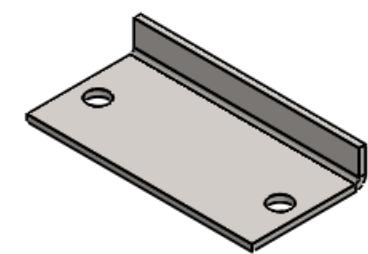
Sunday, March 30, 2014 10:05:54 AM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

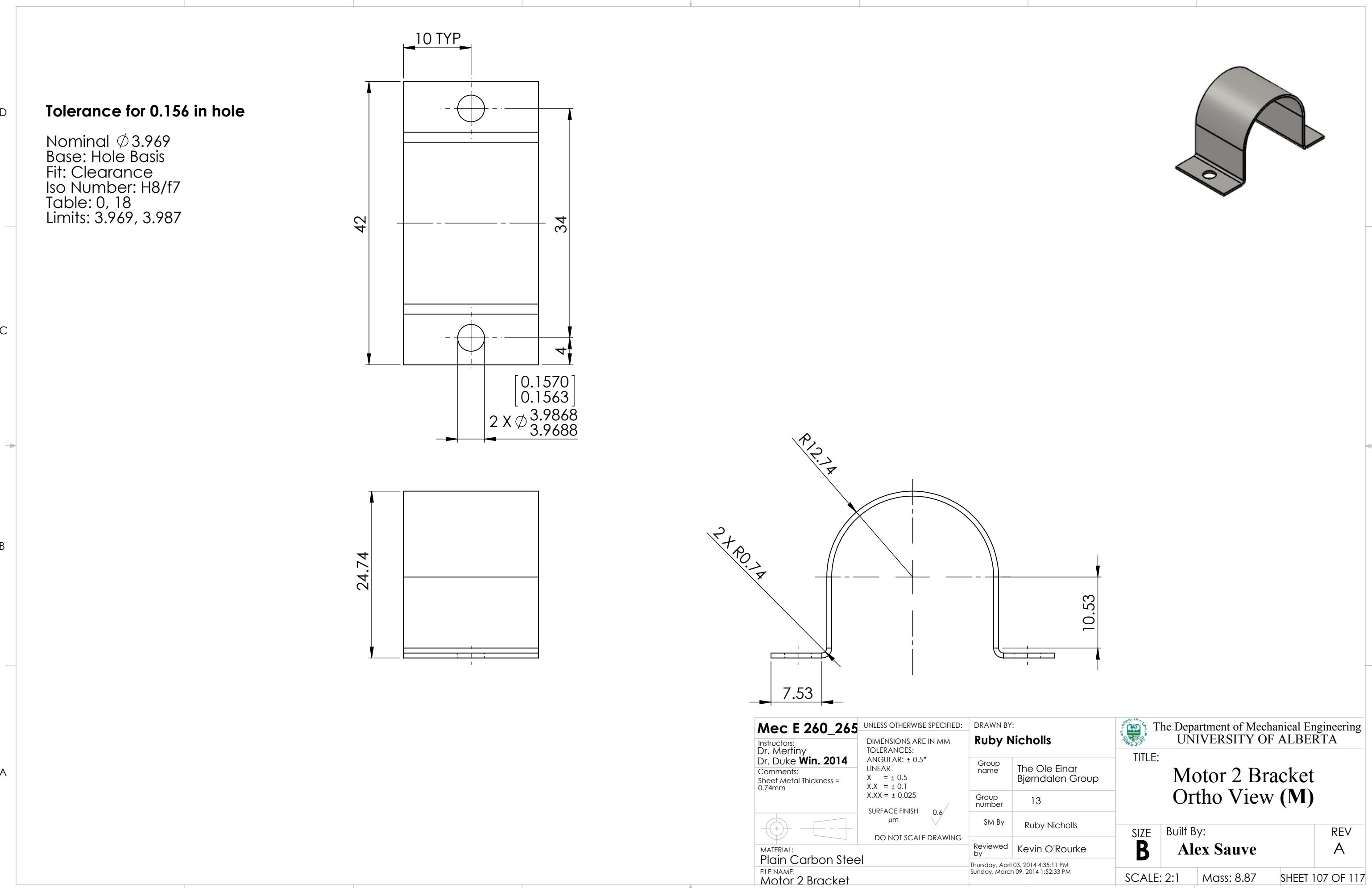
TITLE:
**Motor 2 Backing
Flattened View**

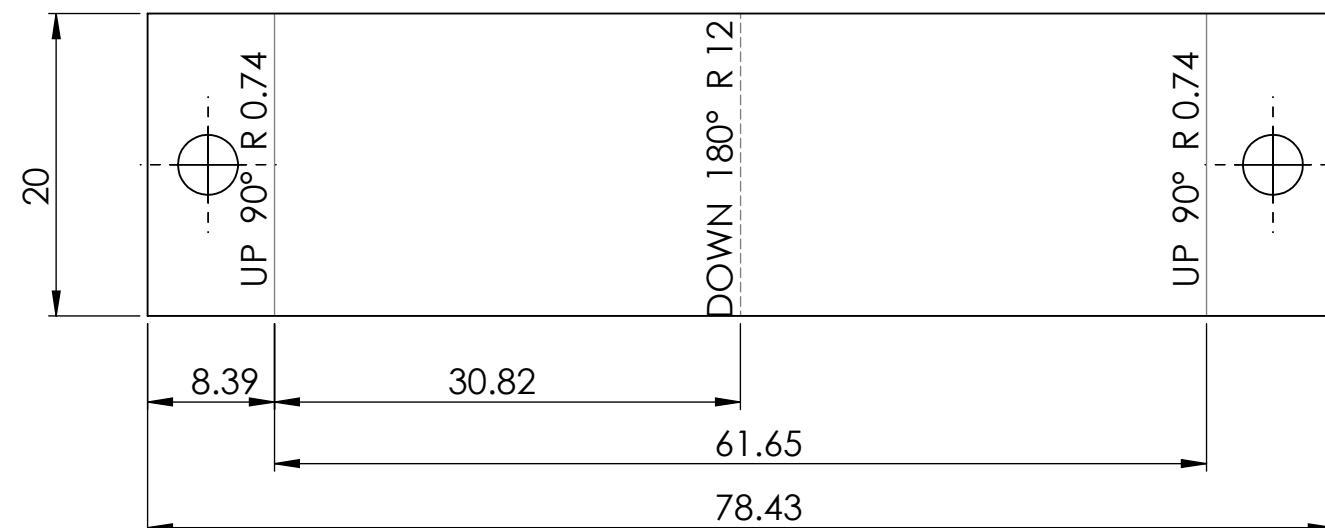
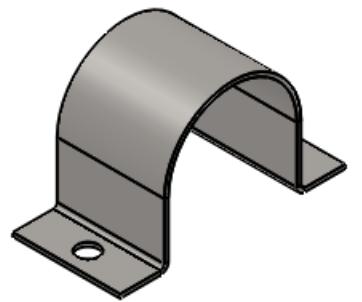
SIZE **B** Built By: Boston Maris REV **A**

SCALE: 2:1 Mass: SHEET 106 OF 117



8 7 6 5 4 3 2 1





Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $XX = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group	TITLE: Motor 2 Bracket
Comments: Sheet Metal Thickness = 0.74mm	DO NOT SCALE DRAWING	Group number 13	Flattened View (M)
		SM By Ruby Nicholls	Built By: Alex Sauve
MATERIAL: Plain Carbon Steel	Reviewed by Kevin O'Rourke	Thursday, April 03, 2014 4:35:11 PM Sunday, March 09, 2014 1:52:33 PM	REV A
FILE NAME: Motor 2 Bracket	SCALE: 2:1	Mass: 8.87	SHEET 108 OF 117

8 7 6 5 4 3 2 1

Tolerance for 0.125 in shaft

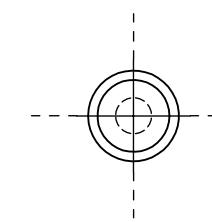
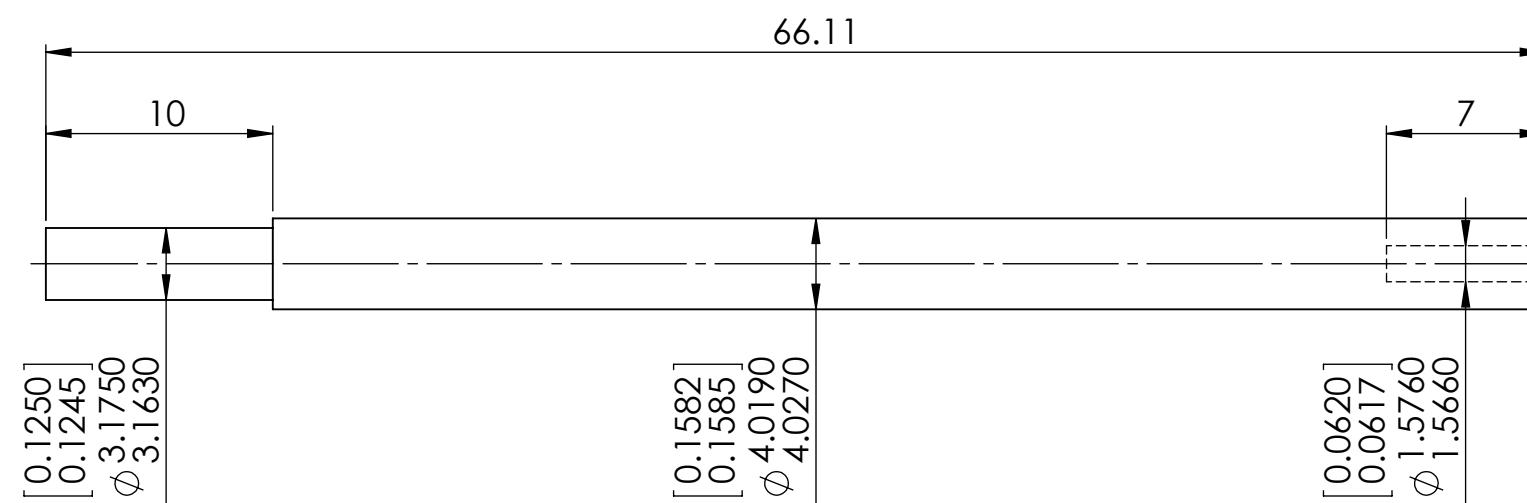
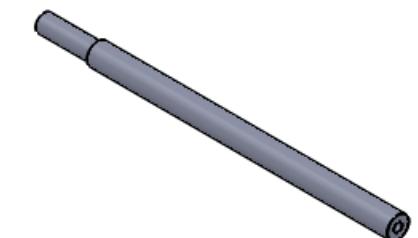
Nominal $\phi 3.175$
Base: Shaft Basis
Fit: Clearance
Iso Number: F8/h7
Table: 0, -12
Limits: 3.175, 3.1630

Tolerance for 0.156 in shaft

Nominal $\phi 4$
Base: Hole Basis
Fit: Interference
Iso Number: H7/s6
Table: 19, 27
Limits: 4.019, 4.027

Tolerance for 0.625 in hole

Nominal $\phi 1.59$
Base: shaft Basis
Fit: Interference
Iso Number: S7/h6
Table: -14, -24
Limits: 1.576, 1.566

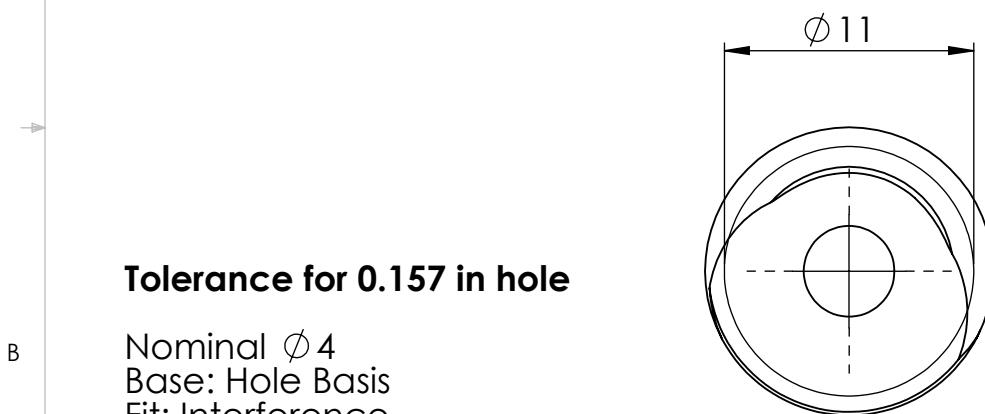
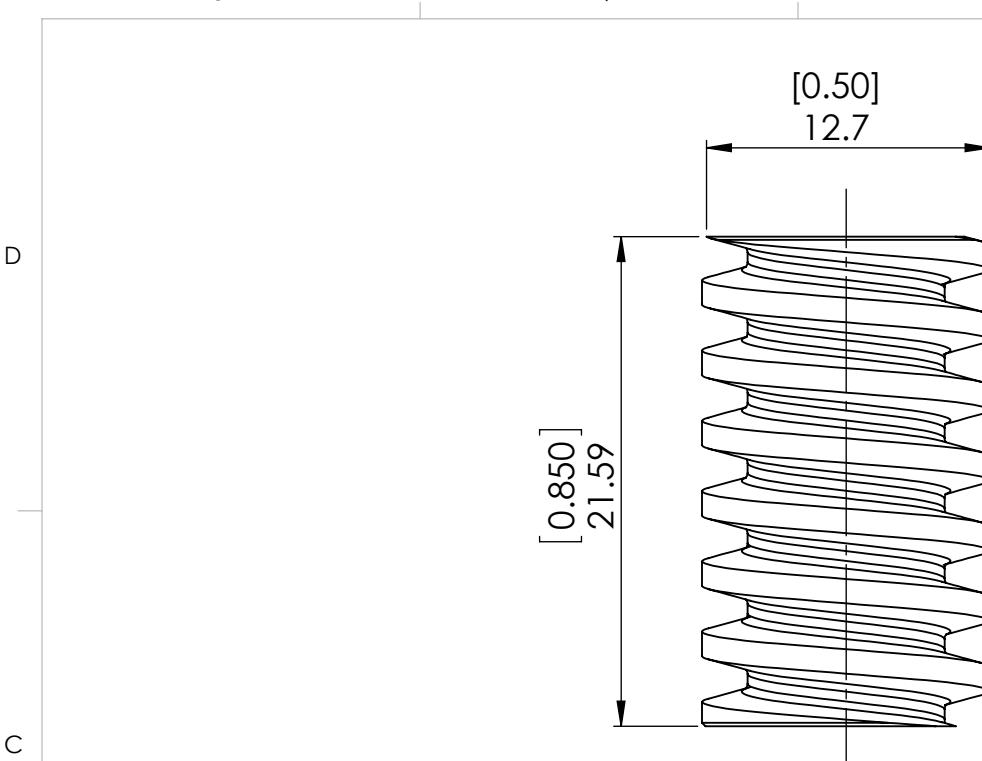


Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	Comments: Edit in SM	Group name The Ole Einar Bjørndalen Group
		SURFACE FINISH $0.6 \mu\text{m}$	Group number 13
		DO NOT SCALE DRAWING	SM By Boston Maris
		MATERIAL: Brass	Reviewed by Kevin O'Rourke
		FILE NAME: Motor 2 step shaft	Sunday, March 30, 2014 2:00:38 PM Tuesday, March 18, 2014 3:49:06 PM
SIZE B		Built By: Machinist	REV A
SCALE: 3:1		Mass: 0.77	SHEET 109 OF 117

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

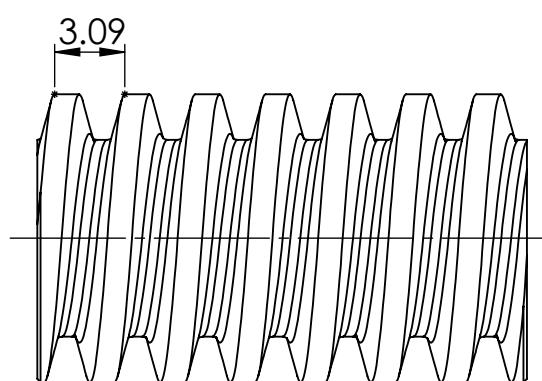
TITLE:
**Motor 2 Step Shaft
Ortho View**

8 7 6 5 4 3 2 1



Tolerance for 0.157 in hole

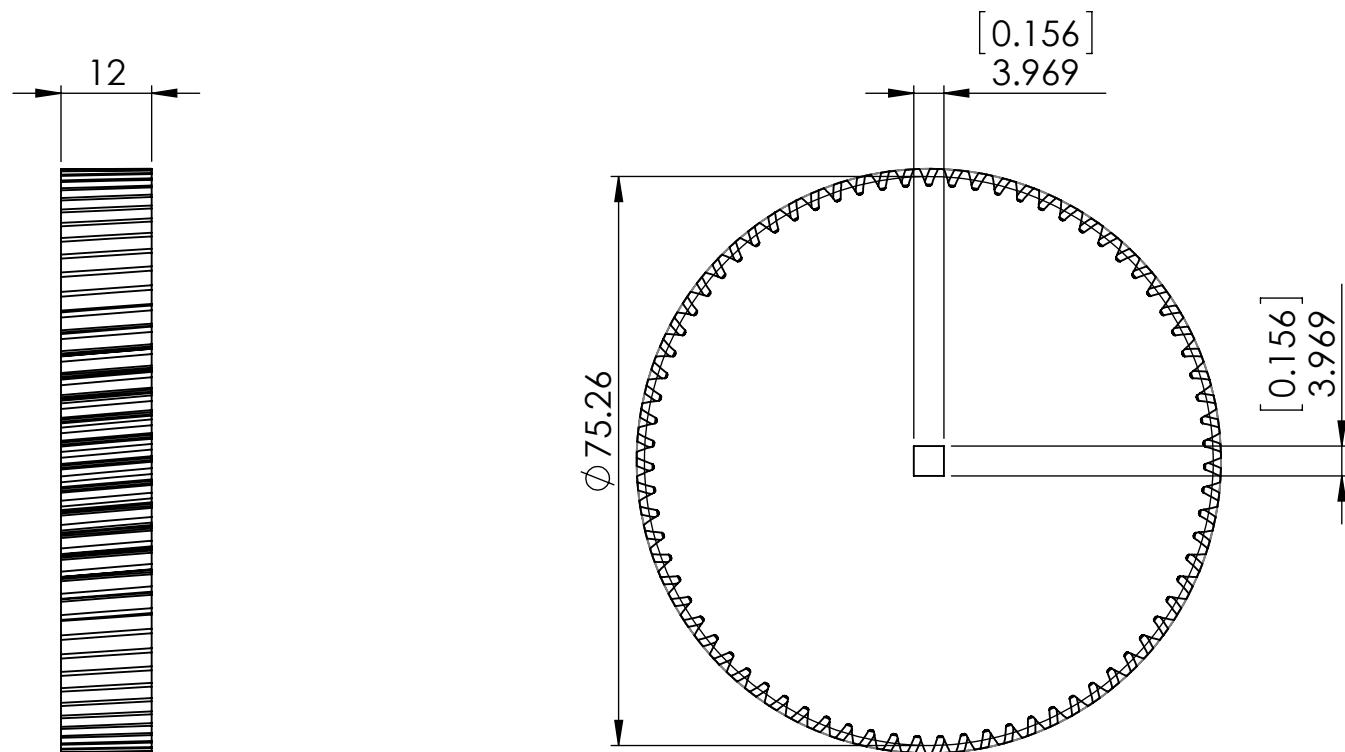
Nominal $\phi 4$
Base: Hole Basis
Fit: Interference
Iso Number: H7/s6
Table: 0, 12
Limits: 4.000, 4.012



20° Pressure Angle
5.17° Lead Angle

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	
		Group number 13	
		SM By D.S. Nobes	
		Reviewed by Kevin O'Rourke	
		Saturday, April 05, 2014 10:17:33 AM Monday, June 18, 2007 7:42:38 AM	
MATERIAL: ABS		SURFACE FINISH $0.6 \mu\text{m}$	
DO NOT SCALE DRAWING			
FILE NAME: Worm_Gear_Single_Start (1)			

	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA	
TITLE: Single Start Worm Gear Motor 2 Ortho View		
B	Built By: Machinist	REV A
SCALE: 3:1	Mass: 1.78	SHEET 110 OF 117



20° Pressure Angle
5.17° Helical Angle

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $XX = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group	TITLE: Helical Gear 75 Tooth Ortho View
Comments:	DO NOT SCALE DRAWING	Group number 13	SIZE B
		SM By Ruby Nicholls/ SW Tool Box	Built By: Rapid Prototype Machine
		Reviewed by Kevin O'Rourke	REV A
		Saturday, April 05, 2014 3:25:36 PM	SCALE: 1:1
		Saturday, March 29, 2014 1:41:21 PM	Mass: 53.11
			SHEET 111 OF 117

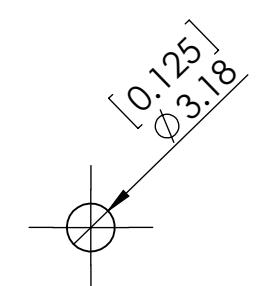
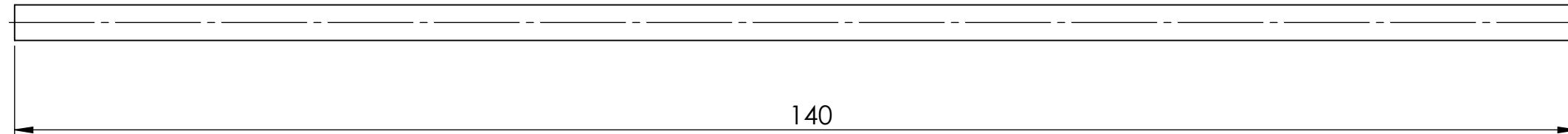
8 7 6 5 4 3 2 1

D

D

C

C



B

B

A

A

Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	
		Group number 13	
		SM By Ruby Nicholls	
		Reviewed by Kevin O'Rourke	
MATERIAL: AISI 4340 Steel, normalized		Thursday, March 20, 2014 5:03:17 PM Wednesday, March 05, 2014 9:32:40 PM	
FILE NAME: helical shaft		DO NOT SCALE DRAWING	
		SIZE B Built By: Modified from 260 kit by: Ruby Nicholls REV A	
SCALE: 2:1		Mass: 8.70	
		SHEET 112 OF 117	

8 7 6 5 4 3 2 1

D

D

1.98 TYP

10

74

[0.063]
Ø1.59

[0.156]
3.97

C

C

104

[0.156]
3.97

[0.125]
3.18
[0.125]
3.18

B

B

Mec E 260_265

Instructors:
Dr. Mertiny
Dr. Duke Win. 2014

Comments:



DO NOT SCALE DRAWING

MATERIAL:
Brass

FILE NAME:
Square tubing-long

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: $\pm 0.5^\circ$
LINEAR

X = ± 0.5
XX = ± 0.1
X.XX = ± 0.025

SURFACE FINISH
 $0.6 \mu\text{m}$

DO NOT SCALE DRAWING

DRAWN BY:
Ruby Nicholls

Group name
The Ole Einar
Bjørndalen Group

Group number
13

SM By
Ruby Nicholls

Reviewed by
Kevin O'Rourke

Saturday, March 29, 2014 6:46:58 PM
Saturday, March 29, 2014 11:09:12 AM

The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
**Modified Brass Square
Rod**

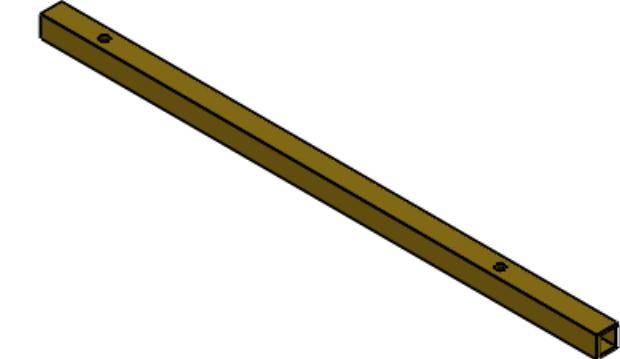
SIZE **B** Built By:
**Modified from 260 kit by:
Kevin O'Rourke** REV **A**

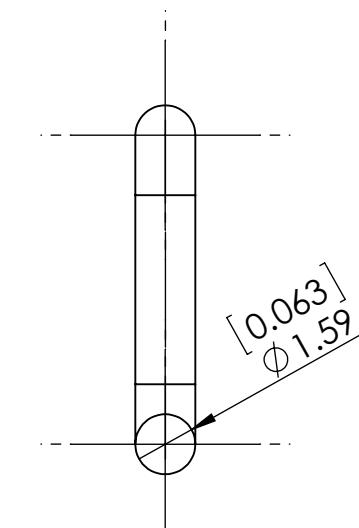
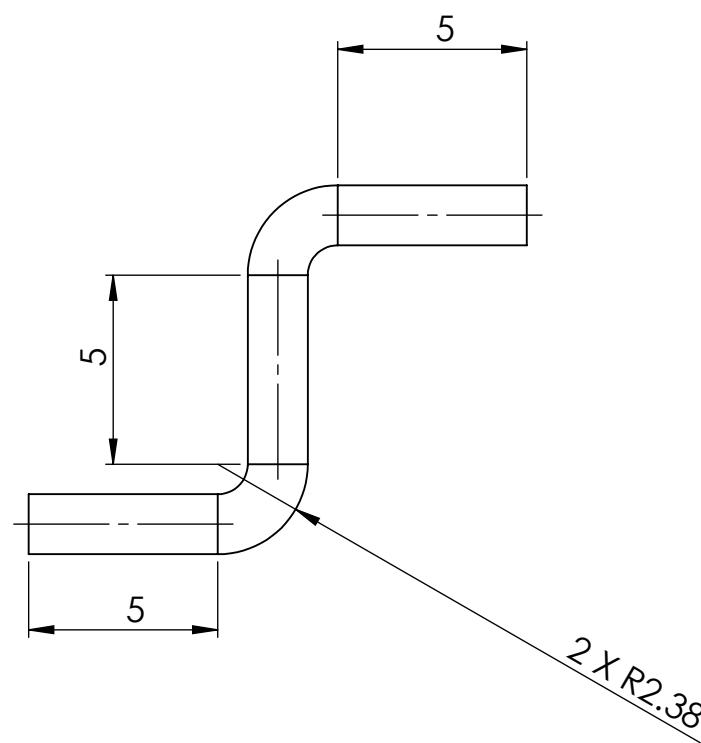
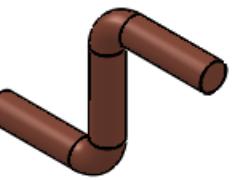
SCALE: 2:1 Mass: 4.99 SHEET 113 OF 117

8 7 6 5 4 3 2 1

A

A





Mec E 260_265		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls
Instructors: Dr. Mertiny Dr. Duke	Win. 2014	Comments:	
		SURFACE FINISH $0.6 \mu\text{m}$	
		DO NOT SCALE DRAWING	
MATERIAL: Copper			
FILE NAME: Axe to Tubing Locking S Bend		Saturday, March 29, 2014 11:36:06 AM Saturday, March 29, 2014 11:28:28 AM	
SIZE B	Built By: Modified from 260 kit by: RN and KO	REV A	
SCALE: 1:1		Mass: 0.35	
		SHEET 114 OF 117	

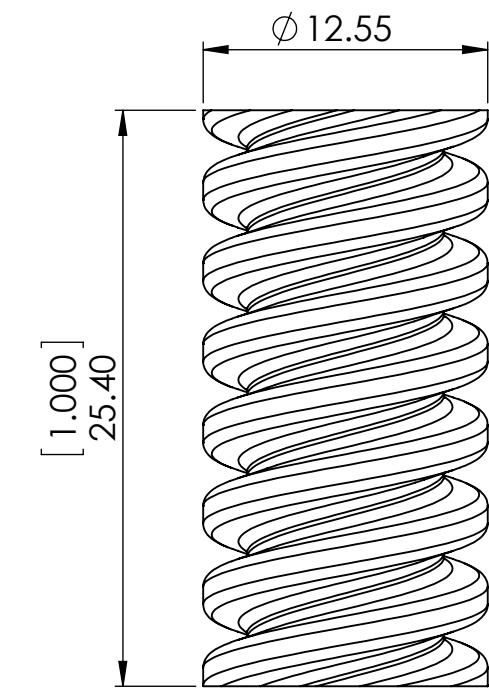
The Department of Mechanical Engineering
UNIVERSITY OF ALBERTA

TITLE:
**Modified Copper Rod
Locking S-Bend**

**REV
A**

8 7 6 5 4 3 2 1

D



C

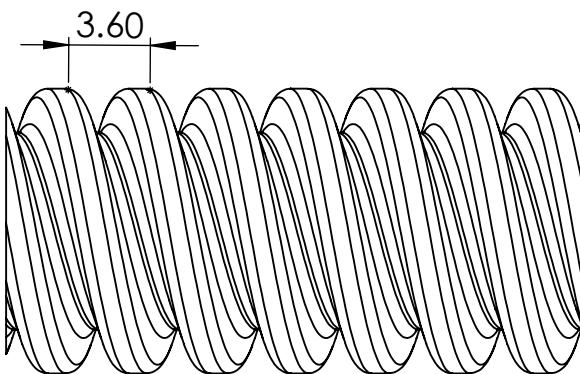
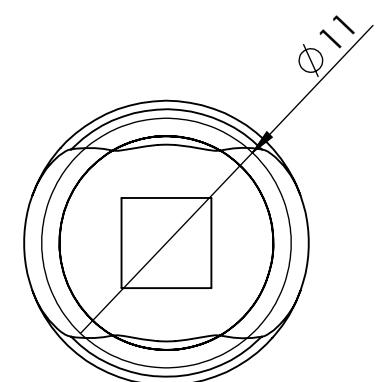
A

A

D

C

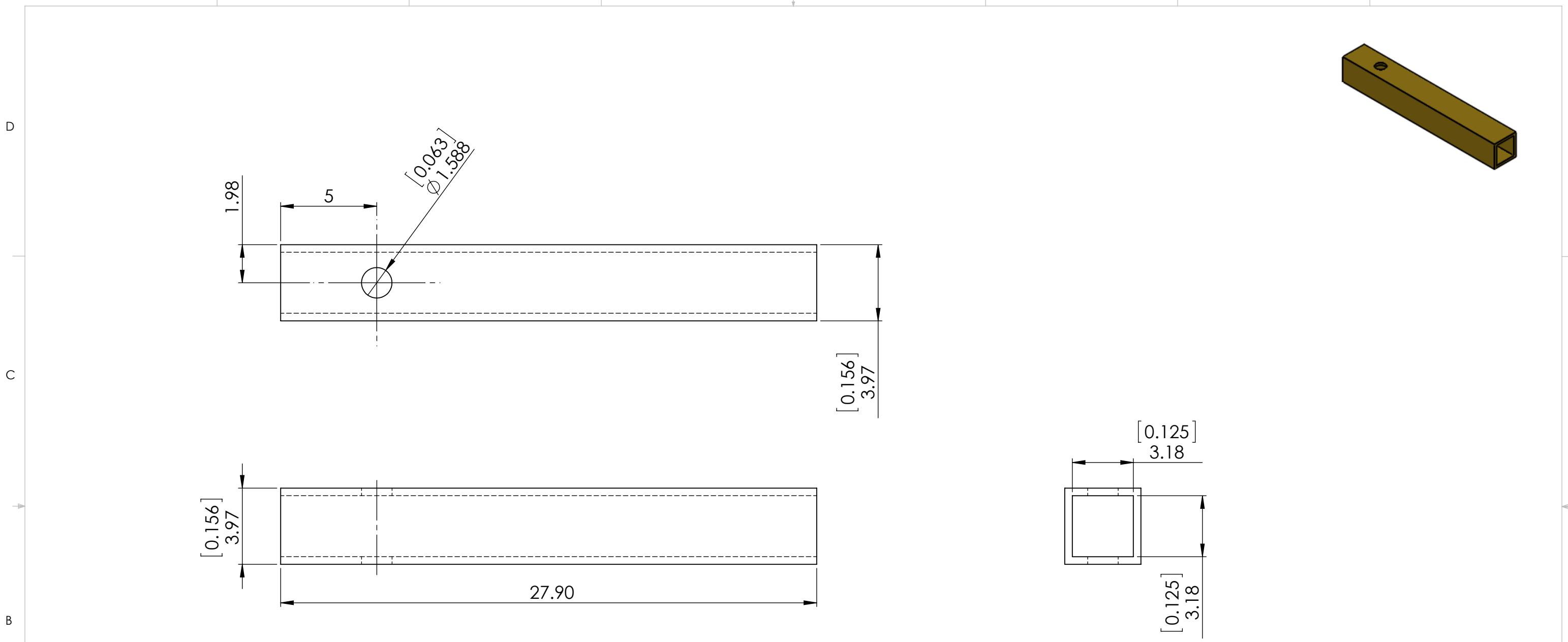
B



14.5° Pressure Angle
11.769° Lead Angle

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014		Group name The Ole Einar Bjørndalen Group	
Comments:		Group number 13	
		SM By G. Gearloose/ Ruby Nicholls	
		Reviewed by Kevin O'Rourke	
		Saturday, March 29, 2014 10:47:18 AM Monday, January 11, 2010 4:56:23 PM	
MATERIAL: ABS	SURFACE FINISH $0.6 \mu\text{m}$	DO NOT SCALE DRAWING	
FILE NAME: Worm Gear_Double_Start			
B	Built By: Machinist	REV A	
SCALE: 3:1	Mass: 2.03	SHEET 115 OF 117	

8 7 6 5 4 3 2 1

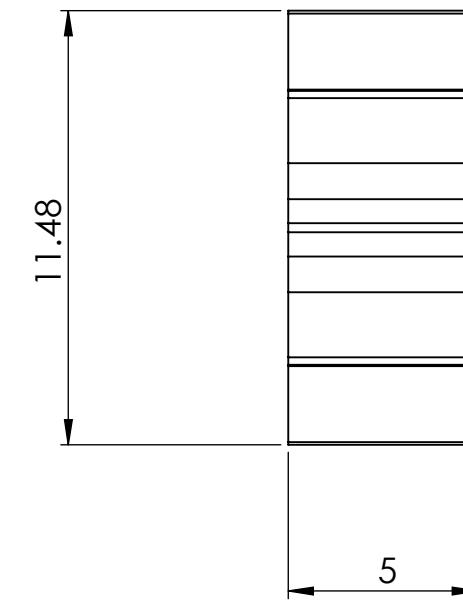


Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	SURFACE FINISH $0.6 \mu\text{m}$	Group name The Ole Einar Bjørndalen Group	TITLE: Modified Brass Square Tubing
Comments:	DO NOT SCALE DRAWING	Group number 13	SIZE B
		SM By Ruby Nicholls	Built By: Modified from 260 kit by: RN and KO
		Reviewed by Kevin O'Rourke	REV A
		Thursday, April 03, 2014 4:34:08 PM Saturday, March 29, 2014 11:01:53 AM	SCALE: 5:1
			Mass: 1.33
			SHEET 116 OF 117



D

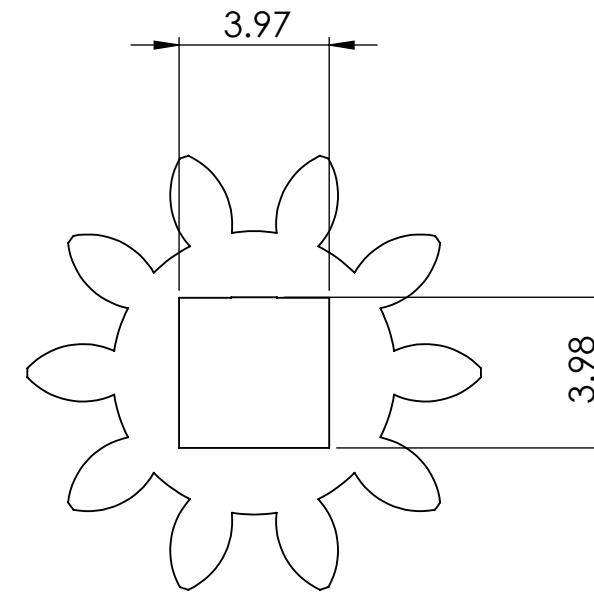
D



B

C

C



B

B

Mec E 260_265	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: $\pm 0.5^\circ$ LINEAR $X = \pm 0.5$ $X.X = \pm 0.1$ $X.XX = \pm 0.025$	DRAWN BY: Ruby Nicholls	The Department of Mechanical Engineering UNIVERSITY OF ALBERTA
Instructors: Dr. Mertiny Dr. Duke Win. 2014	Comments:	Group name The Ole Einar Bjørndalen Group	TITLE: Spur Gear 10 Tooth Modified Part
		Group number 13	SIZE B
		SM By Ruby Nicholls/ SW Tool Box	Built By: 260 kit / machinist
		Reviewed by Kevin O'Rourke	REV A
		Saturday, March 29, 2014 10:50:05 AM Tuesday, February 08, 2000 9:41:59 AM	SCALE: 5:1
			Mass: 0.281
			SHEET 117 OF 117

8

7

6

5

4

3

2

1