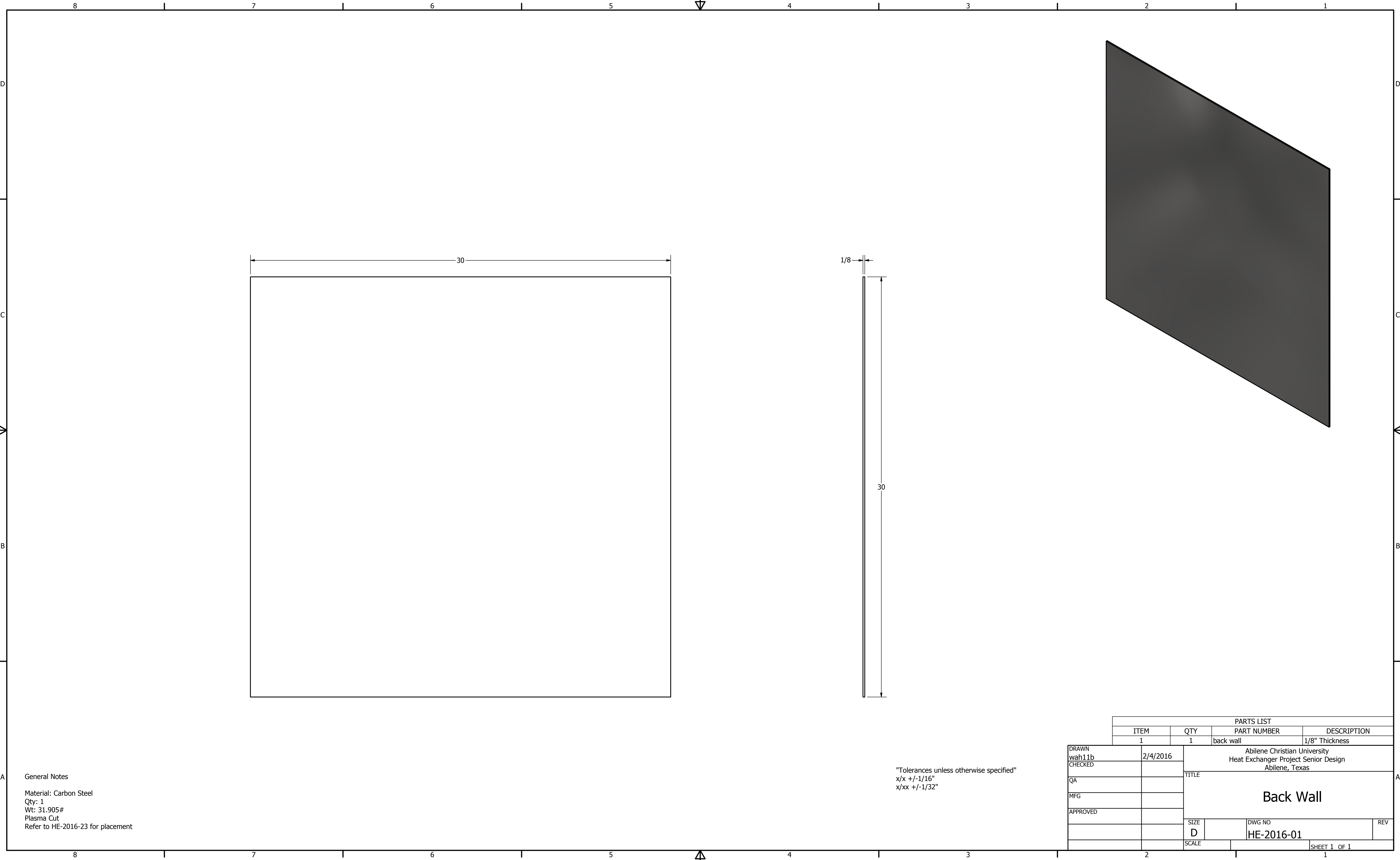


Abilene Christian University  
Department of Engineering and Physics  
Heat Exchanger  
Detail Drawings

DRAWN wah11b	2/19/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas		
CHECKED		TITLE		
QA		Heat Exchanger Design		
MFG				
APPROVED		SIZE D	DWG NO Title Page	REV 11
		SCALE		SHEET 1 OF 1



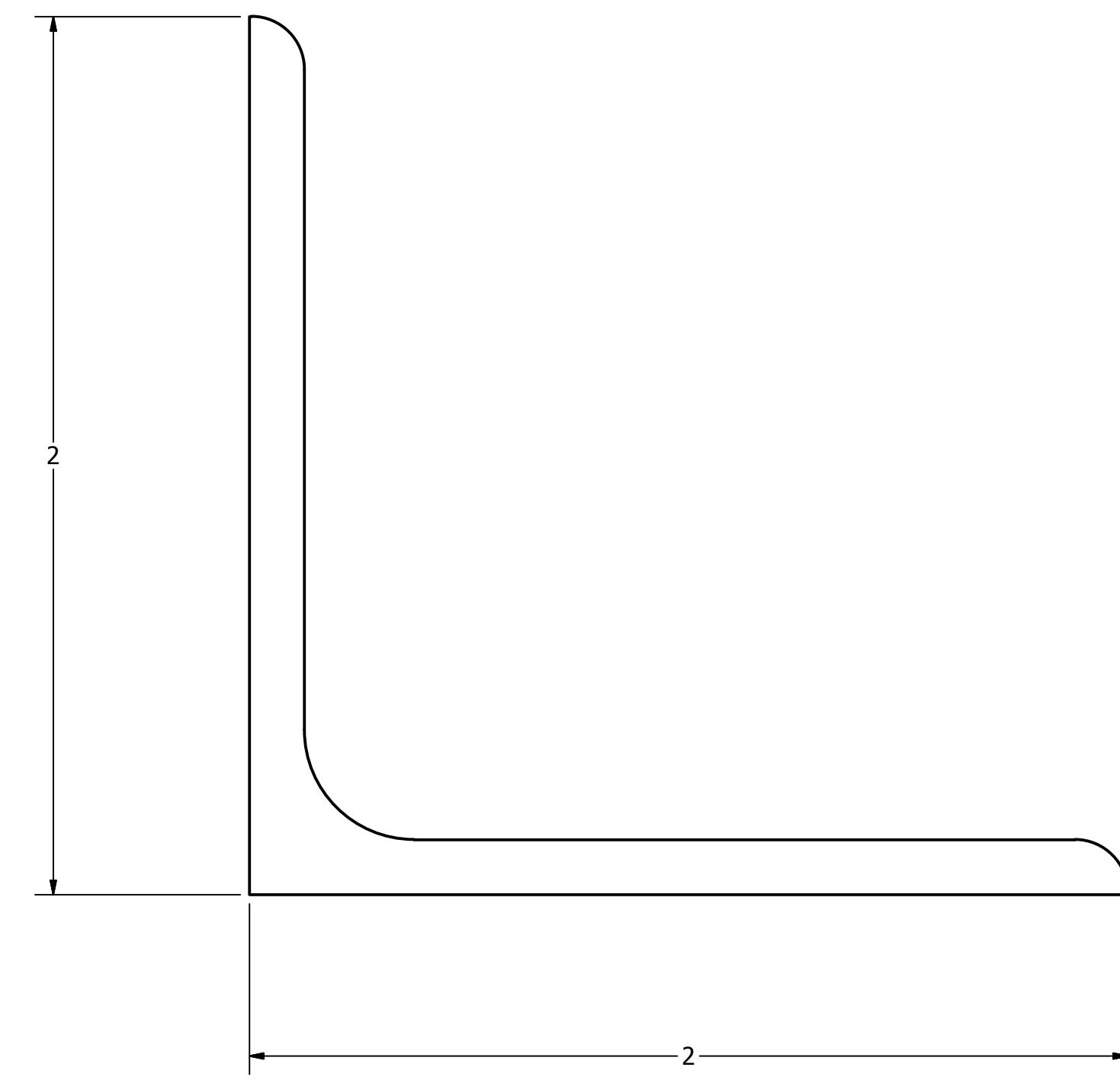
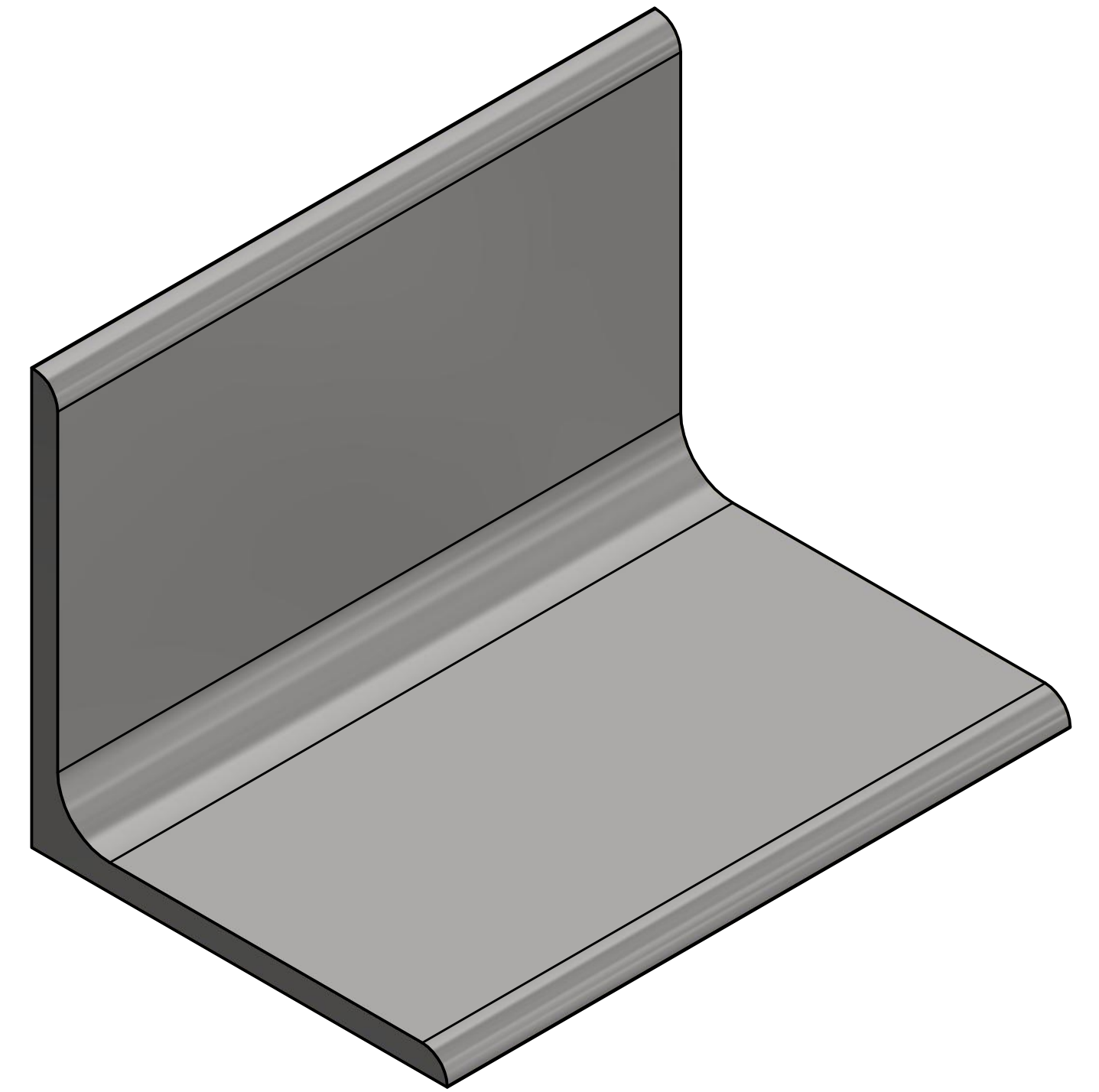
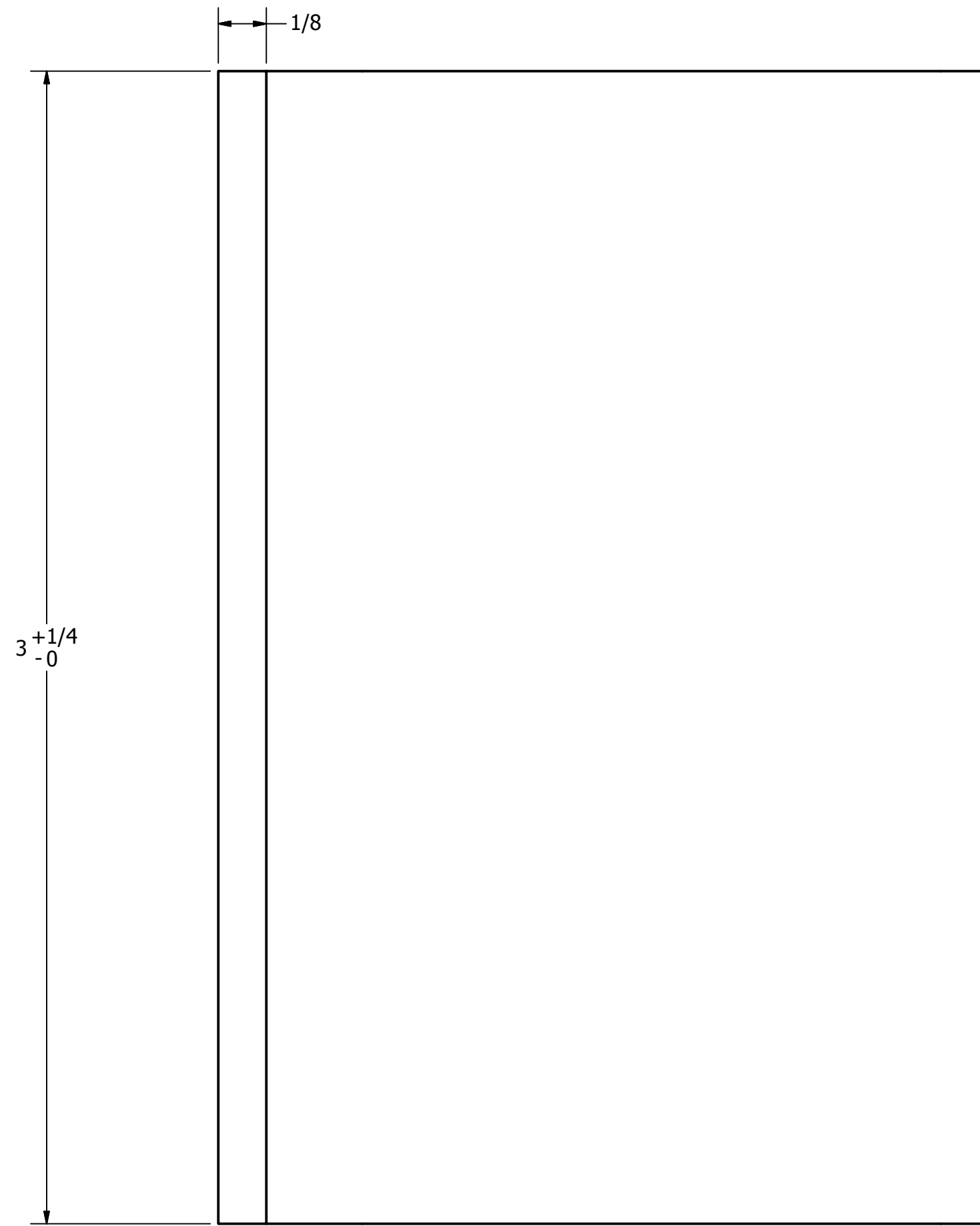
General Notes  
 Material: Carbon Steel  
 Qty: 1  
 Wt: 31.905#  
 Plasma Cut  
 Refer to HE-2016-23 for placement

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	back wall	1/8" Thickness

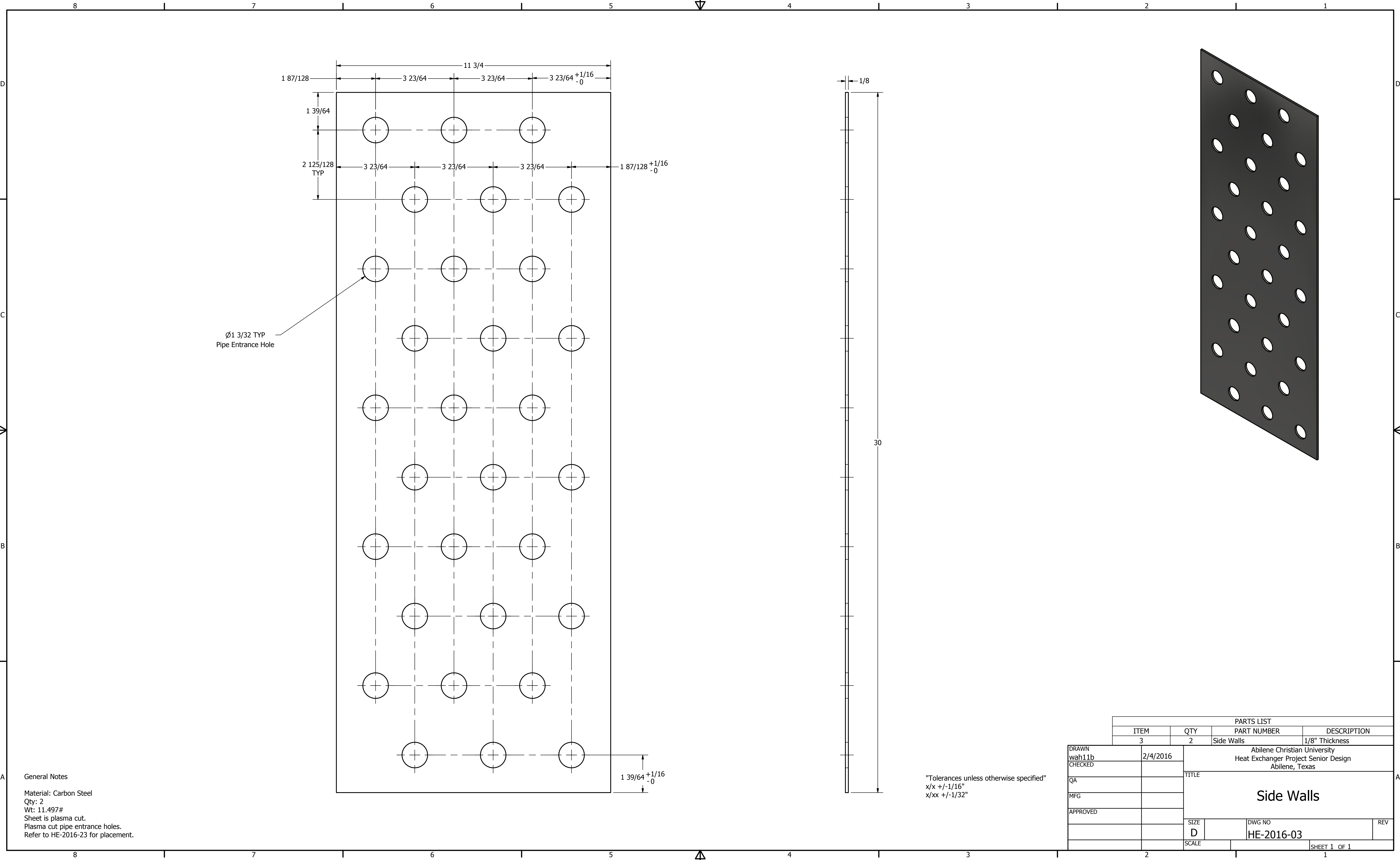
DRAWN wah11b	2/4/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Back Wall</b>	
QA		SIZE D	DWG NO HE-2016-01
MFG		SCALE	REV
APPROVED			
			SHEET 1 OF 1



General Notes  
 Material: Carbon Steel  
 Qty: 6  
 Wt: 0.418#  
 Chop saw to length.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
2	6	Angle Iron	Length 3"
DRAWN wah11b 2/18/2016		Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron</b>	
QA		SIZE D	
MFG			
APPROVED		DWG NO HE-2016-02	REV
SCALE 3 : 1		SHEET 1 OF 1	



Ø1 3/32 TYP  
Pipe Entrance Hole

General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 11.497#  
 Sheet is plasma cut.  
 Plasma cut pipe entrance holes.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

		PARTS LIST		
		ITEM	QTY	DESCRIPTION
		3	2	Side Walls 1/8" Thickness
DRAWN wah11b CHECKED		2/4/2016		
QA		TITLE		
MFG		Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas		
APPROVED		Side Walls		
		SIZE D	DWG NO HE-2016-03	REV
		SCALE	SHEET 1 OF 1	

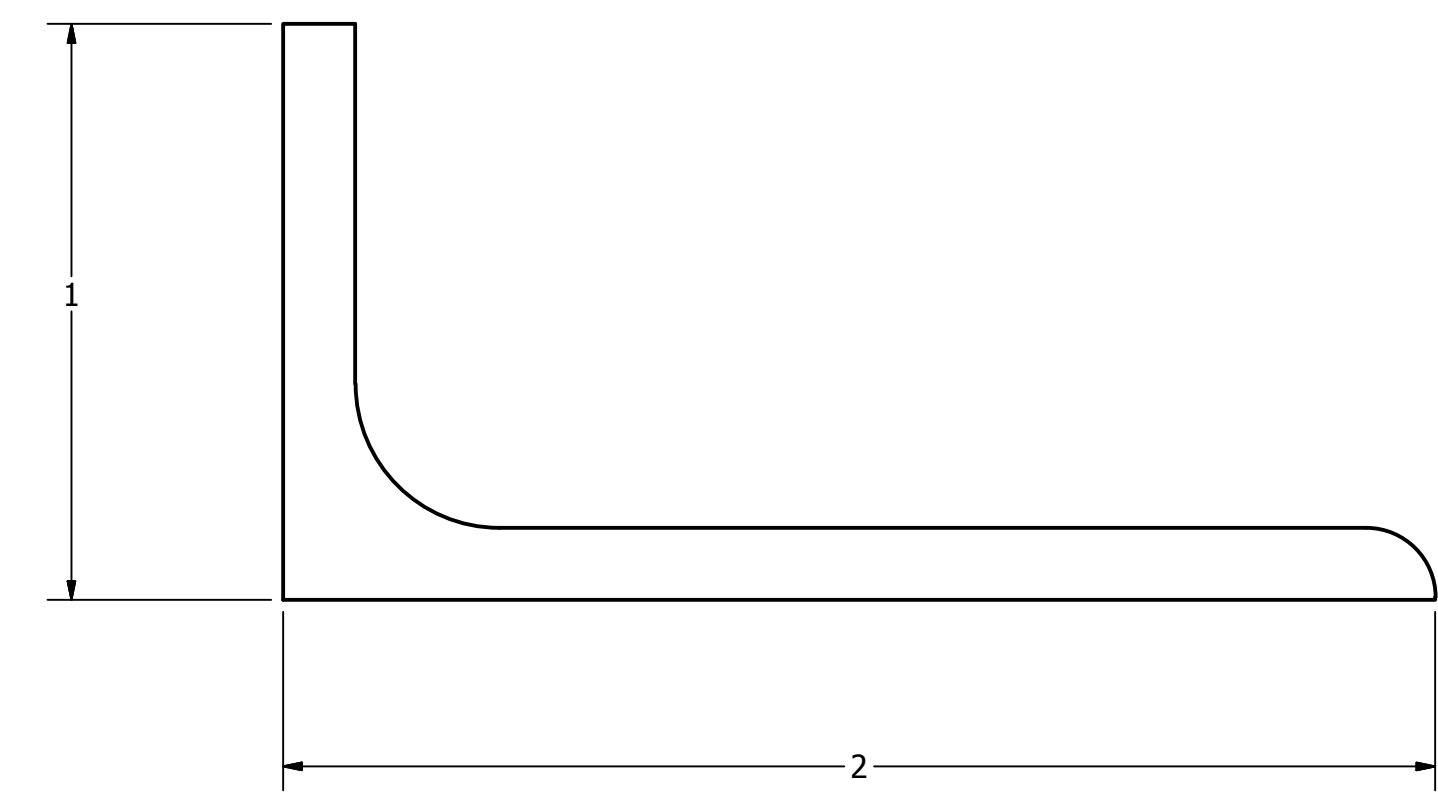
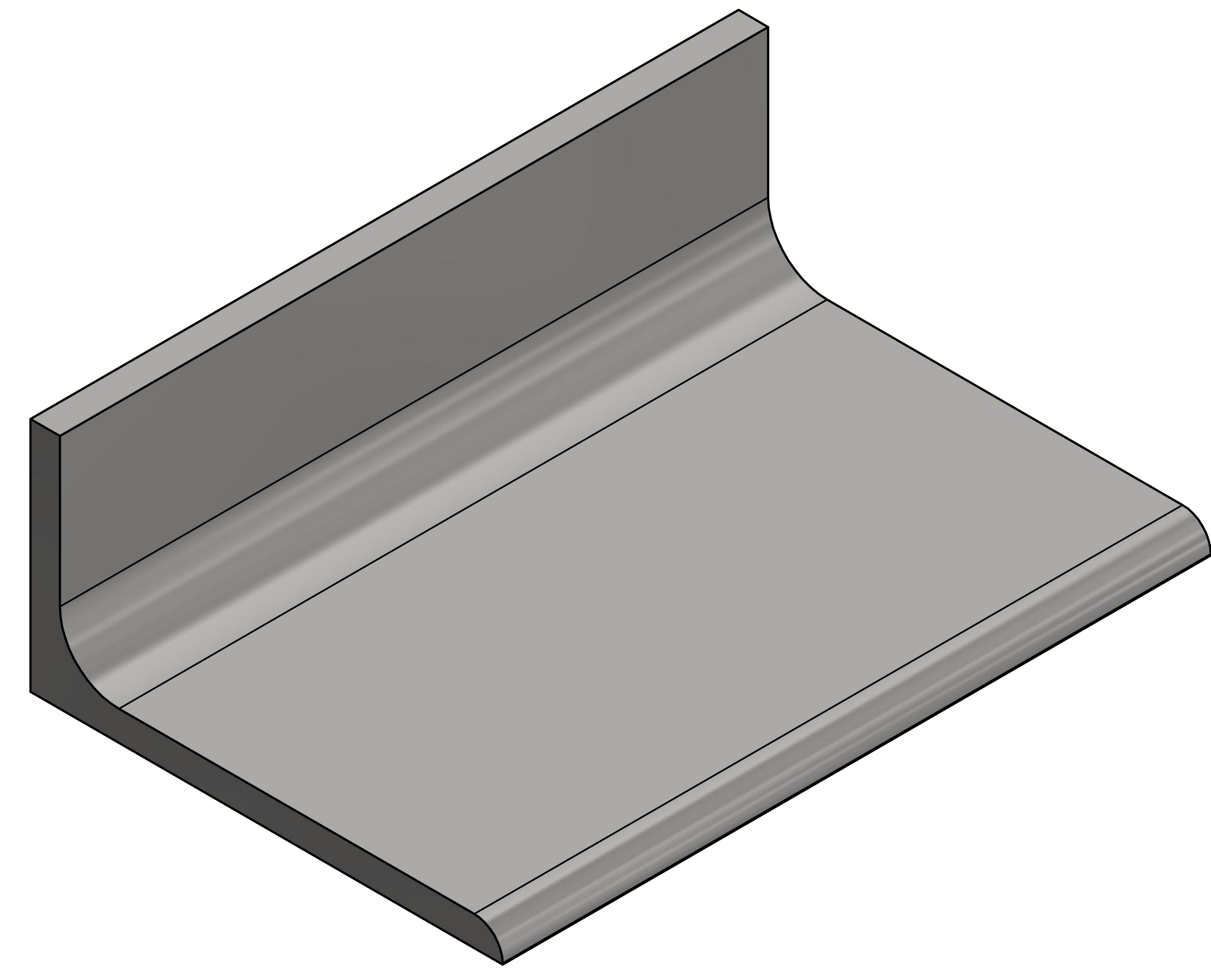
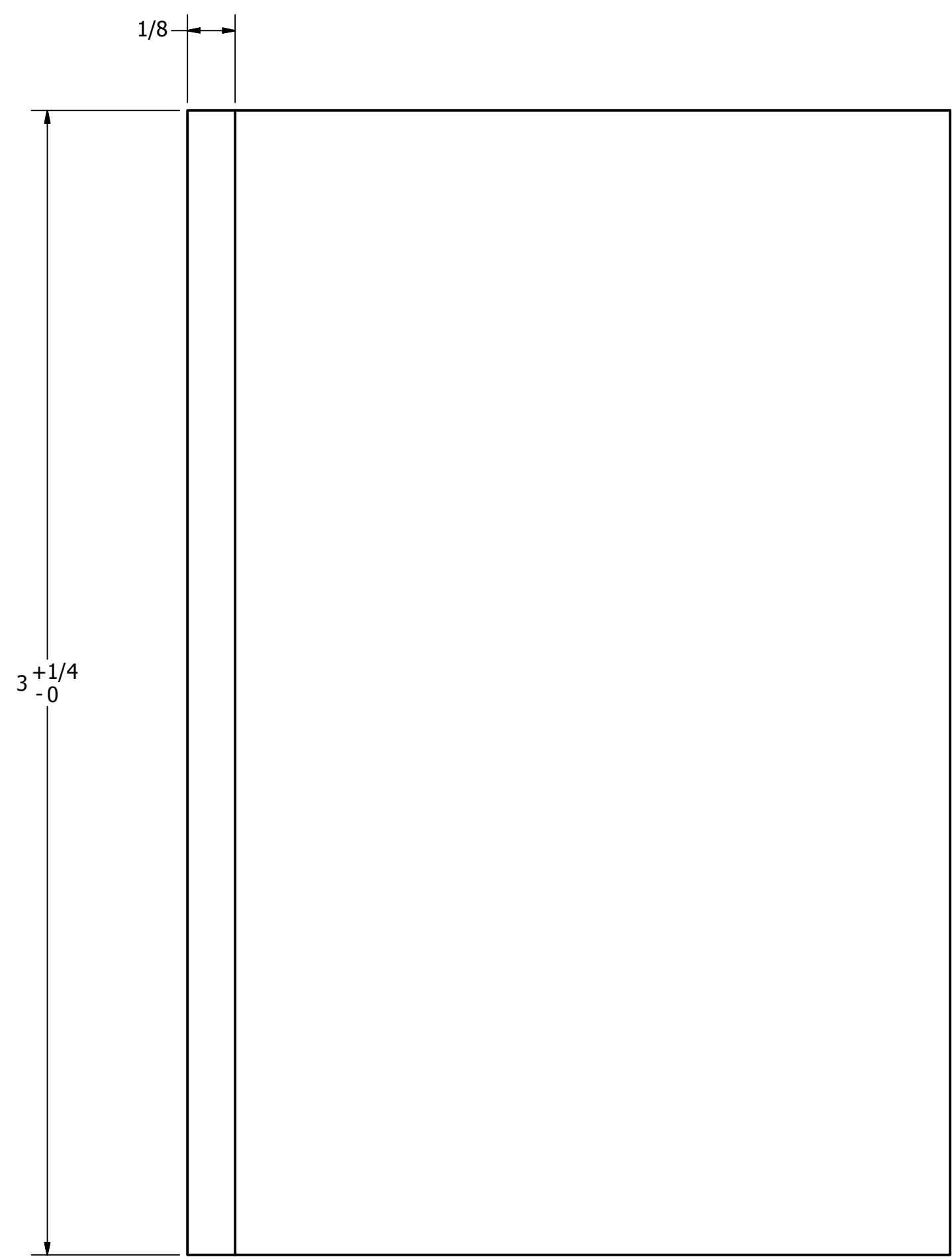
8 7 6 5 4 3 2 1

D

C

B

A



General Notes  
 Material: Carbon Steel  
 Qty: 6  
 Wt: 0.315#  
 Chop saw to length.  
 Band saw the side to 1".  
 Refer to HE-2016-23 for placement.

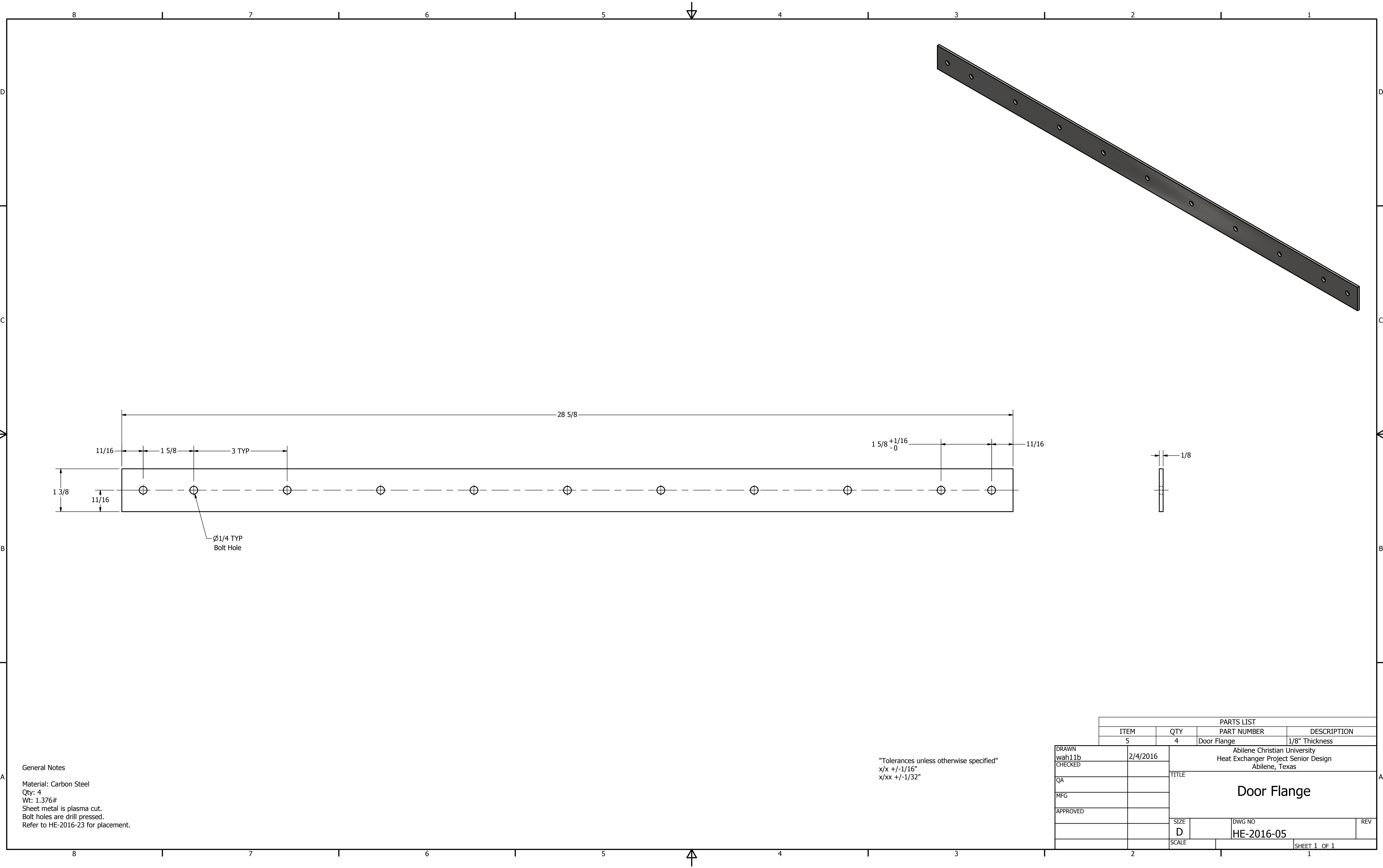
"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
4	6	Angle Iron CUT	Length 3"

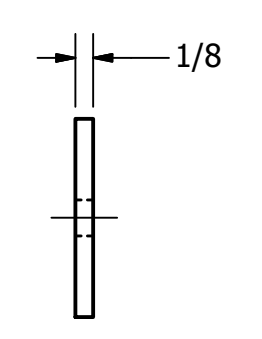
  

DRAWN wah11b	2/18/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron CUT</b>	
QA		SIZE D	DWG NO HE-2016-04
MFG		SCALE 3 : 1	REV
APPROVED		SHEET 1 OF 1	

8 7 6 5 4 3 2 1



$28 \frac{5}{8}$   
 $11/16$   $1 \frac{5}{8}$   $3 \text{ TYP}$   $1 \frac{5}{8} + \frac{1}{16} - 0$   $11/16$   
 $1 \frac{3}{8}$   $11/16$   
 $\varnothing 1/4 \text{ TYP}$   
 Bolt Hole



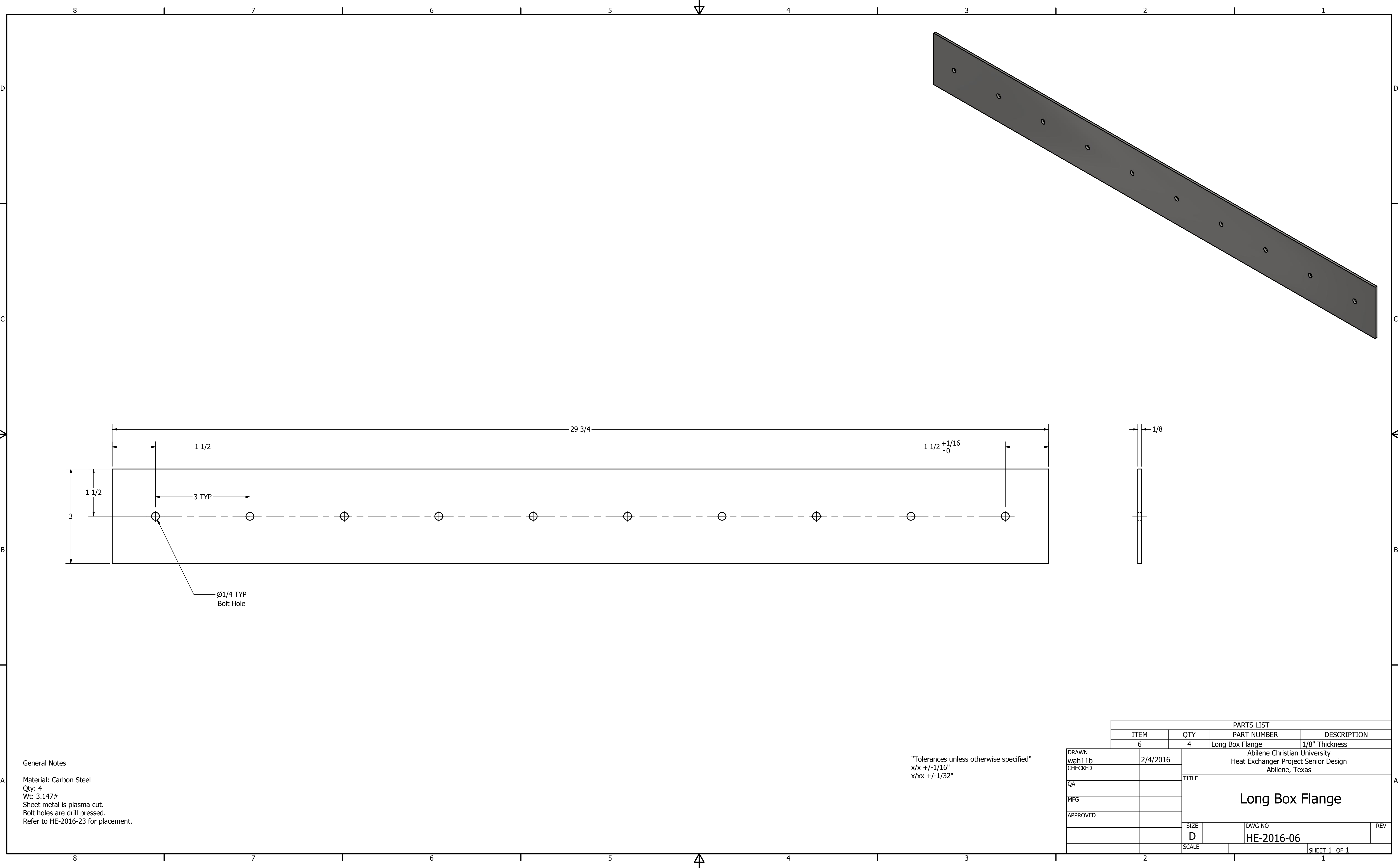
"Tolerances unless otherwise specified"  
 $x/x \pm 1/16"$   
 $x/xx \pm 1/32"$

General Notes  
 Material: Carbon Steel  
 Qty: 4  
 Wt: 1.376#  
 Sheet metal is plasma cut.  
 Bolt holes are drill pressed.  
 Refer to HE-2016-23 for placement.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
5	4	Door Flange	1/8" Thickness

DRAWN wah11b	2/4/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Door Flange</b>	
QA		SIZE D	DWG NO HE-2016-05
MFG		SCALE	REV
APPROVED			
		SHEET 1 OF 1	



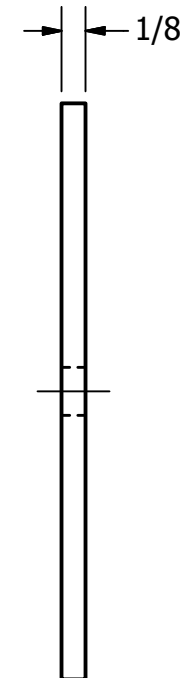
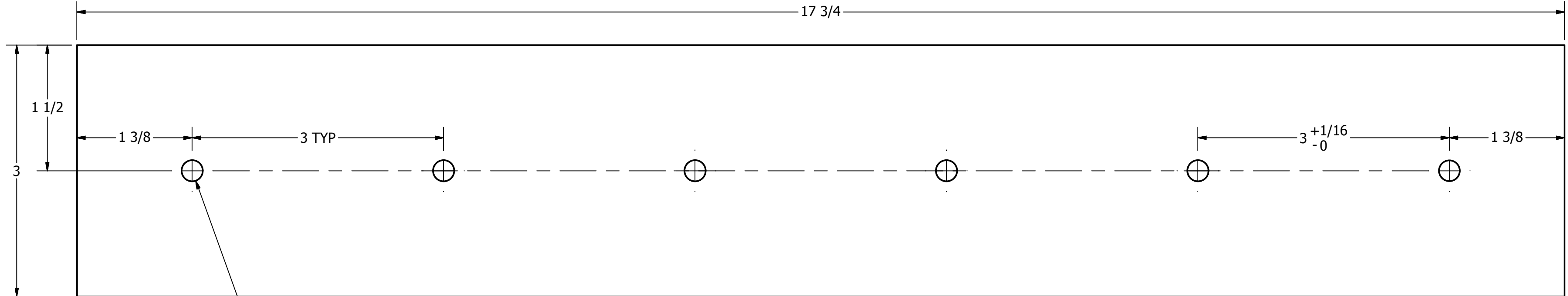
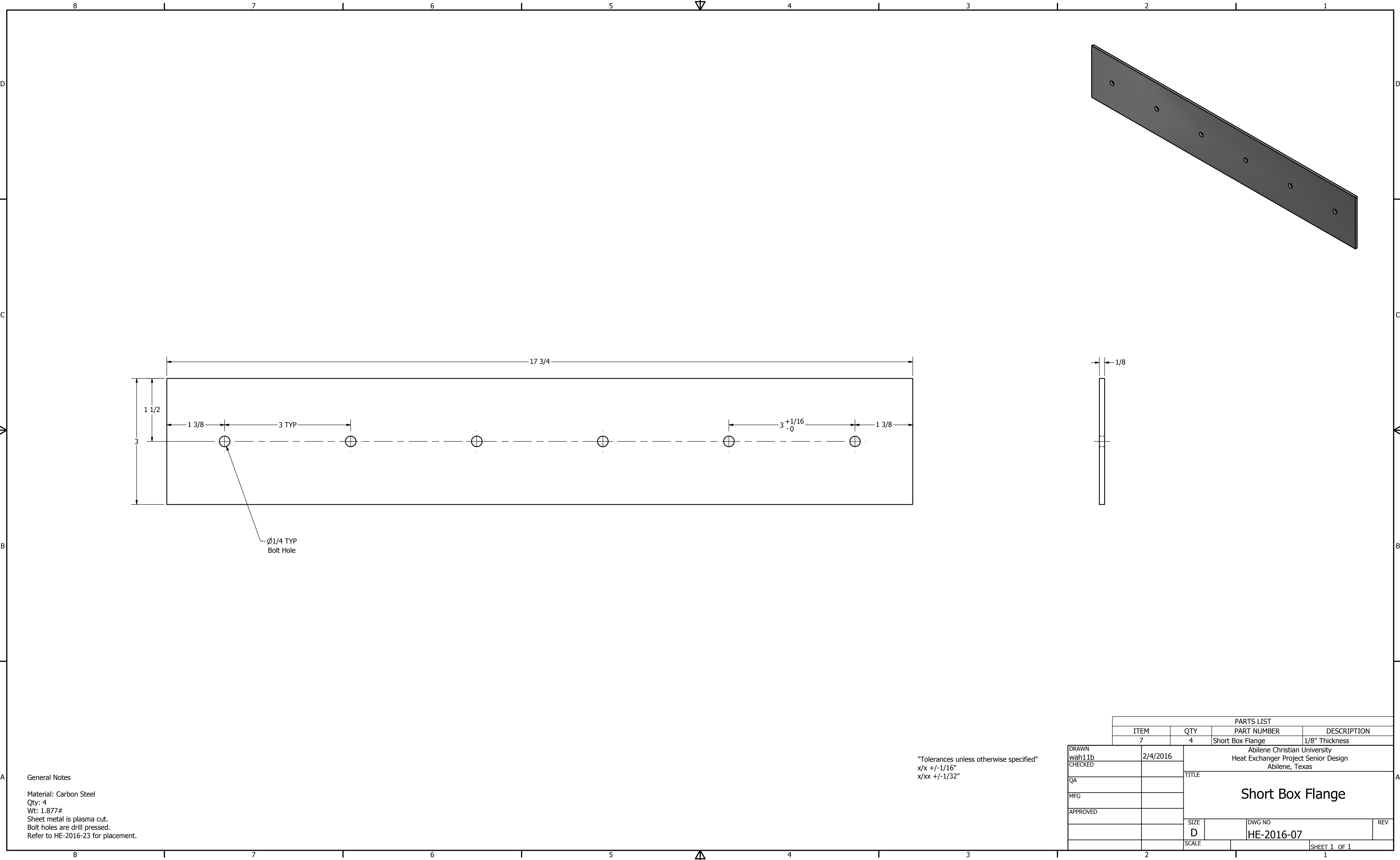
General Notes  
 Material: Carbon Steel  
 Qty: 4  
 Wt: 3.147#  
 Sheet metal is plasma cut.  
 Bolt holes are drill pressed.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/- 1/16"  
 x/xx +/- 1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
6	4	Long Box Flange	1/8" Thickness

DRAWN wah11b	2/4/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Long Box Flange</b>	
QA		SIZE D	DWG NO HE-2016-06
MFG		SCALE	REV
APPROVED			1



Ø1/4 TYP  
Bolt Hole

General Notes  
 Material: Carbon Steel  
 Qty: 4  
 Wt: 1.877#  
 Sheet metal is plasma cut.  
 Bolt holes are drill pressed.  
 Refer to HE-2016-23 for placement.

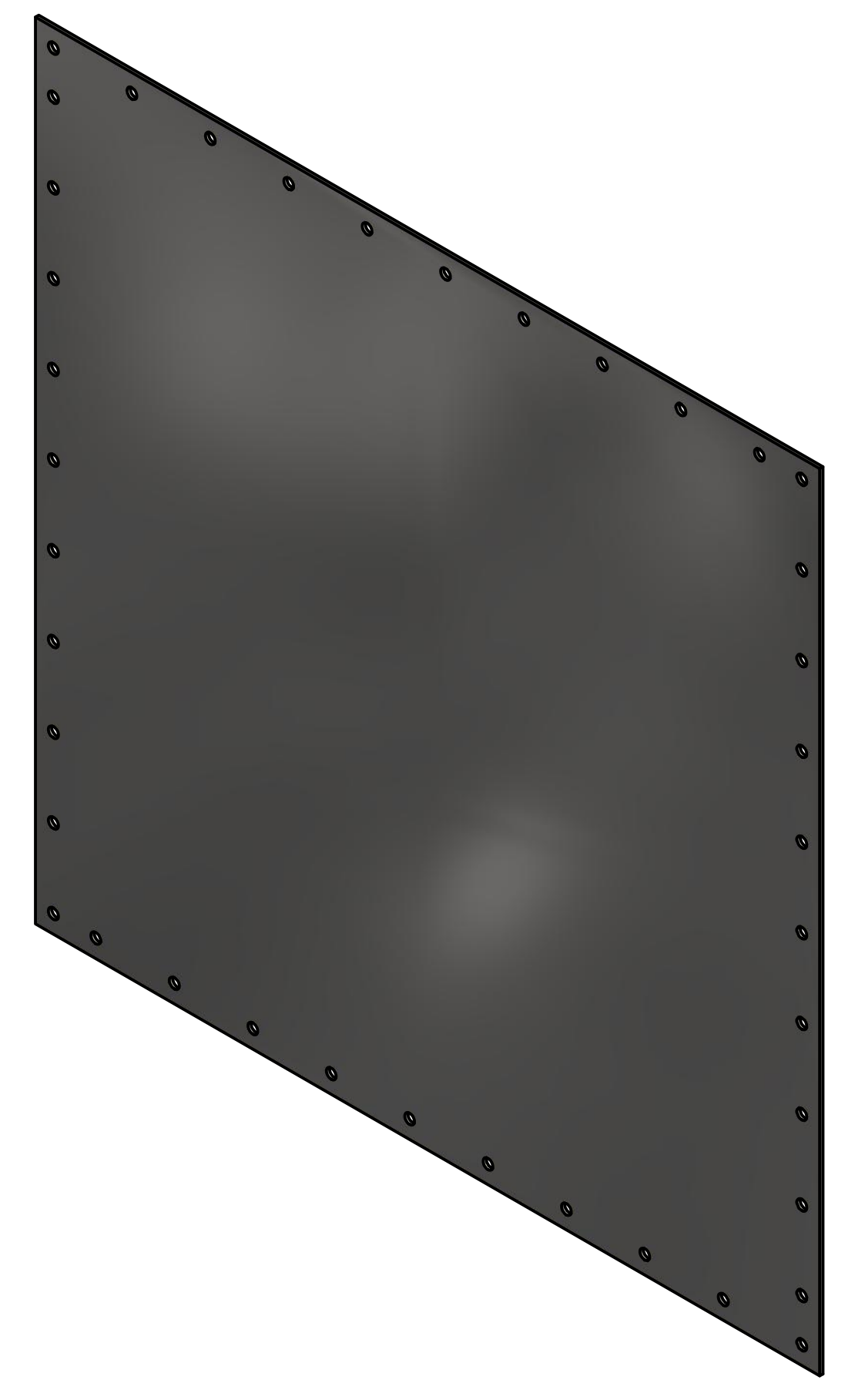
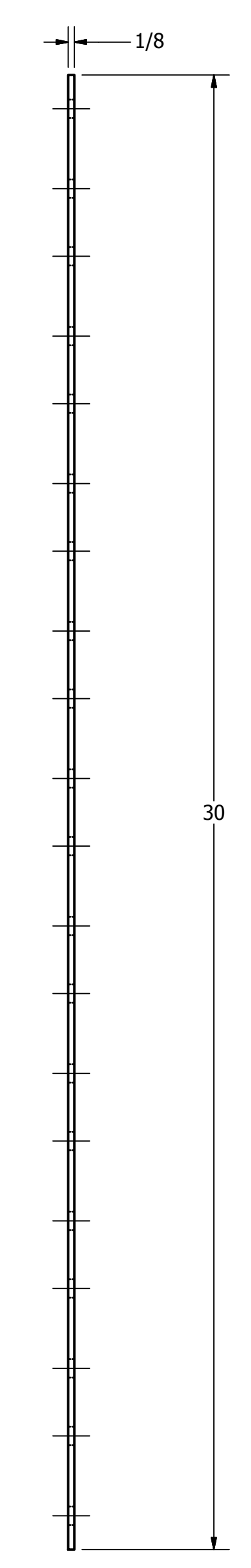
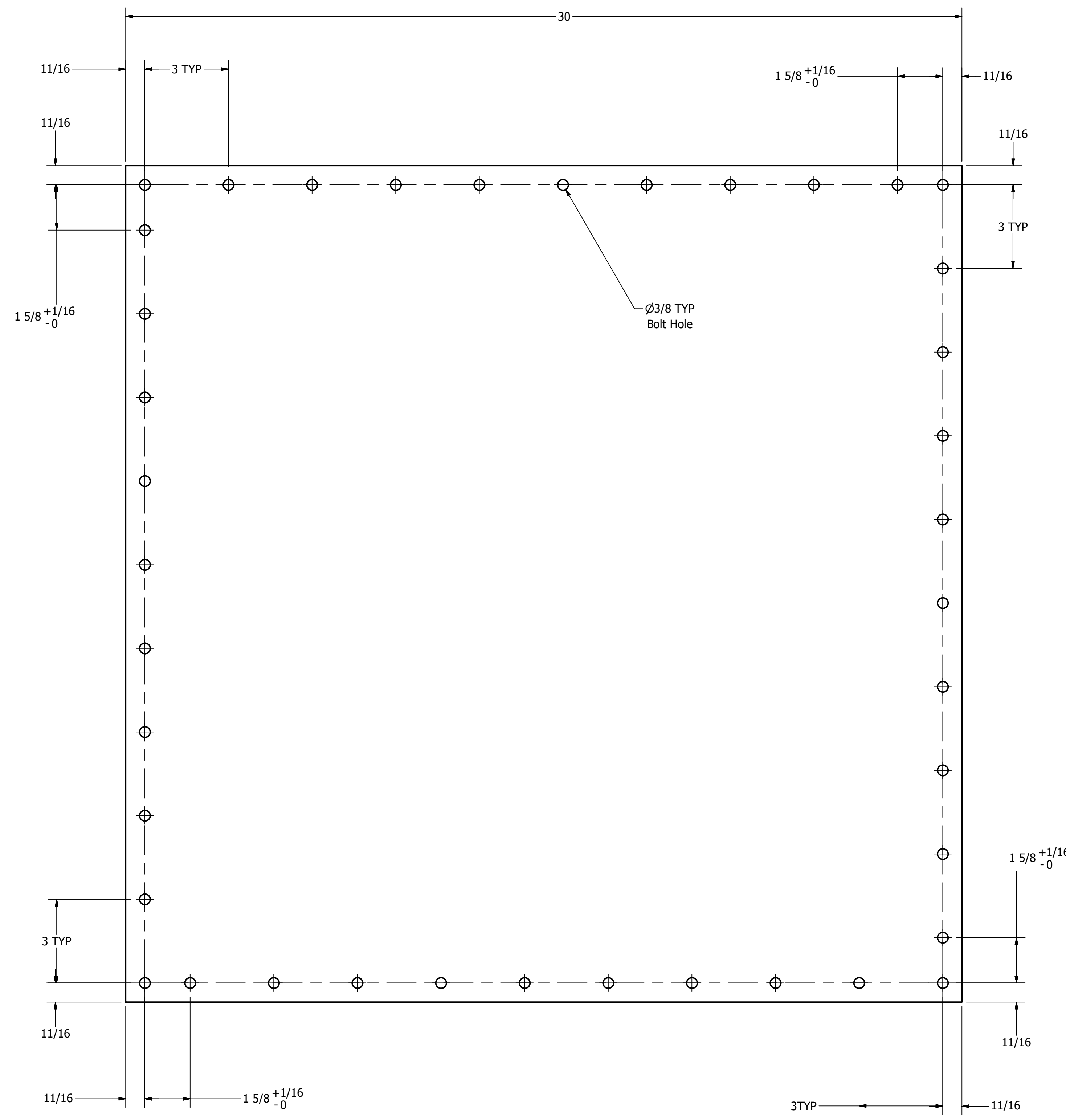
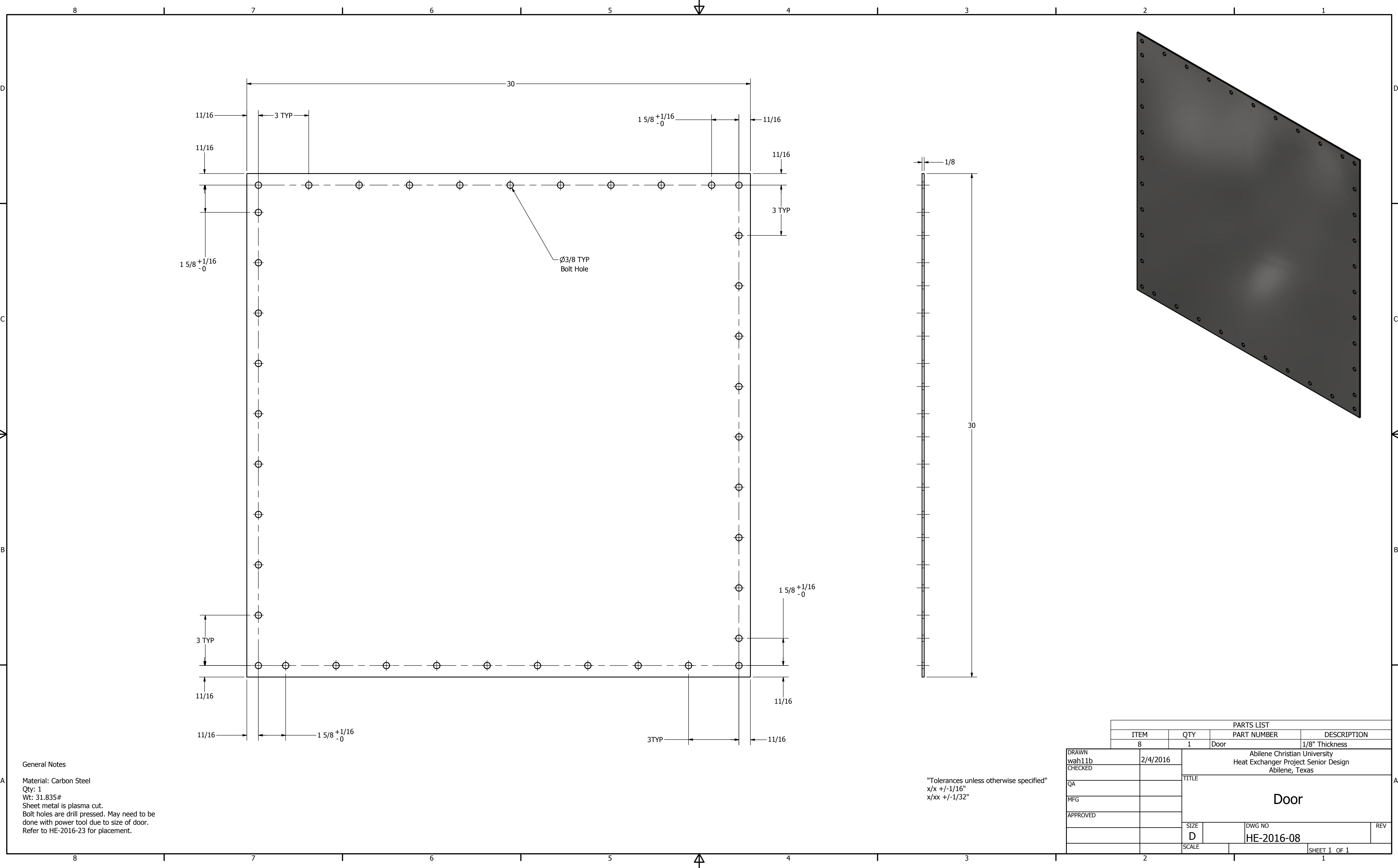
"Tolerances unless otherwise specified"  
 x/x +/- 1/16"  
 x/xx +/- 1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
7	4	Short Box Flange	1/8" Thickness

DRAWN wah11b	2/4/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Short Box Flange</b>	
QA		SIZE D	DWG NO HE-2016-07
MFG		SCALE	REV
APPROVED			
		SHEET 1 OF 1	





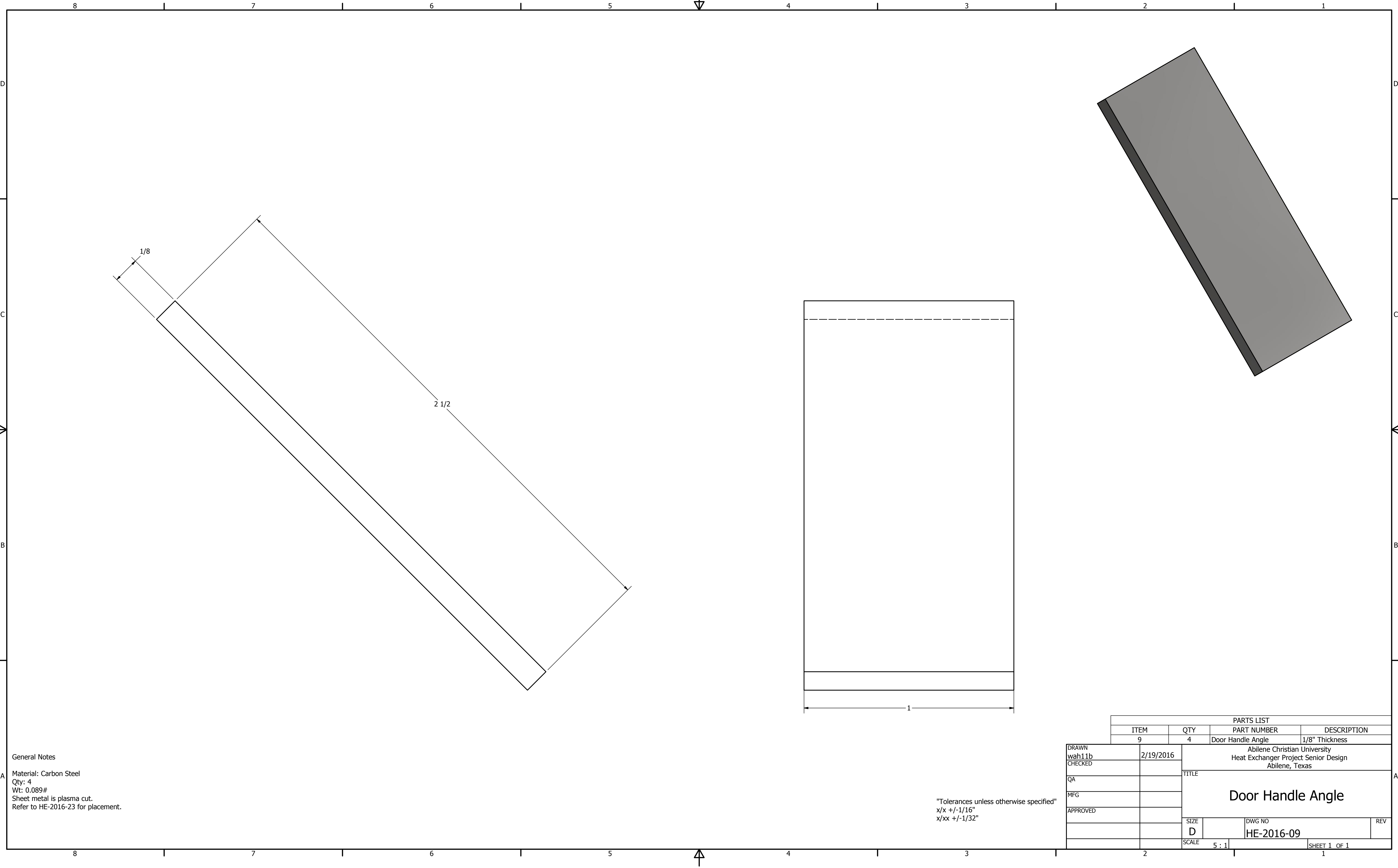
General Notes  
 Material: Carbon Steel  
 Qty: 1  
 Wt: 31.835#  
 Sheet metal is plasma cut.  
 Bolt holes are drill pressed. May need to be done with power tool due to size of door.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
8	1	Door	1/8" Thickness

DRAWN wah11b	2/4/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Door</b>	
QA		SIZE D	DWG NO HE-2016-08
MFG		SCALE	REV
APPROVED			

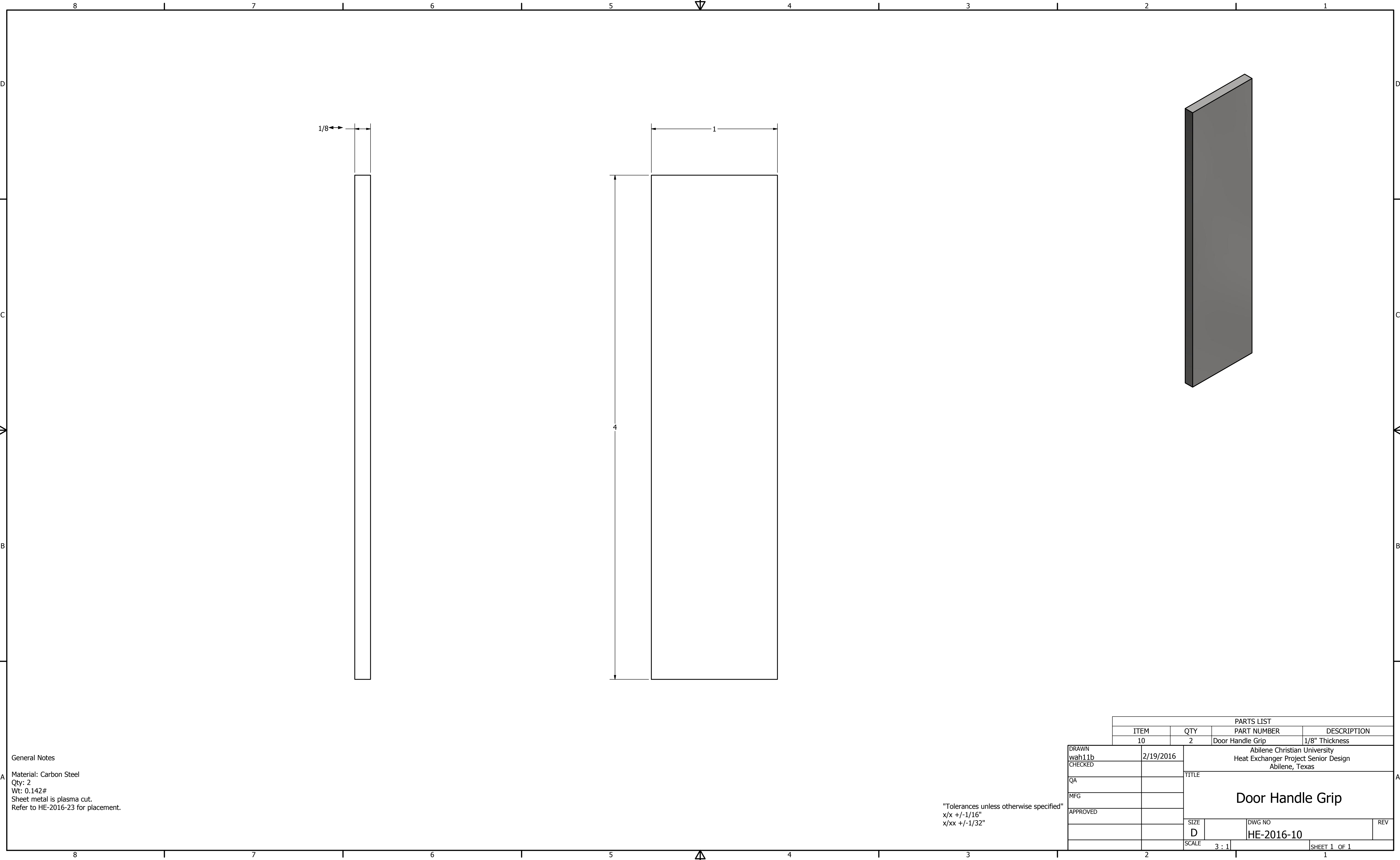
SHEET 1 OF 1



General Notes  
 Material: Carbon Steel  
 Qty: 4  
 Wt: 0.089#  
 Sheet metal is plasma cut.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

DRAWN		PARTS LIST	
ITEM	QTY	PART NUMBER	DESCRIPTION
9	4	Door Handle Angle	1/8" Thickness
DRAWN wah11b 2/19/2016		Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Door Handle Angle</b>	
QA		SIZE D	DWG NO HE-2016-09
MFG		SCALE 5 : 1	REV
APPROVED		SHEET 1 OF 1	



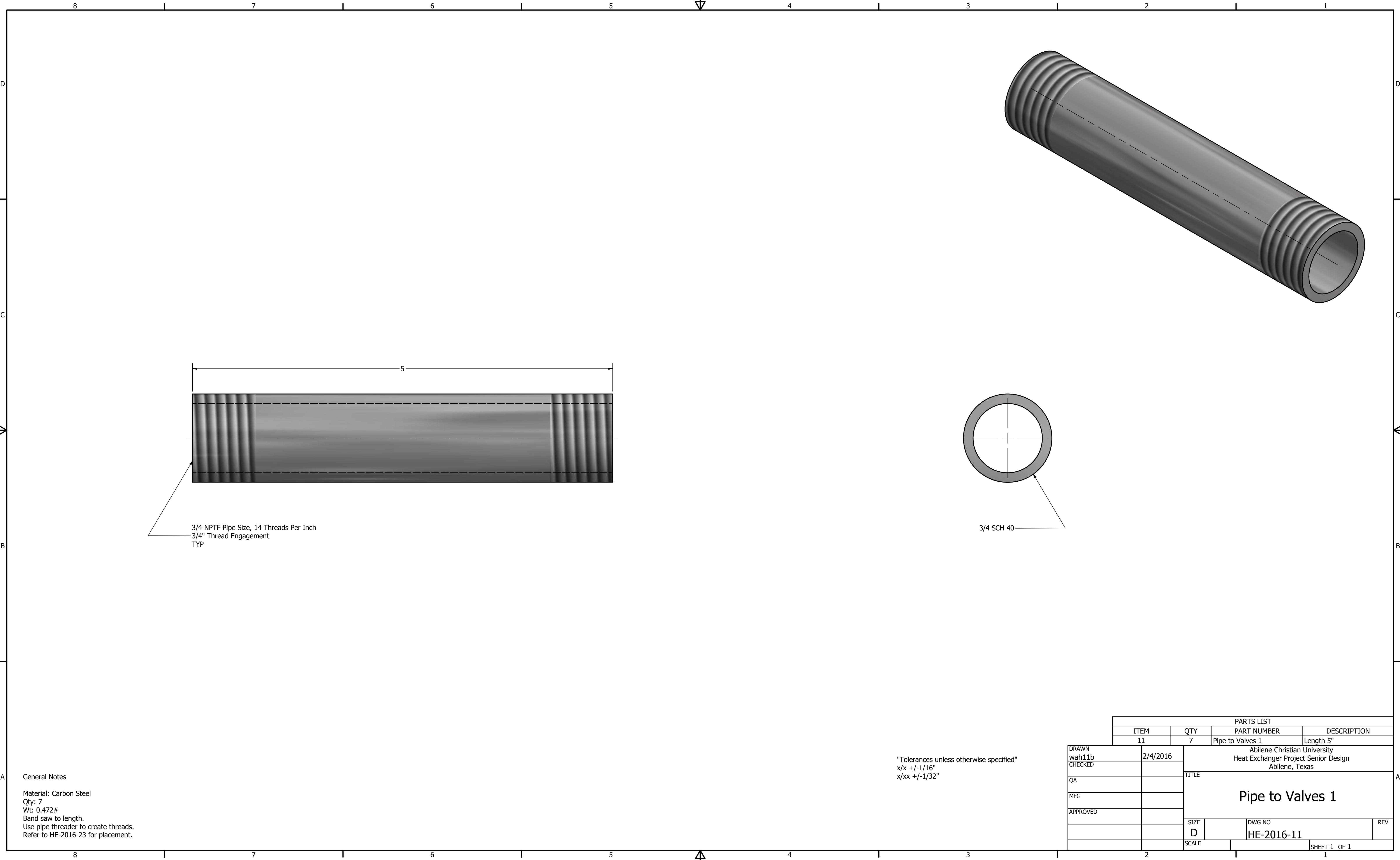
General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 0.142#  
 Sheet metal is plasma cut.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST		DESCRIPTION	
ITEM	QTY	PART NUMBER	DESCRIPTION
10	2	Door Handle Grip	1/8" Thickness

DRAWN wah11b	2/19/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE	
QA		<b>Door Handle Grip</b>	
MFG			
APPROVED		SIZE D	DWG NO HE-2016-10
		SCALE 3 : 1	REV 1 OF 1



3/4 NPTF Pipe Size, 14 Threads Per Inch  
 3/4" Thread Engagement  
 TYP

3/4 SCH 40

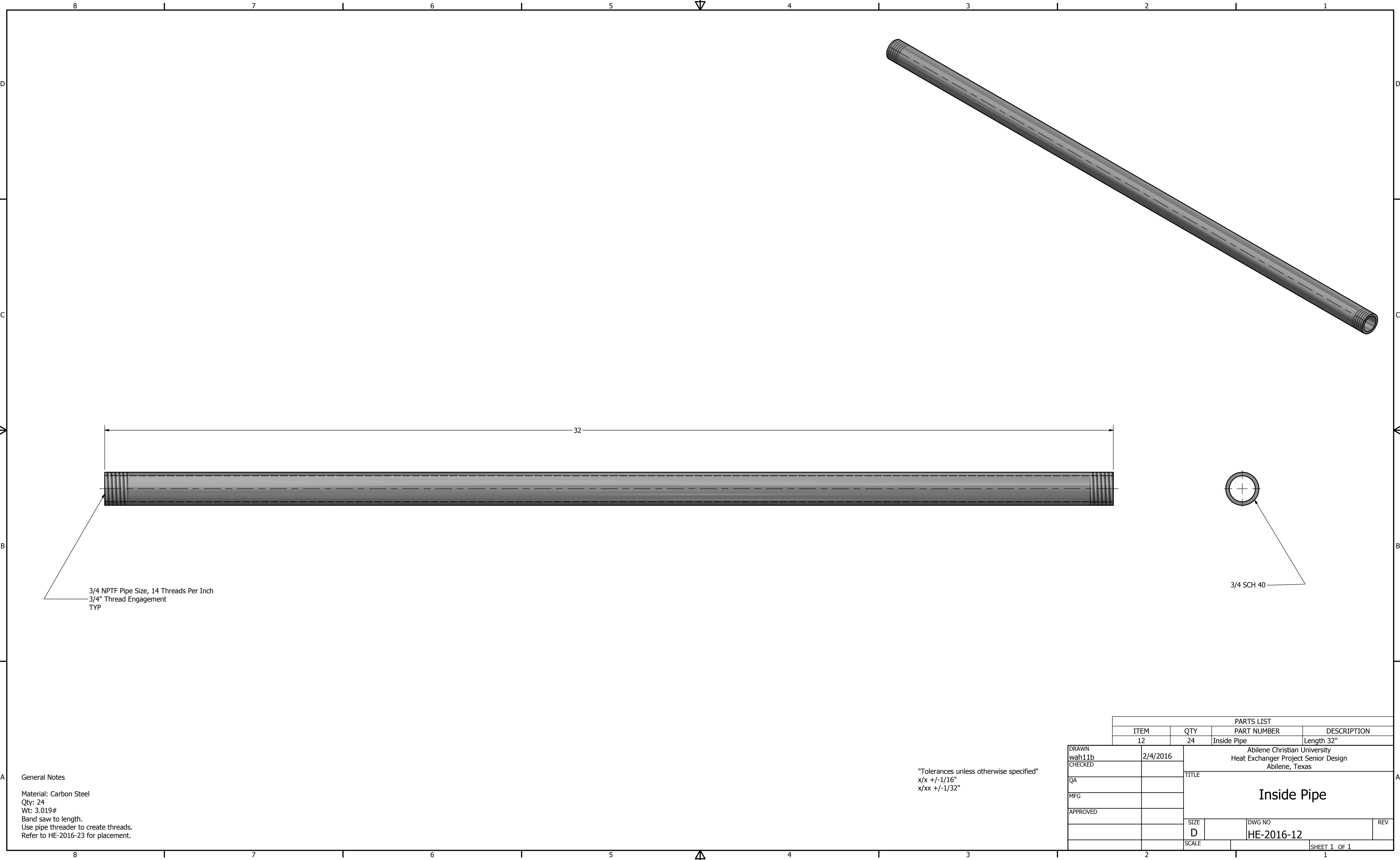
"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

General Notes  
 Material: Carbon Steel  
 Qty: 7  
 Wt: 0.472#  
 Band saw to length.  
 Use pipe threader to create threads.  
 Refer to HE-2016-23 for placement.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
11	7	Pipe to Valves 1	Length 5"

DRAWN wah11b	2/4/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Pipe to Valves 1</b>	
QA		SIZE D	DWG NO HE-2016-11
MFG		SCALE	REV
APPROVED			SHEET 1 OF 1



3/4 NPTF Pipe Size, 14 Threads Per Inch  
 3/4" Thread Engagement  
 TYP

3/4 SCH 40

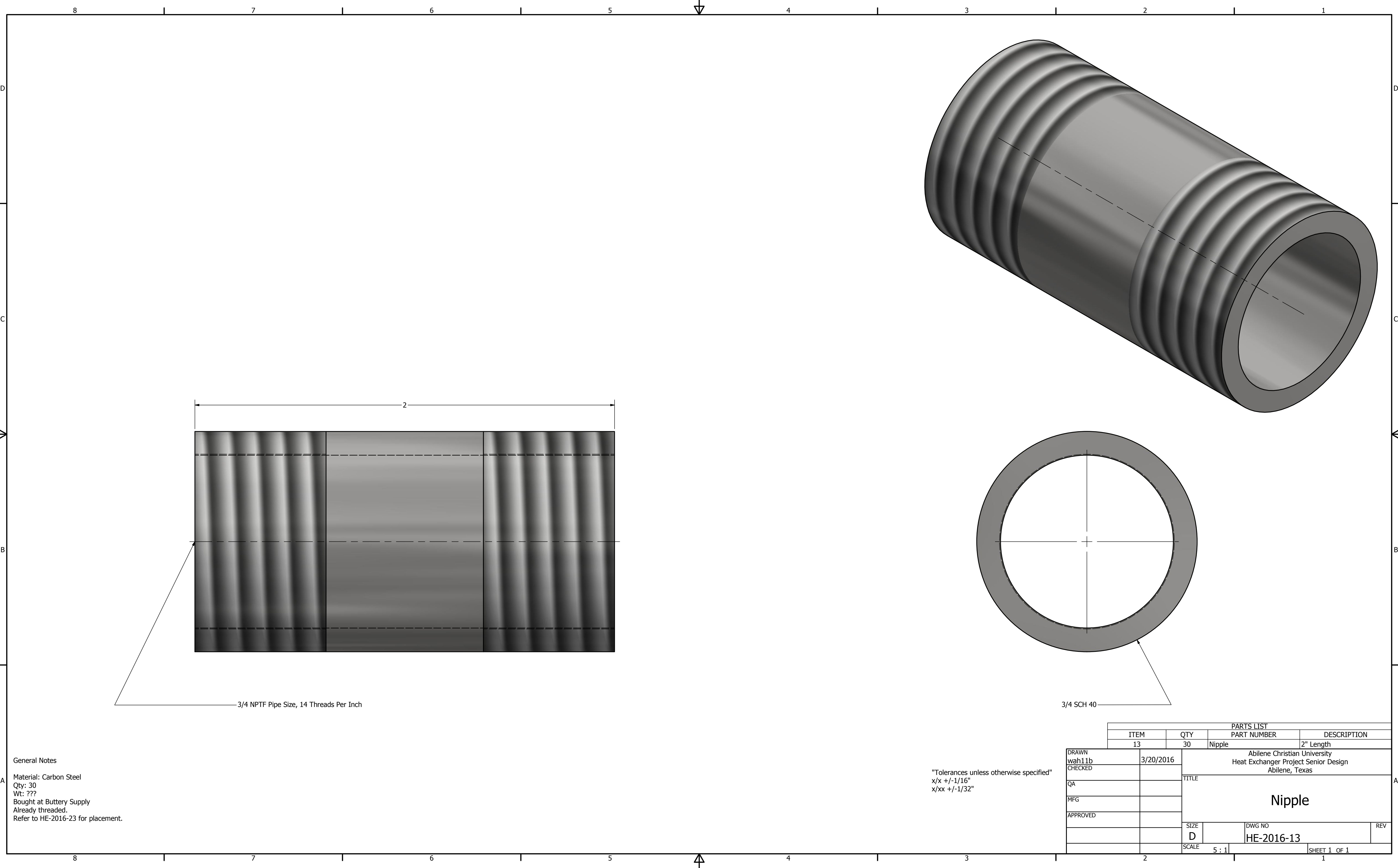
"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

General Notes  
 Material: Carbon Steel  
 Qty: 24  
 Wt: 3.019#  
 Band saw to length.  
 Use pipe threader to create threads.  
 Refer to HE-2016-23 for placement.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
12	24	Inside Pipe	Length 32"

DRAWN wah11b	2/4/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Inside Pipe</b>	
QA		SIZE D	DWG NO HE-2016-12
MFG		SCALE	REV
APPROVED			
			SHEET 1 OF 1



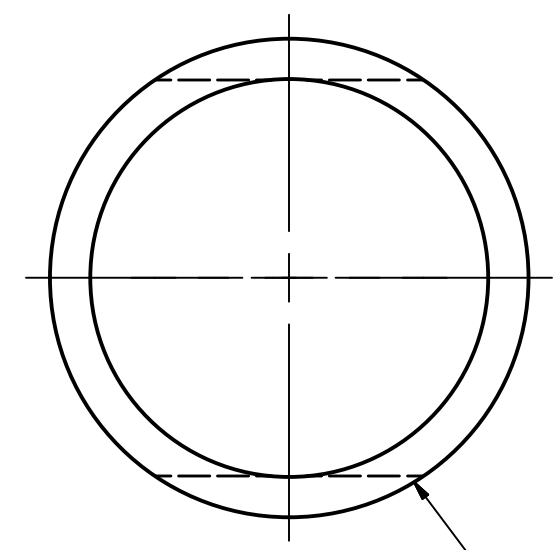
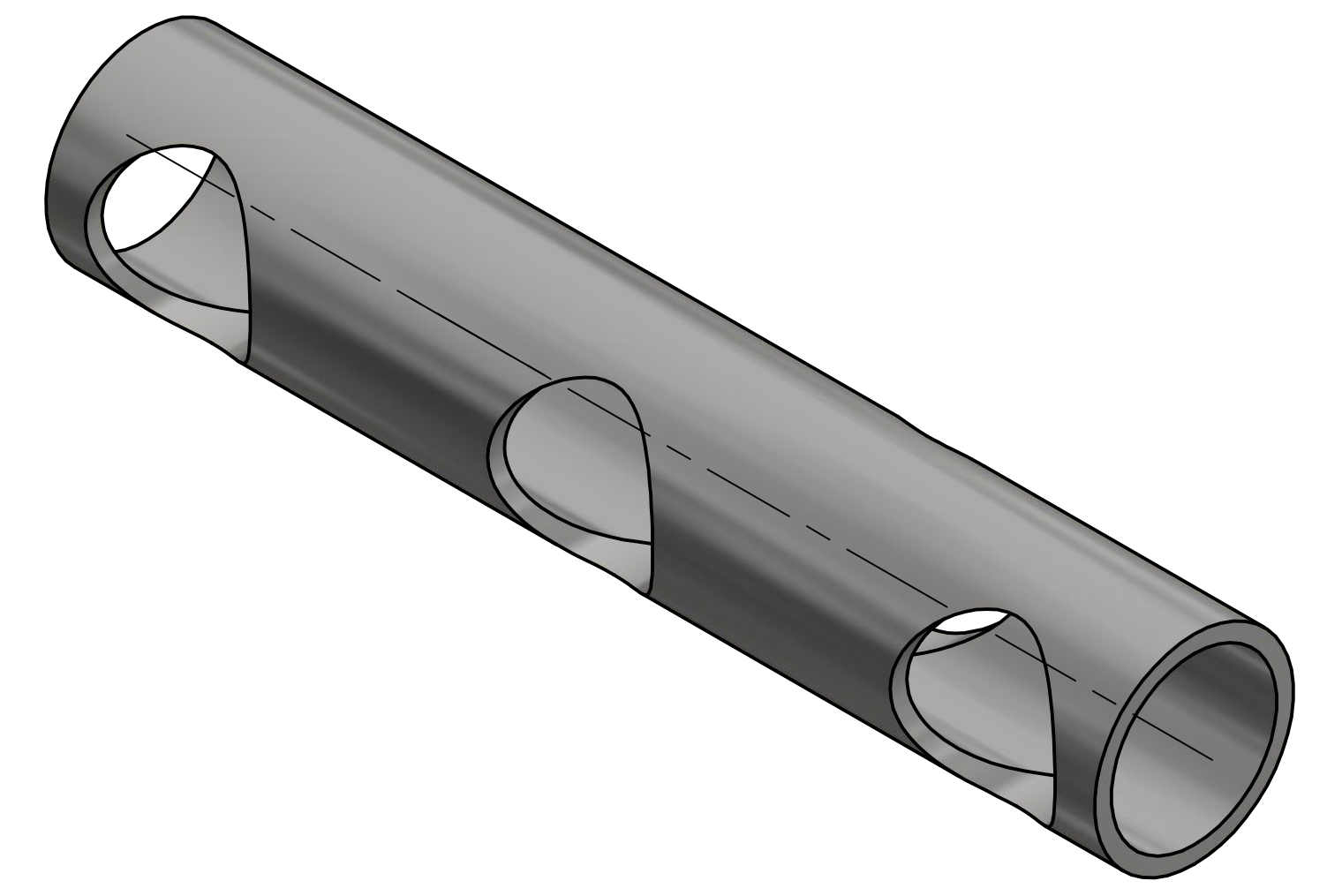
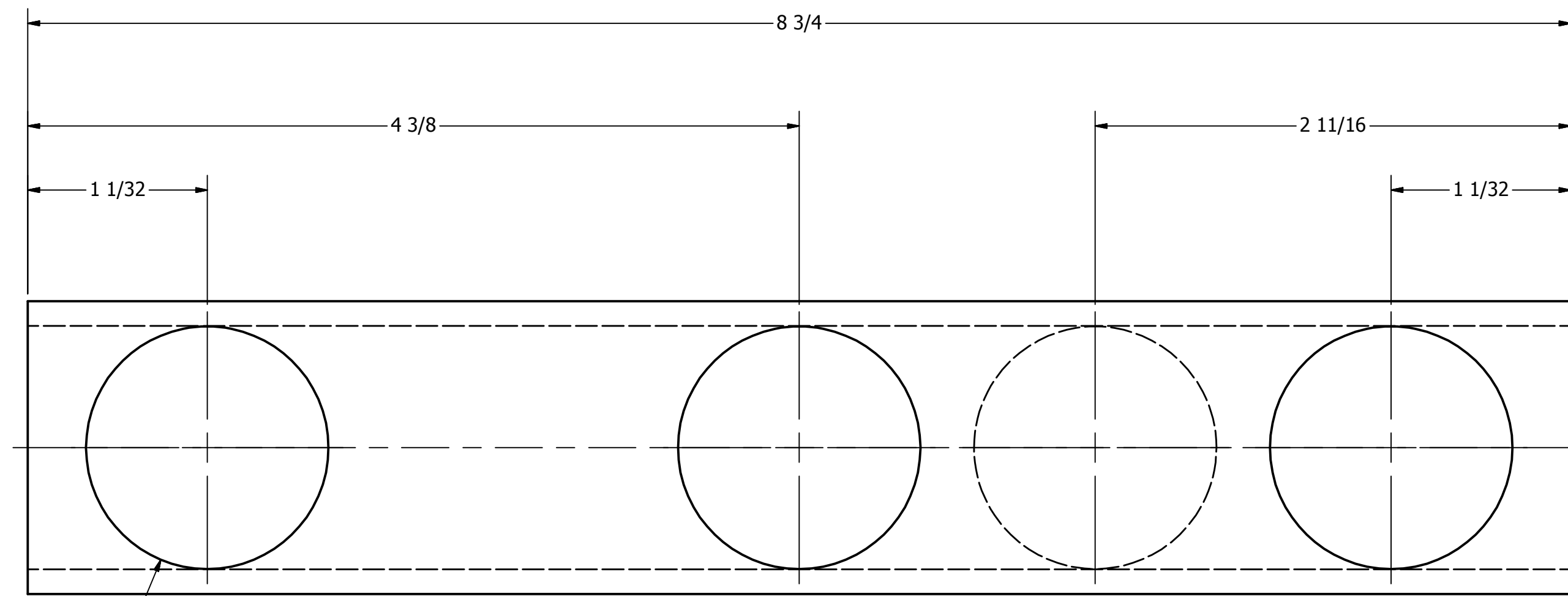
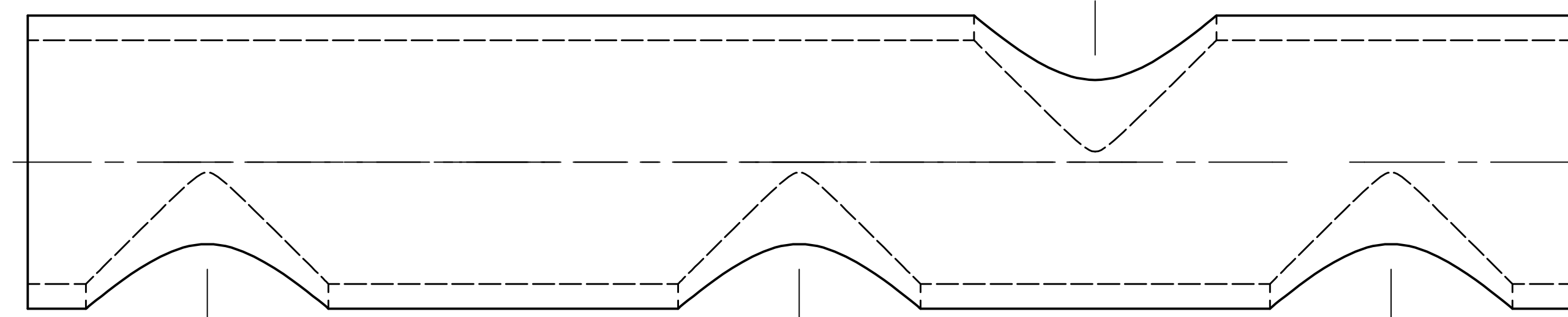
General Notes  
 Material: Carbon Steel  
 Qty: 30  
 Wt: ???  
 Bought at Buttery Supply  
 Already threaded.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
13	30	Nipple	2" Length

DRAWN wah11b	3/20/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Nipple</b>	
QA		SIZE D	DWG NO HE-2016-13
MFG		SCALE 5 : 1	REV
APPROVED		SHEET 1 OF 1	



Ø1 3/8 TYP  
Coupling Entrance Hole

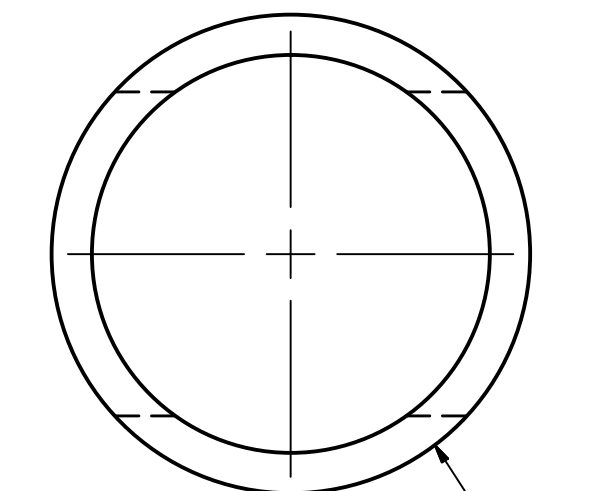
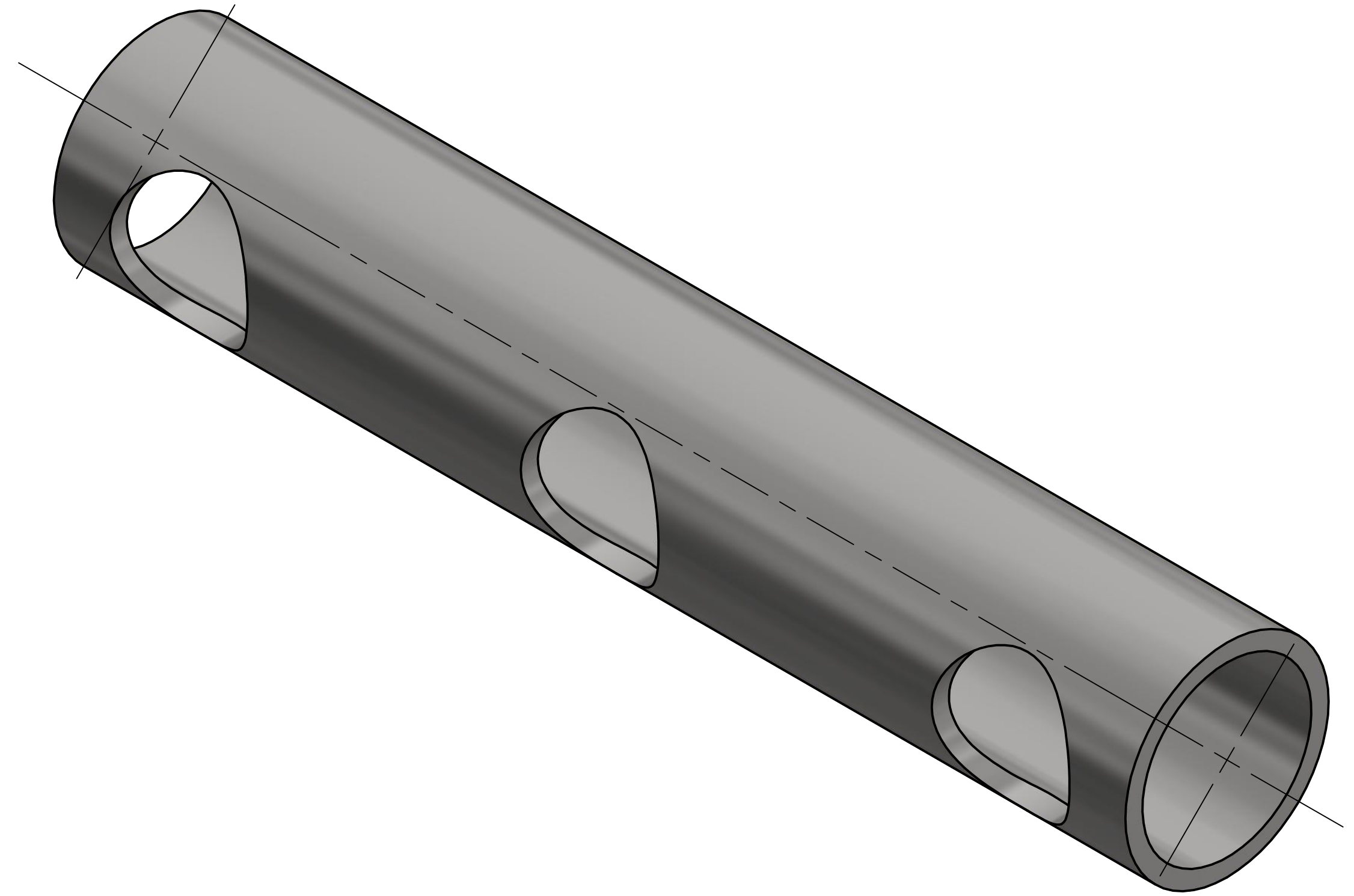
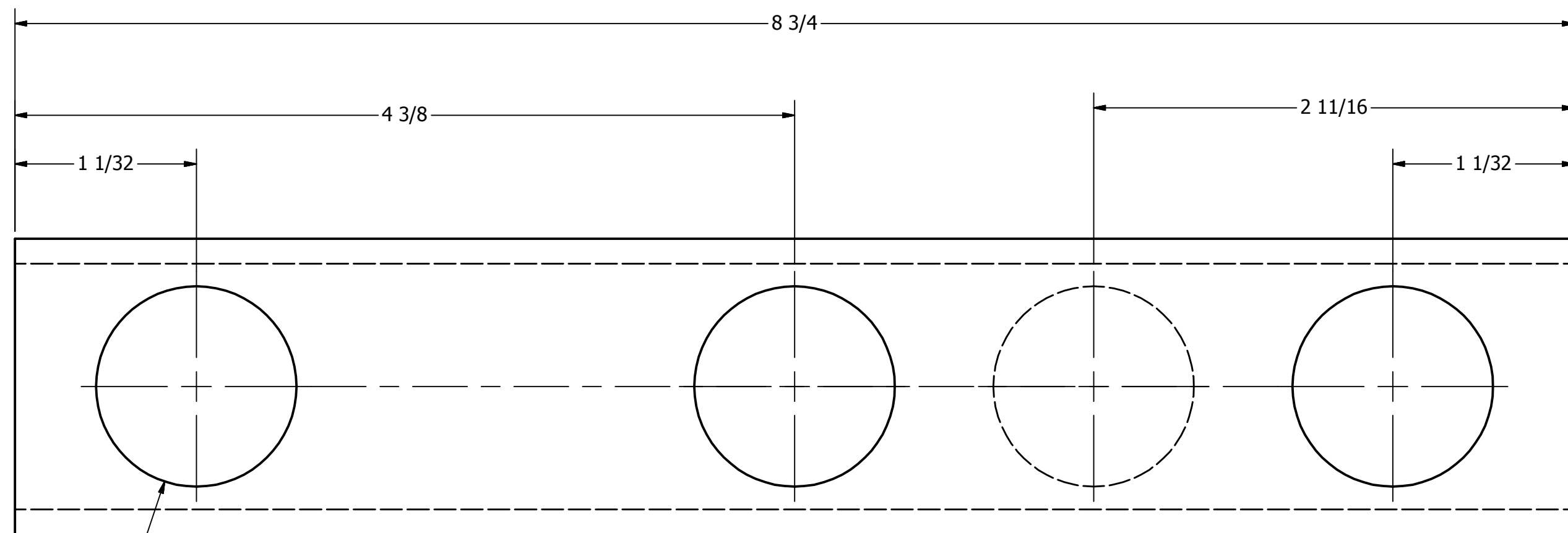
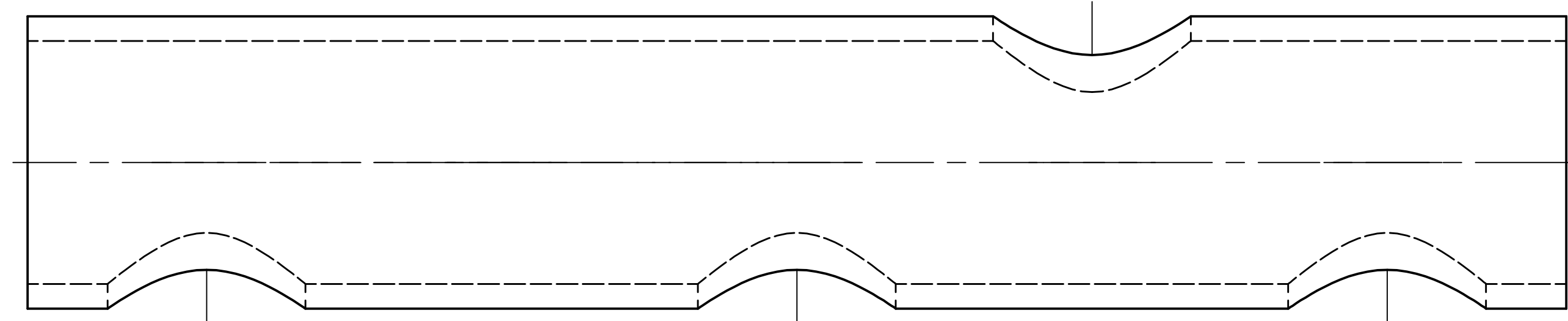
General Notes  
Material: Carbon Steel  
Qty: 2  
Wt: 1.382#  
Band saw to length.  
Plasma cut coupling entrance holes.  
Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
x/x +/-1/16"  
x/xx +/-1/32"

PARTS LIST		DESCRIPTION	
ITEM	QTY	PART NUMBER	DESCRIPTION
14	2	Pipe Head Body	Length 8 3/4"

DRAWN wah11b	2/17/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Bottom Pipe Head Body</b>	
QA		SIZE D	DWG NO HE-2016-14a
MFG		SCALE	REV
APPROVED			SHEET 1 OF 1



R9/16  
Coupling Entrance Hole  
Diameter: 1 3/8"

General Notes

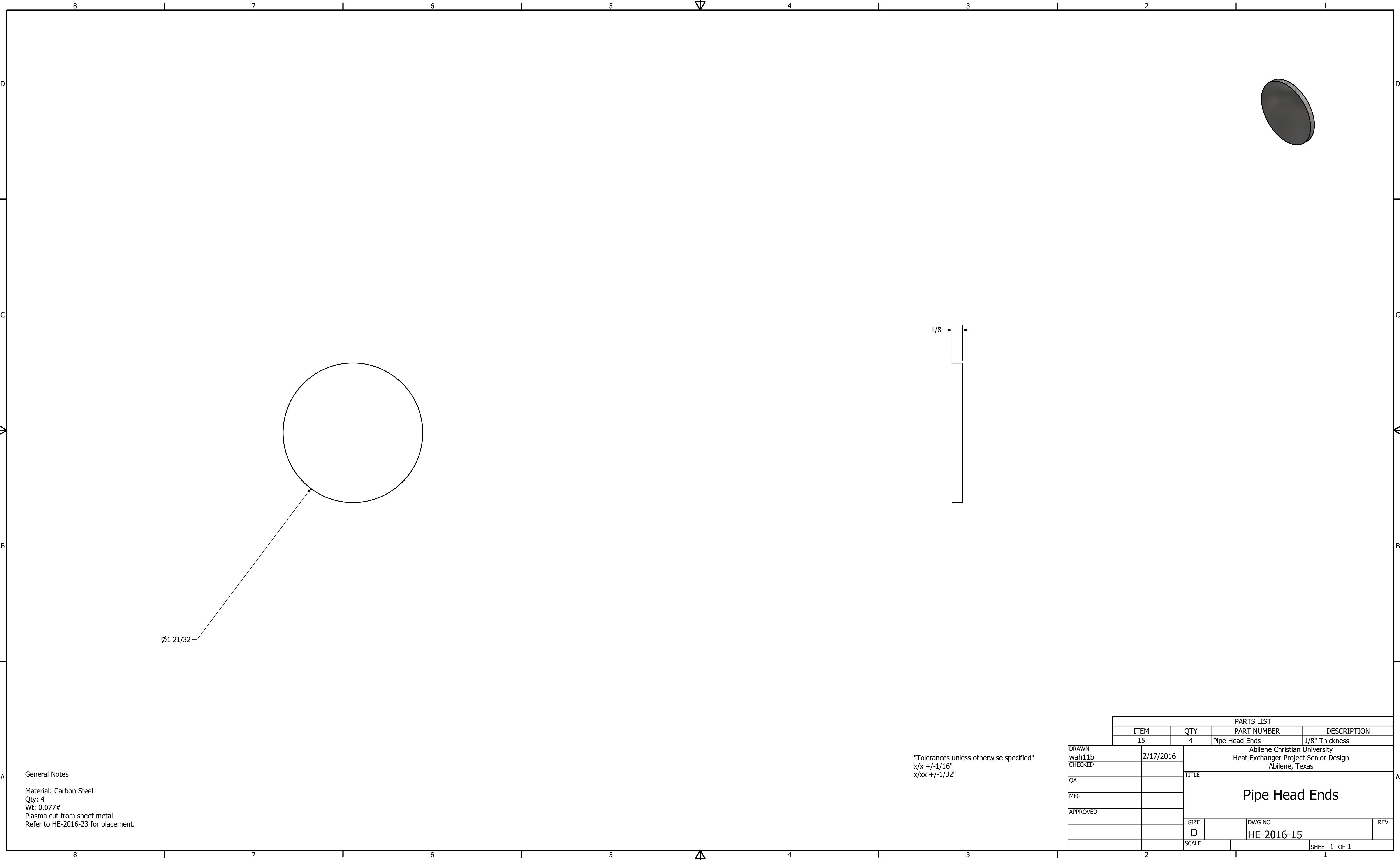
Material: Carbon Steel  
Qty: 1  
Wt: 1.487#  
Band saw to length.  
Plasma cut coupling entrance holes.  
Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
x/x +/-1/16"  
x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
14b	1	Top Pipe Head Body	Length 8 3/4"

DRAWN wah11b	4/7/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Top Pipe Head Body</b>	
QA		SIZE D	DWG NO HE-2016-14b
MFG		SCALE 1.5	REV
APPROVED		SHEET 1 OF 1	





Ø1 21/32

1/8

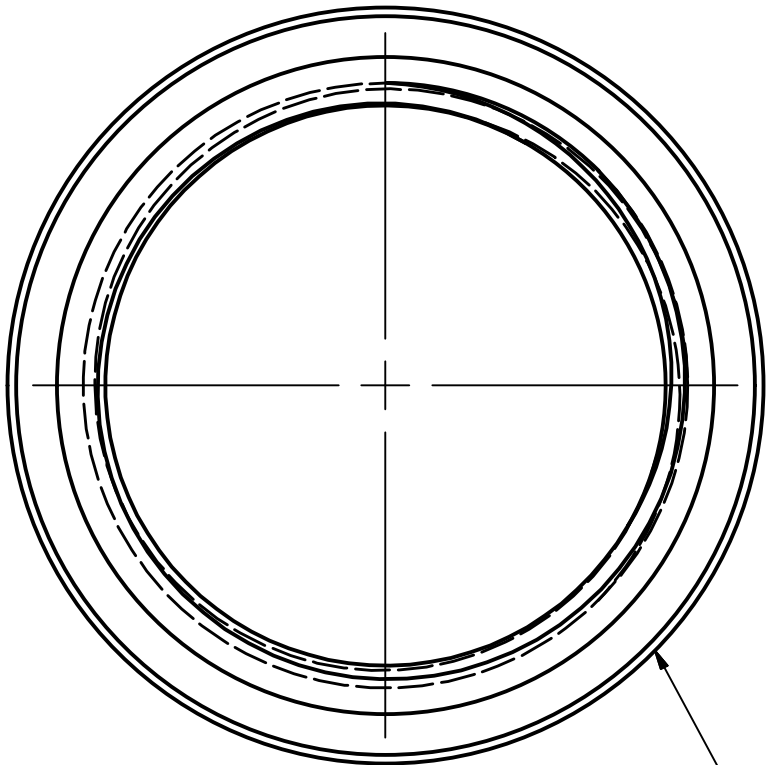
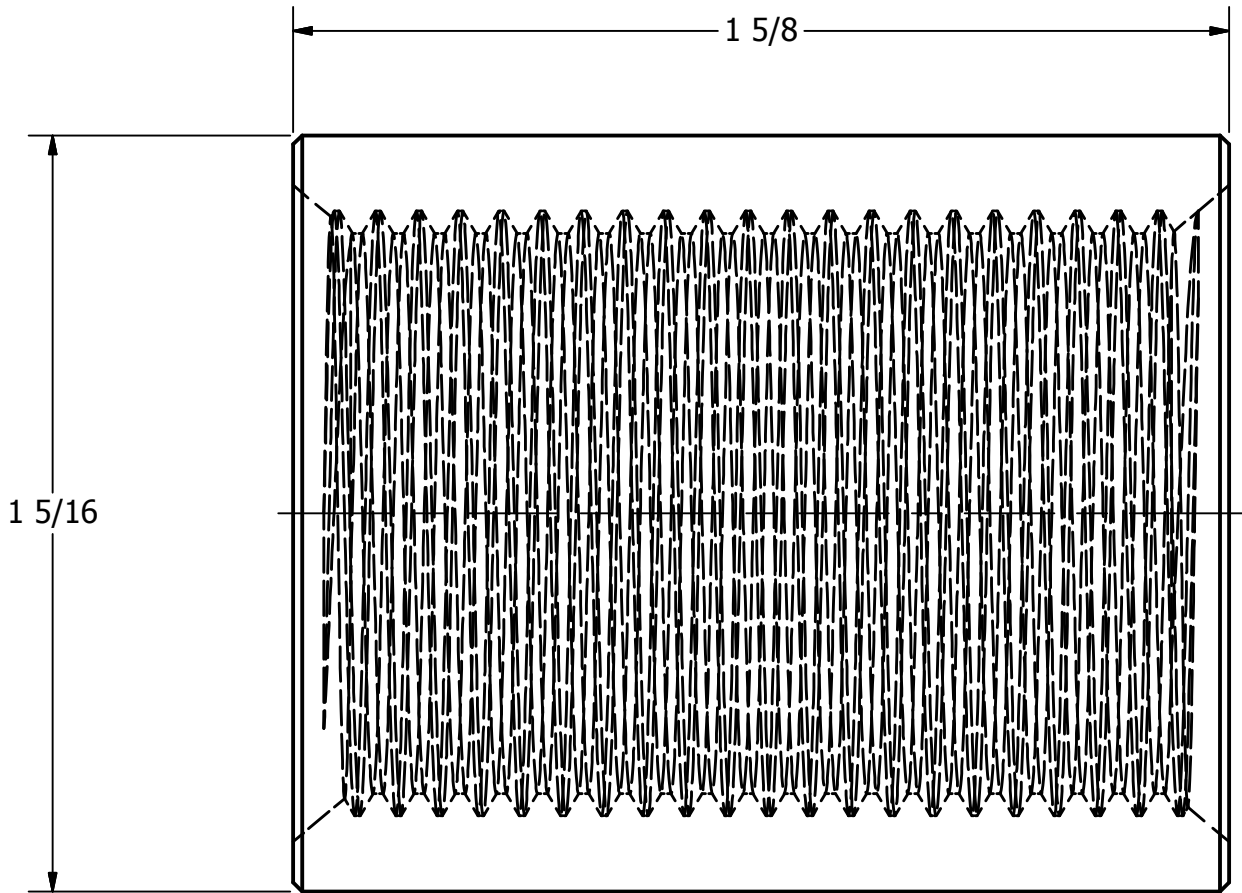
General Notes  
 Material: Carbon Steel  
 Qty: 4  
 Wt: 0.077#  
 Plasma cut from sheet metal  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
15	4	Pipe Head Ends	1/8" Thickness

DRAWN wah11b	2/17/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Pipe Head Ends</b>	
QA		SIZE D	DWG NO HE-2016-15
MFG		SCALE	REV
APPROVED			
			SHEET 1 OF 1



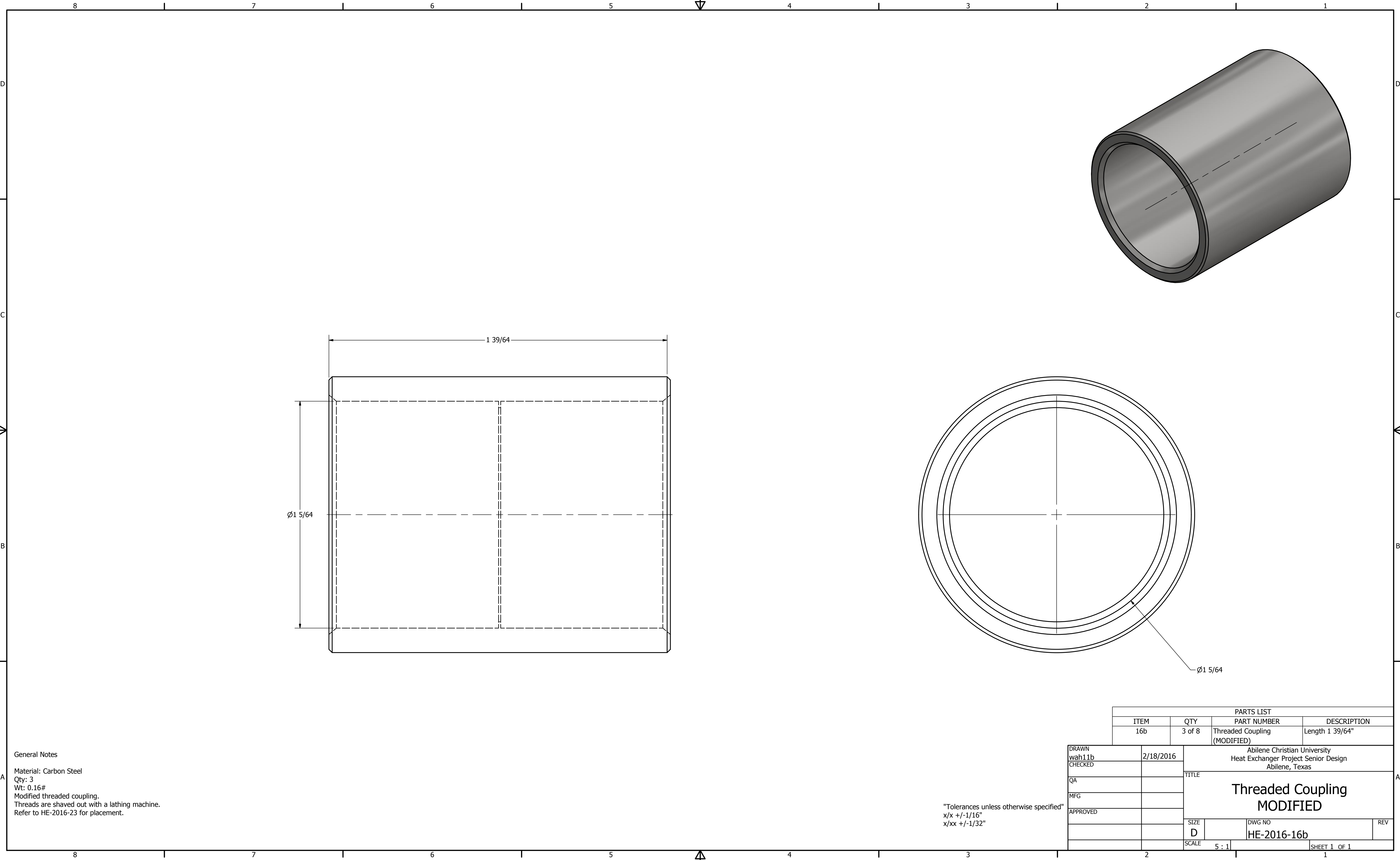
3/4 NPSC Pipe Size, 14 Threads Per Inch

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

General Notes  
 Material: Carbon Steel  
 Qty: 8 (3 modified, 5 kept original)  
 Wt: 0.251#  
 Threaded coupling bought from McMaster-Carr.  
 Refer to HE-2016-16b for modification instruction.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
16a	8	Threaded Coupling (46685K265)	Length 1 5/8"

DRAWN wah11b	2/17/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Threaded Coupling</b> (46685K265)	
QA		SIZE D	DWG NO HE-2016-16a
MFG		SCALE	REV
APPROVED			
			SHEET 1 OF 1



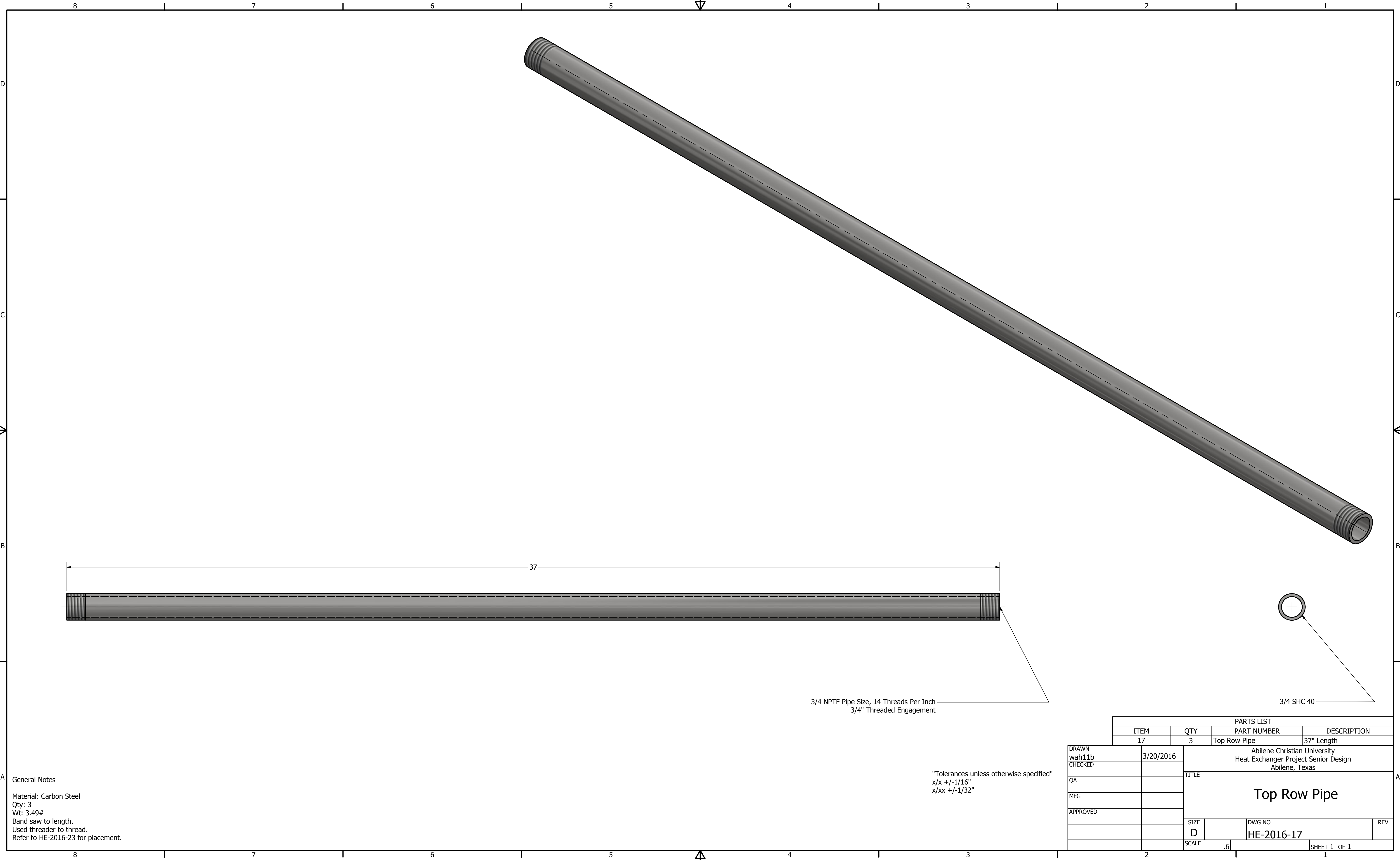
General Notes  
 Material: Carbon Steel  
 Qty: 3  
 Wt: 0.16#  
 Modified threaded coupling.  
 Threads are shaved out with a lathing machine.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
16b	3 of 8	Threaded Coupling (MODIFIED)	Length 1 39/64"

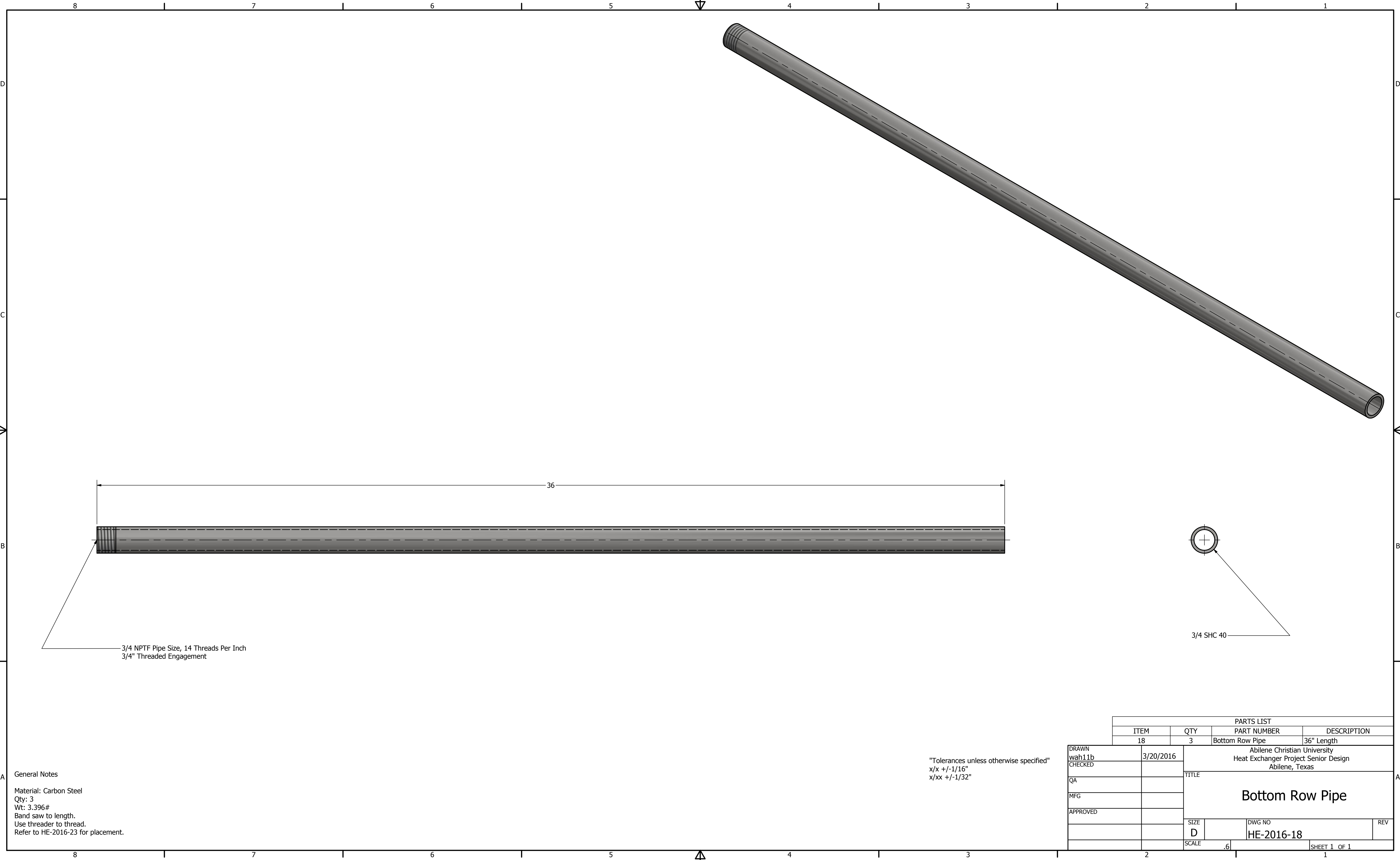
DRAWN wah11b	2/18/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Threaded Coupling MODIFIED</b>	
QA		SIZE D	DWG NO HE-2016-16b
MFG		SCALE 5 : 1	REV
APPROVED		SHEET 1 OF 1	



General Notes  
 Material: Carbon Steel  
 Qty: 3  
 Wt: 3.49#  
 Band saw to length.  
 Used threader to thread.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

ITEM		QTY	PARTS LIST	
DESCRIPTION		PART NUMBER	DESCRIPTION	
17	3	Top Row Pipe	37" Length	
DRAWN	wah11b	3/20/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED			TITLE	
QA			Top Row Pipe	
MFG				
APPROVED				
		SIZE	DWG NO	REV
		D	HE-2016-17	
		SCALE	.6	SHEET 1 OF 1



36

3/4 NPTF Pipe Size, 14 Threads Per Inch  
3/4" Threaded Engagement

3/4 SHC 40

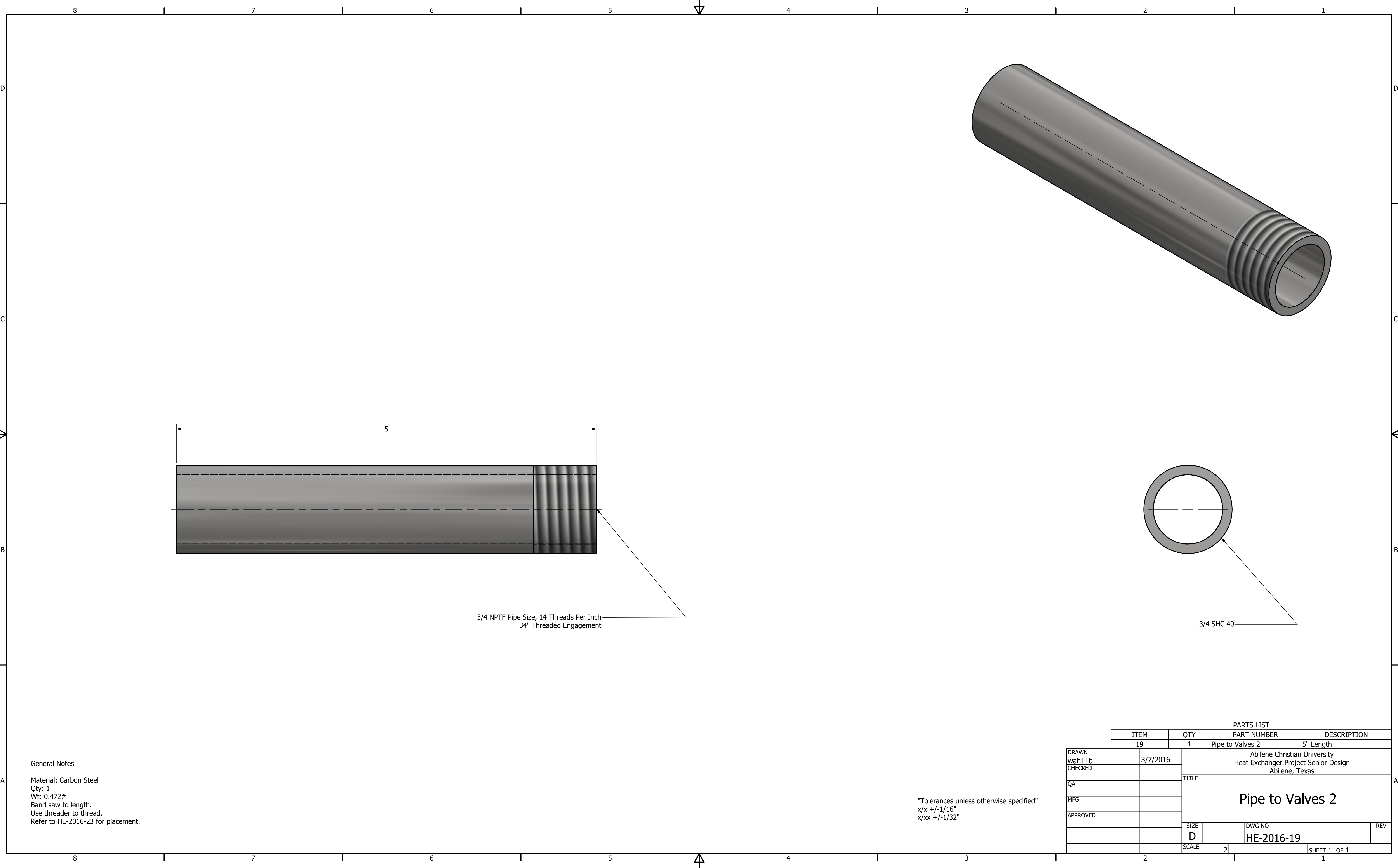
"Tolerances unless otherwise specified"  
x/x +/-1/16"  
x/xx +/-1/32"

General Notes  
Material: Carbon Steel  
Qty: 3  
Wt: 3.396#  
Band saw to length.  
Use threader to thread.  
Refer to HE-2016-23 for placement.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
18	3	Bottom Row Pipe	36" Length

DRAWN wah11b	3/20/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Bottom Row Pipe</b>	
QA		SIZE D	DWG NO HE-2016-18
MFG		SCALE .6	REV
APPROVED		SHEET 1 OF 1	



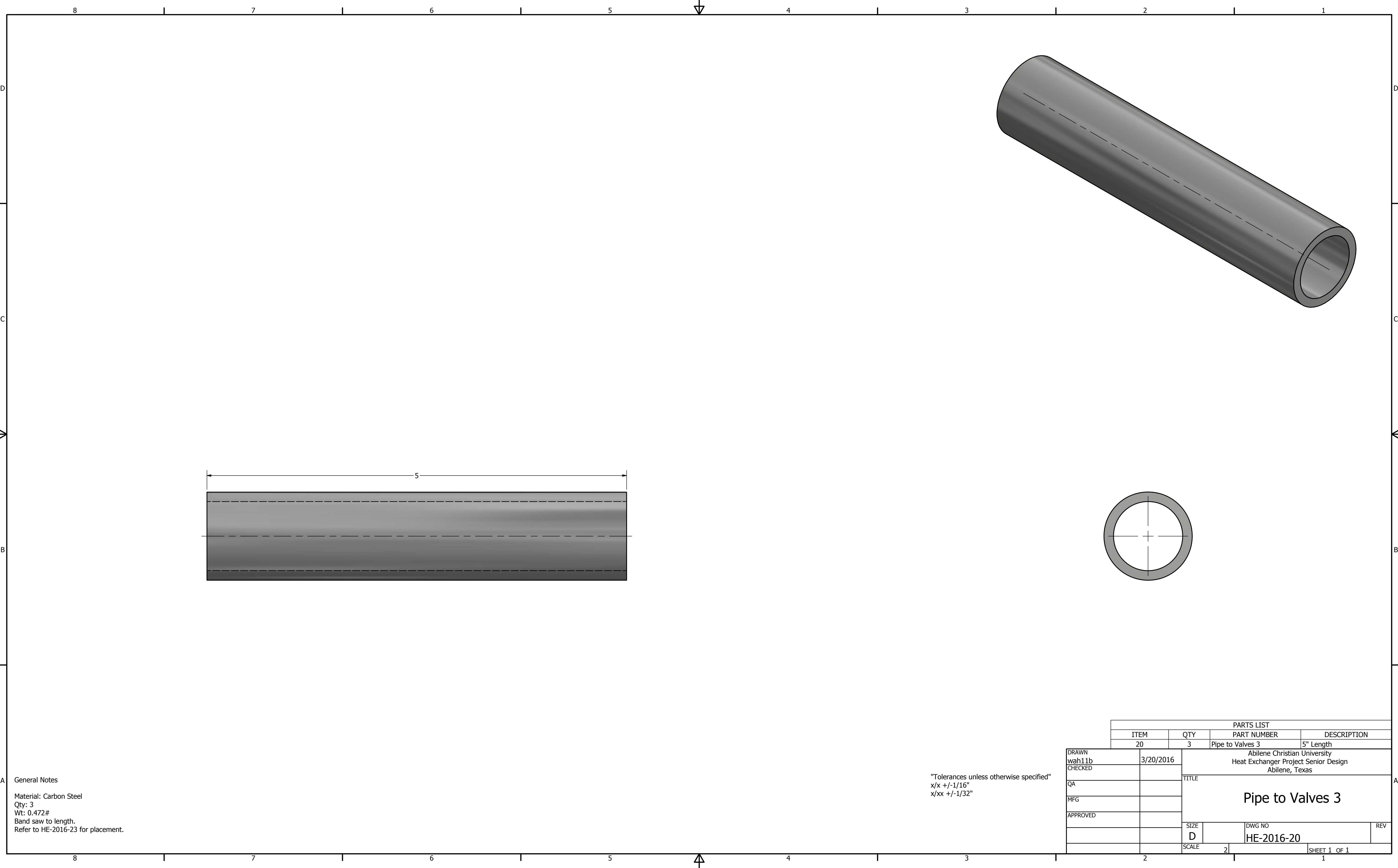
General Notes  
 Material: Carbon Steel  
 Qty: 1  
 Wt: 0.472#  
 Band saw to length.  
 Use threader to thread.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
19	1	Pipe to Valves 2	5" Length

DRAWN wah11b	3/7/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Pipe to Valves 2</b>	
QA		SIZE D	DWG NO HE-2016-19
MFG		SCALE 2	REV
APPROVED		SHEET 1 OF 1	



General Notes  
 Material: Carbon Steel  
 Qty: 3  
 Wt: 0.472#  
 Band saw to length.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
20	3	Pipe to Valves 3	5" Length

DRAWN wah11b	3/20/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Pipe to Valves 3</b>	
QA		SIZE D	DWG NO HE-2016-20
MFG		SCALE 2	REV
APPROVED		SHEET 1 OF 1	

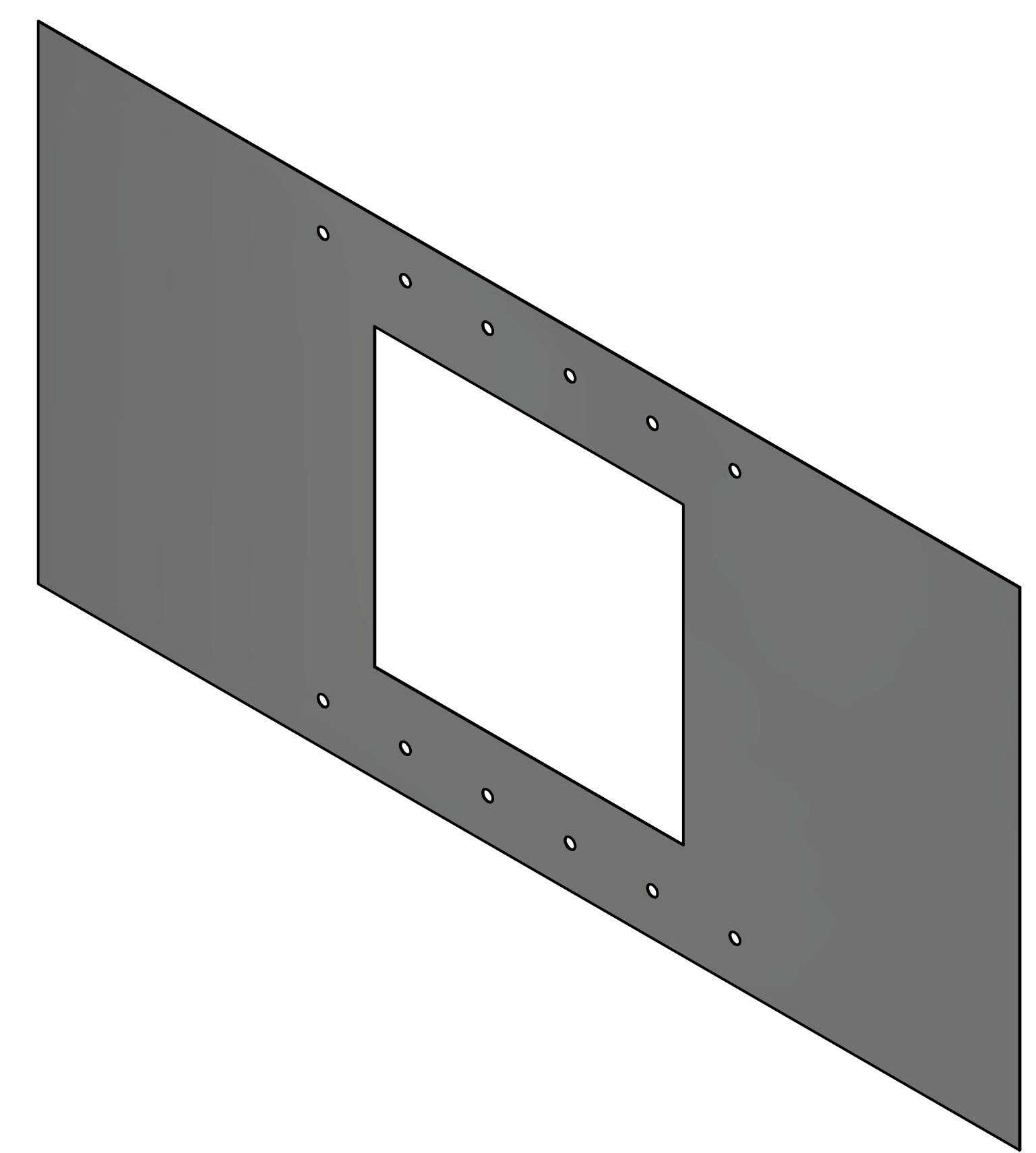
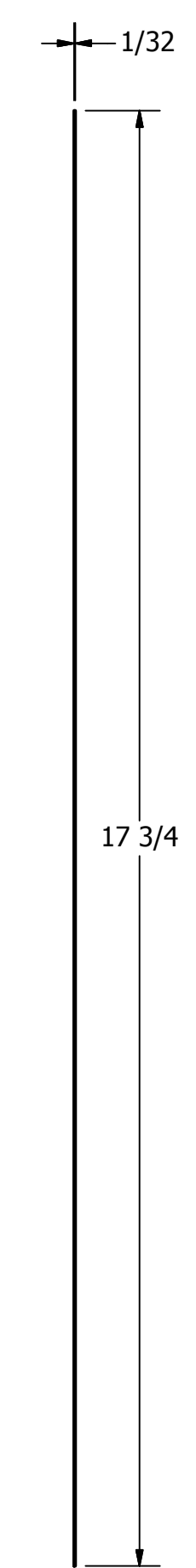
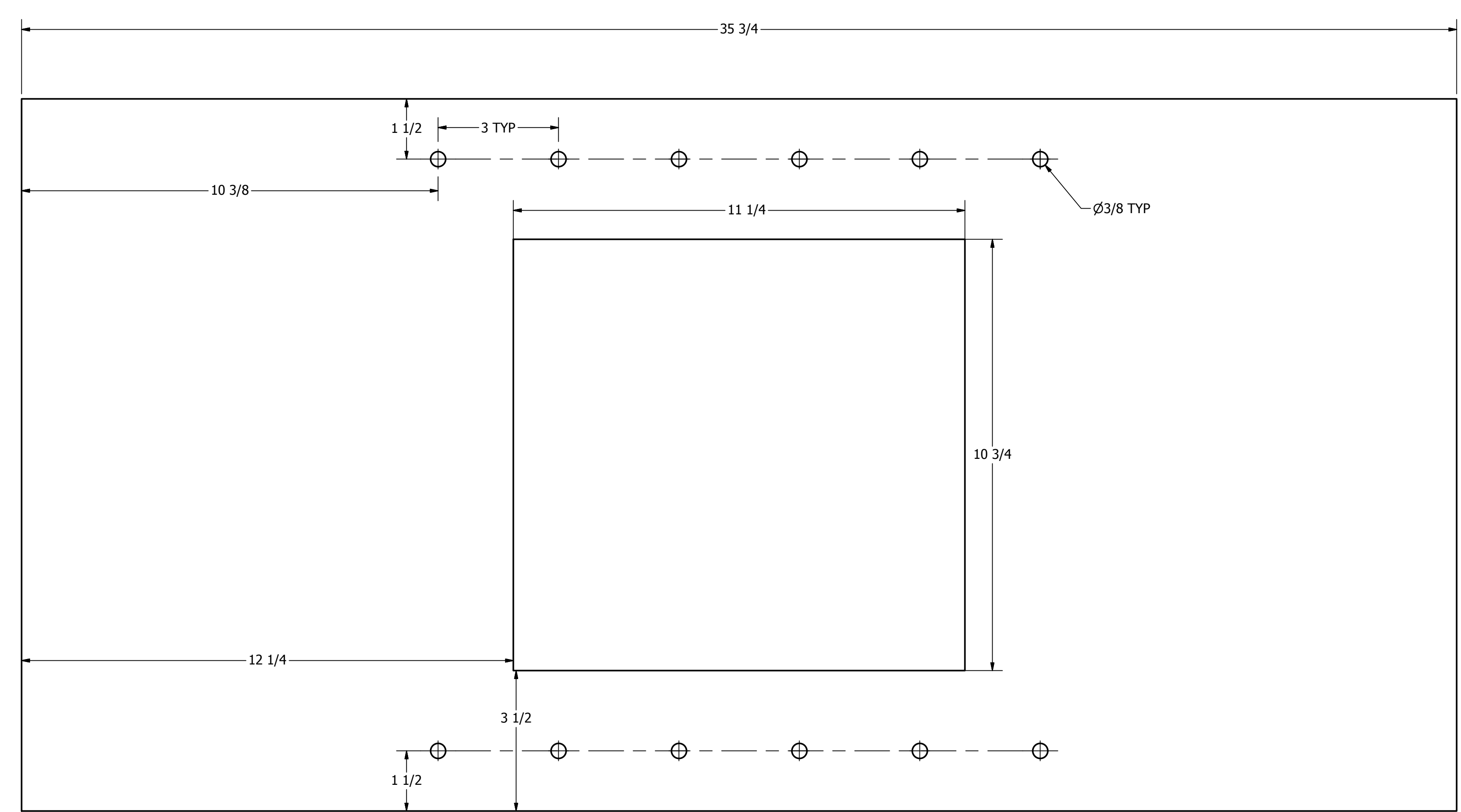
8 7 6 5 4 3 2 1

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General Notes  
 Material: Aluminum  
 Qty: 1  
 Wt: 0.781#  
 Plasma cut the square. Hand drill the holes.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

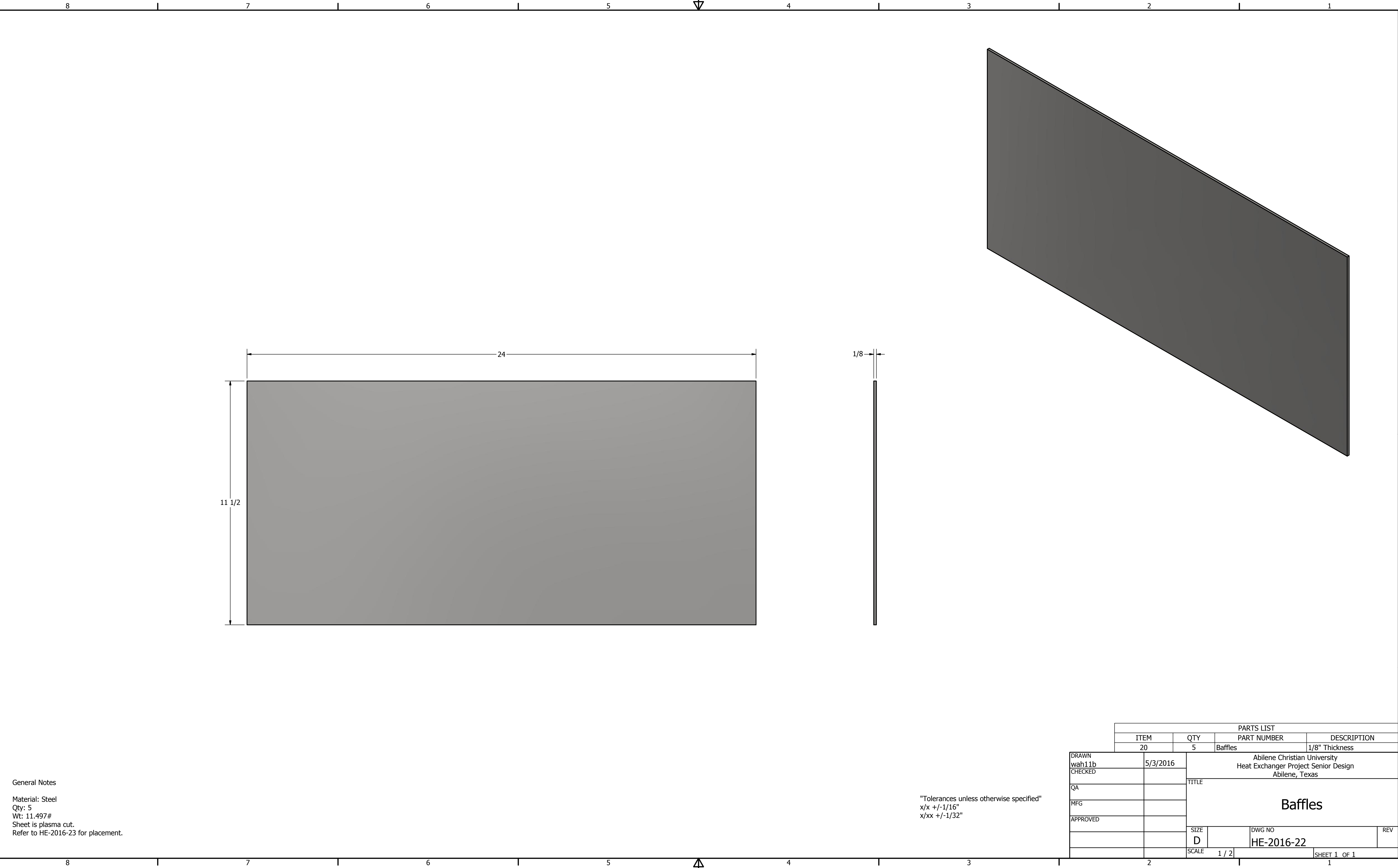
PARTS LIST		DESCRIPTION	
ITEM	QTY	PART NUMBER	DESCRIPTION
24	1	Floor	1/64" Thickness

DRAWN wah11b	3/30/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Floor</b>	
QA		SIZE D	DWG NO HE-2016-21
MFG		SCALE .5	REV
APPROVED		SHEET 1 OF 1	

8 7 6 5 4 3 2 1





General Notes  
 Material: Steel  
 Qty: 5  
 Wt: 11.497#  
 Sheet is plasma cut.  
 Refer to HE-2016-23 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

DRAWN		PARTS LIST	
ITEM	QTY	PART NUMBER	DESCRIPTION
20	5	Baffles	1/8" Thickness
wah11b	5/3/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE	
QA		Baffles	
MFG			
APPROVED		SIZE	DWG NO
		D	HE-2016-22
		SCALE	1 / 2
			SHEET 1 OF 1

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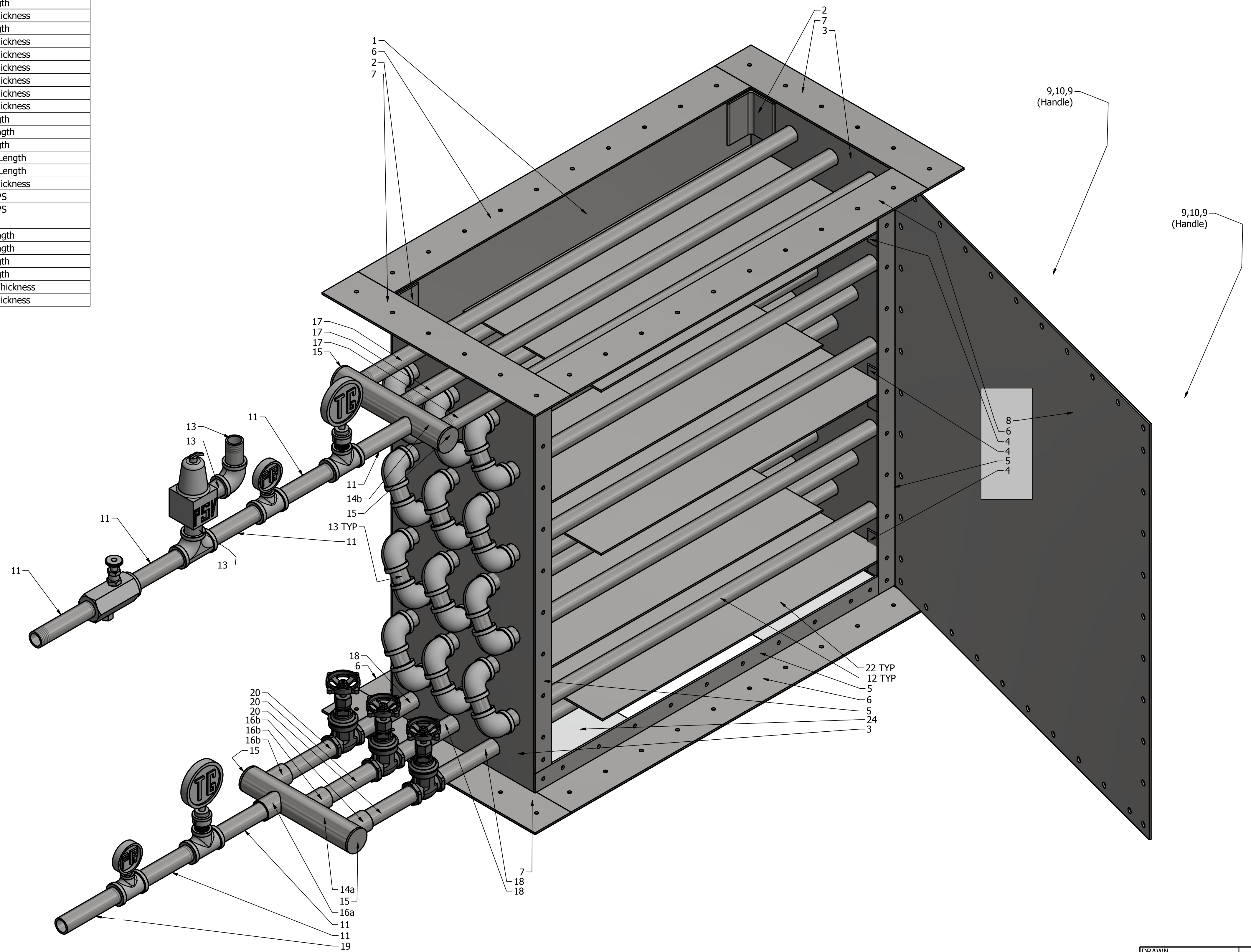
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PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Back Wall	1/8" Thickness
2	6	Angle Iron	3" Length
3	2	Side Wall	1/8" Thickness
4	6	Angle Iron CUT	3" Length
5	4	Door Flange	1/8" Thickness
6	4	Long Box Flange	1/8" Thickness
7	4	Short Box Flange	1/8" Thickness
8	1	Door	1/8" Thickness
9	4	Door Handle Angle	1/8" Thickness
10	2	Door Handle Grip	1/8" Thickness
11	7	Pipe to Valves 1	5" Length
12	24	Inside Pipe	32" Length
13	30	Nipple	2" Length
14a	1	Bottom Pipe Head Body	8 3/4" Length
14b	1	Top Pipe Head Body	8 3/4" Length
15	4	Pipe Head Ends	1/8" Thickness
16a	1	Threaded Coupling	3/4" NPS
16b	3	Threaded Coupling	3/4" NPS MODIFIED
17	3	Top Row Pipe	37" Length
18	3	Bottom Row Pipe	36" Length
19	1	Pipe to Valves 2	5" Length
20	3	Pipe to Valves 3	5" Length
21	1	Floor	1/64" Thickness
22	5	Baffles	1/8" Thickness



General Notes

Wt: 280.706#

Unmodified coupling (16a) is screwed onto the outlet pipe at the bottom (11). Modified couplings (16b) are welded to the Pipe to Valves 3 (19). All couplings (16a and 16b) are welded to the Bottom Pipe Head (14a).

Pipe to Valves 3 (19) are welded to the bottom couplings (16b) and to the Gate Valves, which are welded to the Bottom Row Pipes (18).

After all the Inside Pipes (12), Nipples (13), elbows, and Top Row Pipes (17) have been assembled throughout the Heat Exchanger Box, the Top Pipe Head (14b) is welded onto the Top Row Pipes (17).

The following Pipe to Valve 1 (11) is welded to the Top Pipe Head (14b).

The rest of the assembly parts at the top, following the Top Pipe Head (14b), are screwed onto each other.

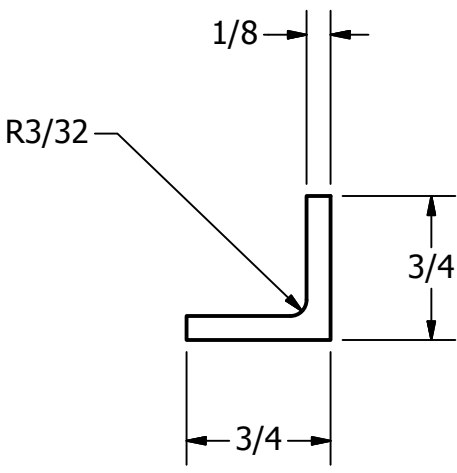
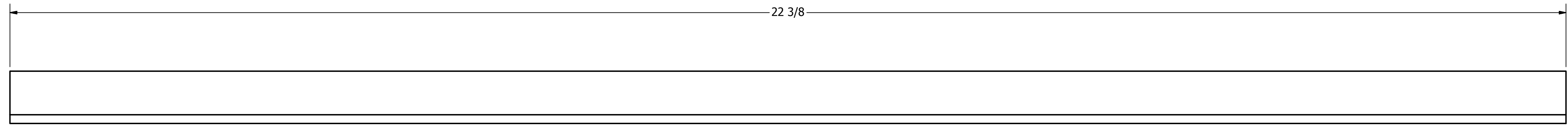
Refer to HE-2016-41 for Testing Procedure placement.

"Tolerances unless otherwise specified"

x/x +/-1/16"

x/xx +/-1/32"

DRAWN wah11b	3/30/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Exchanger</b>	
QA		SIZE D	DWG NO HE-2016-23
MFG		SCALE .3	REV
APPROVED		SHEET 1 OF 1	



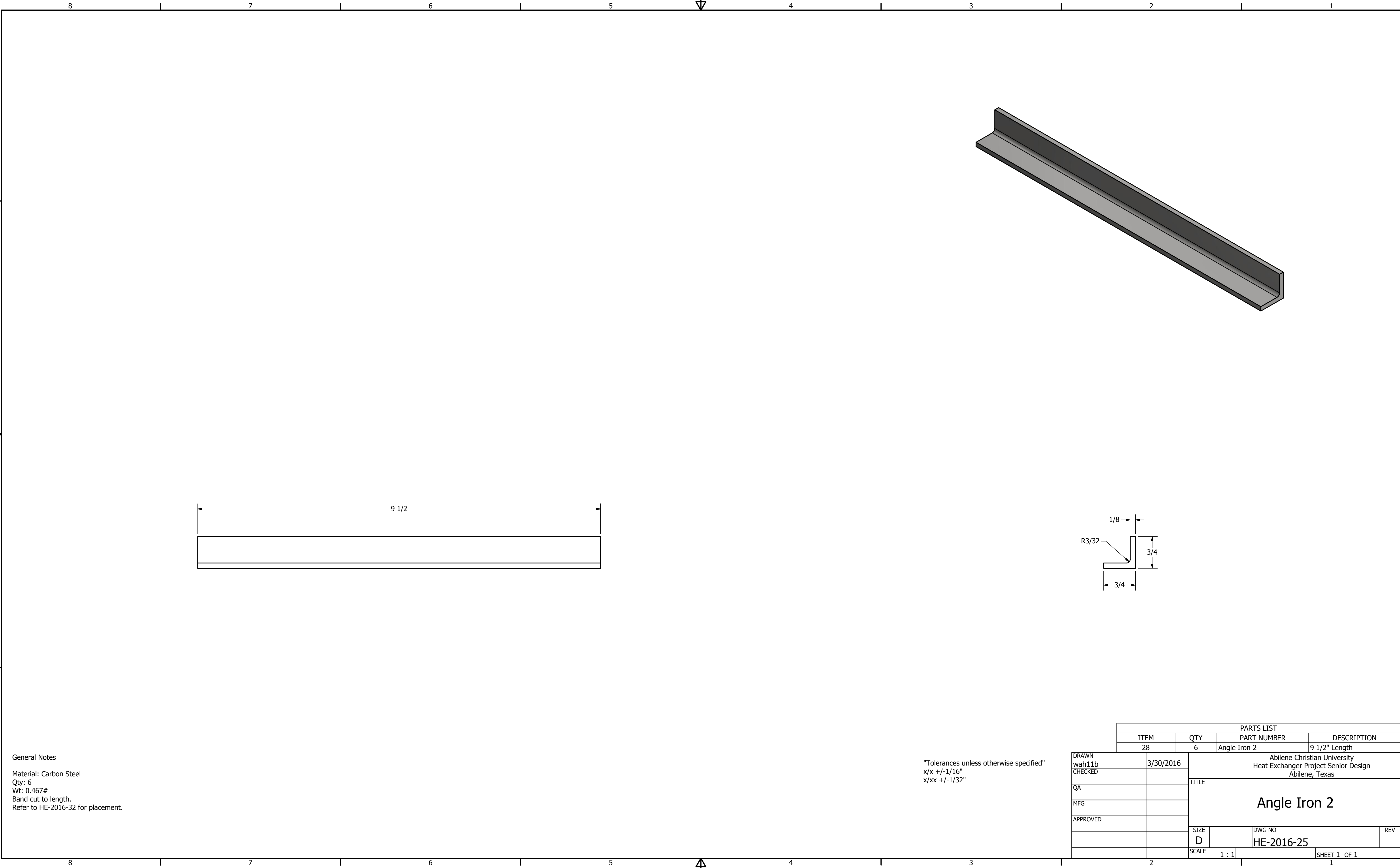
"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 1.100#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
27	2	Angle Iron 1	22 3/8" Length

DRAWN wah11b	3/30/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 1</b>	
QA		SIZE D	DWG NO HE-2016-24
MFG		SCALE 1	REV
APPROVED		SHEET 1 OF 1	



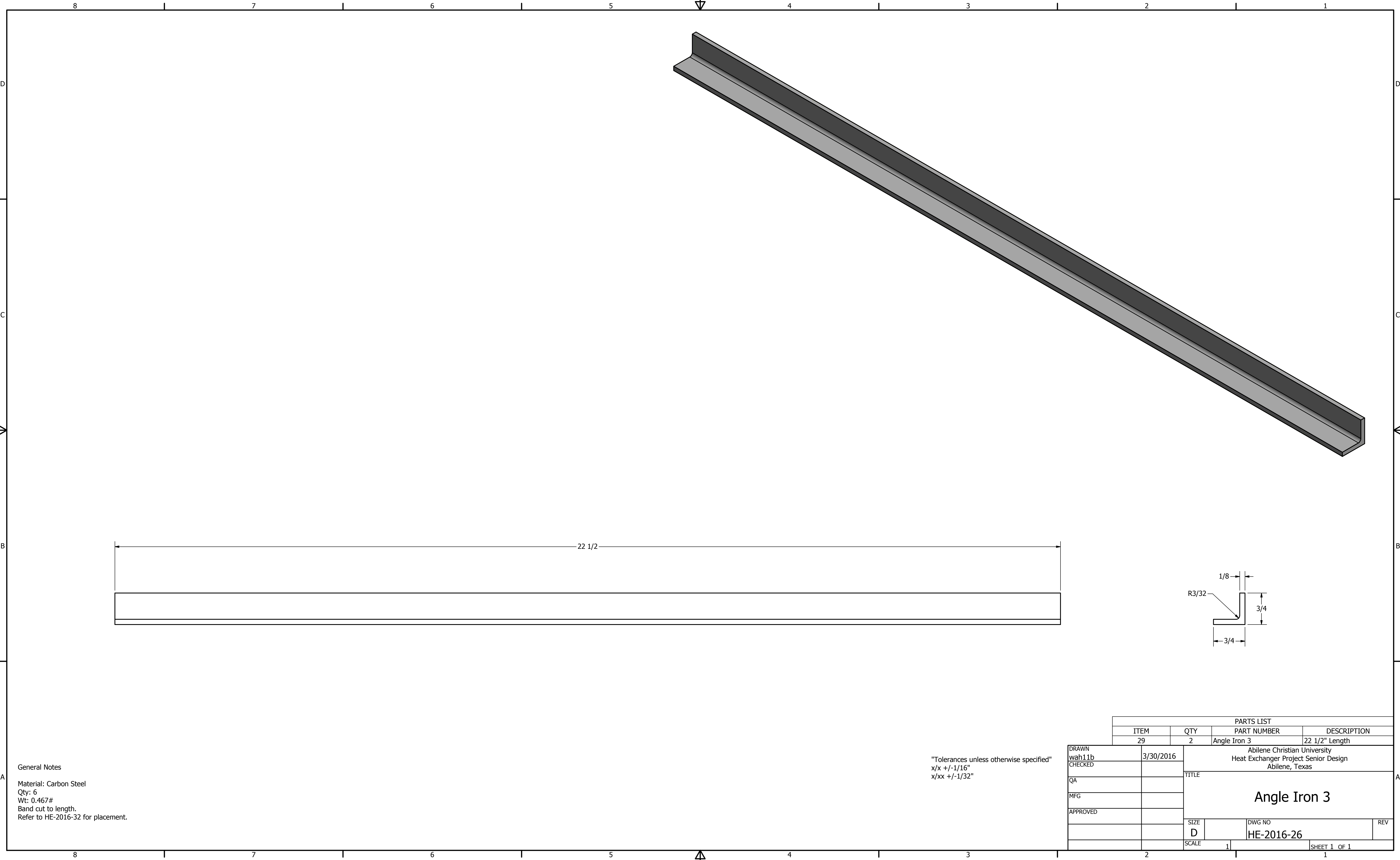
General Notes  
 Material: Carbon Steel  
 Qty: 6  
 Wt: 0.467#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

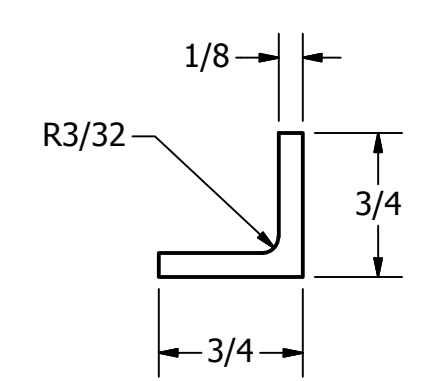
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
28	6	Angle Iron 2	9 1/2" Length

DRAWN wah11b	3/30/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 2</b>	
QA		SIZE D	DWG NO HE-2016-25
MFG		SCALE 1 : 1	REV
APPROVED		SHEET 1 OF 1	



22 1/2



General Notes  
 Material: Carbon Steel  
 Qty: 6  
 Wt: 0.467#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
29	2	Angle Iron 3	22 1/2" Length

DRAWN wah11b	3/30/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 3</b>	
QA		SIZE D	DWG NO HE-2016-26
MFG		SCALE 1	REV
APPROVED		SHEET 1 OF 1	

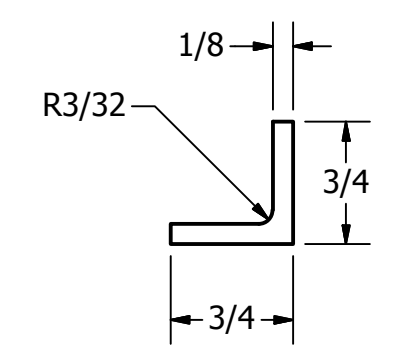
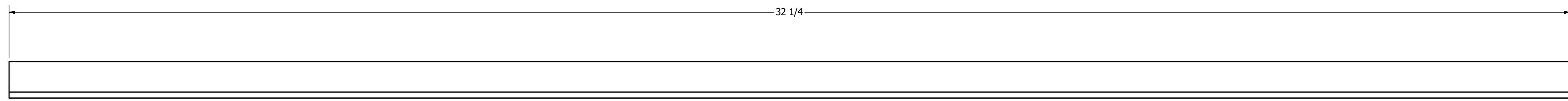
8 7 6 5 4 3 2 1

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General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 1.586#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

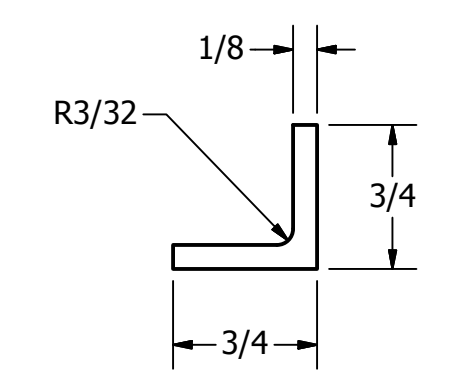
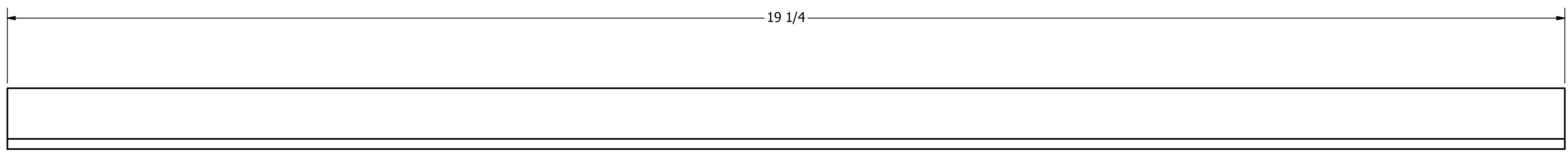
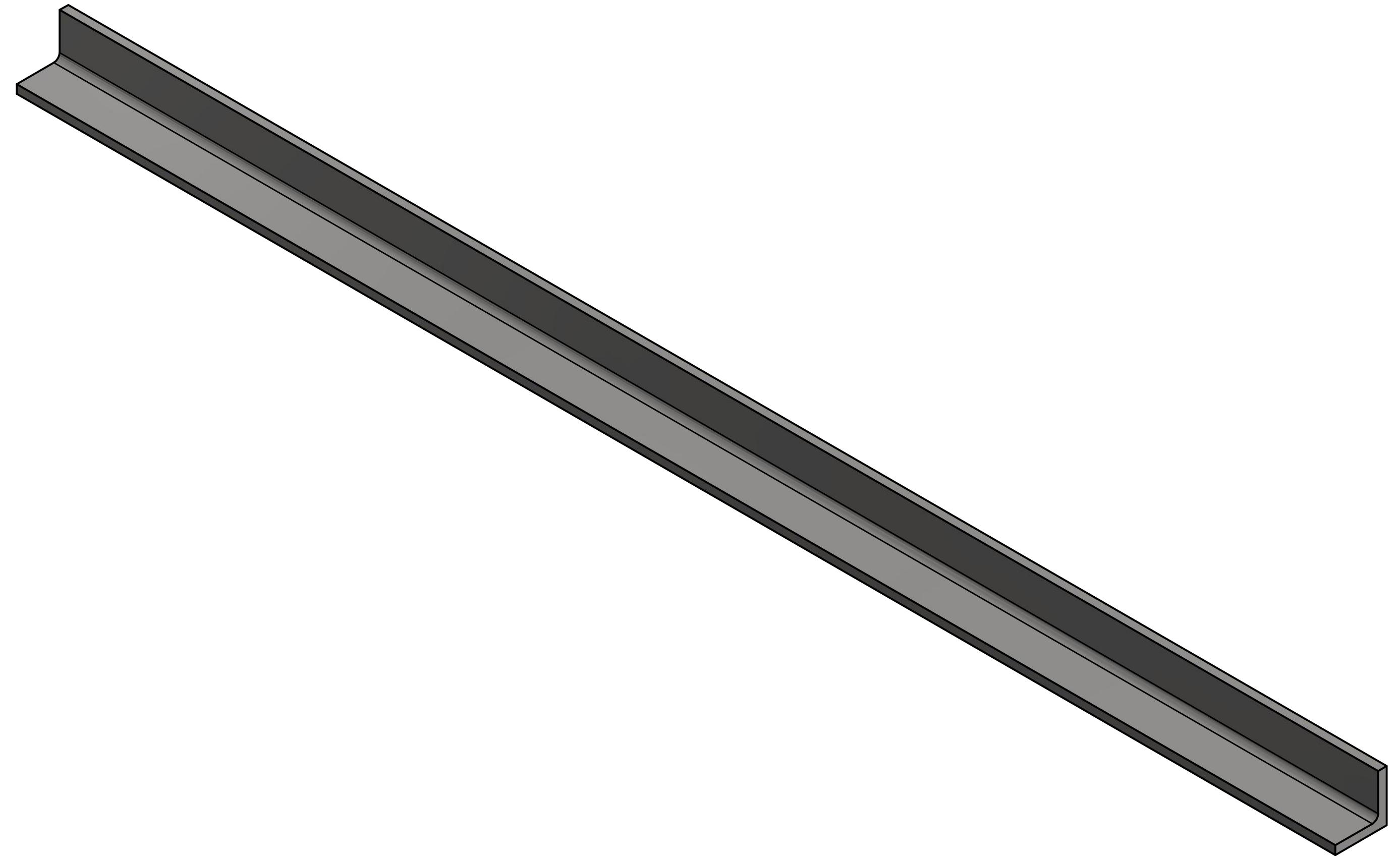
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
30	2	Angle Iron 4	32 1/4" Length

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 4</b>	
QA		SIZE D	DWG NO HE-2016-27
MFG		SCALE .85	REV
APPROVED		SHEET 1 OF 1	

8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1



"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

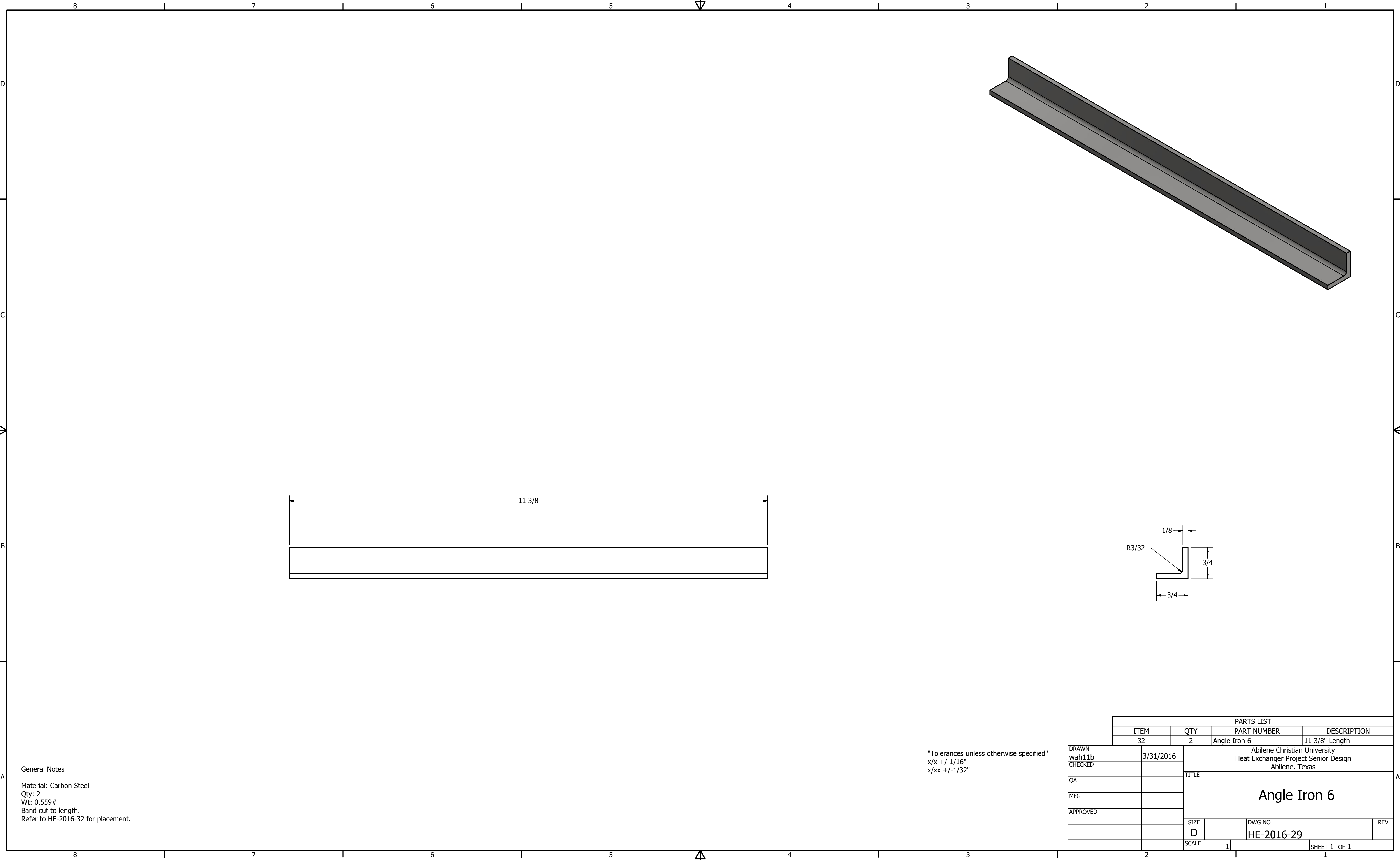
General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 0.947#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
31	2	Angle Iron 5	19 1/4" Length

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 5</b>	
QA		SIZE D	DWG NO HE-2016-28
MFG		SCALE 1	REV
APPROVED		SHEET 1 OF 1	

8 7 6 5 4 3 2 1



General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 0.559#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

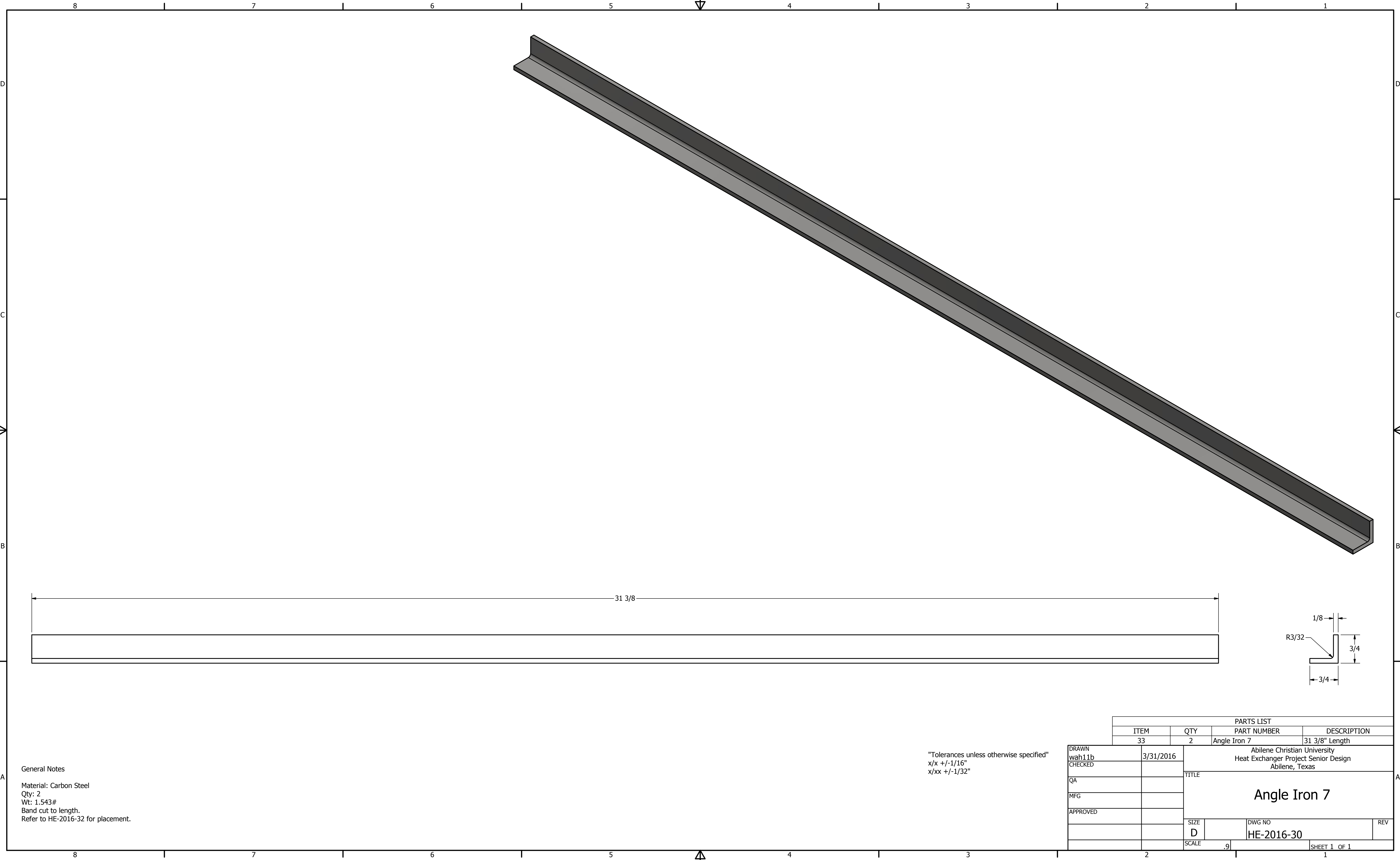
"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
32	2	Angle Iron 6	11 3/8" Length

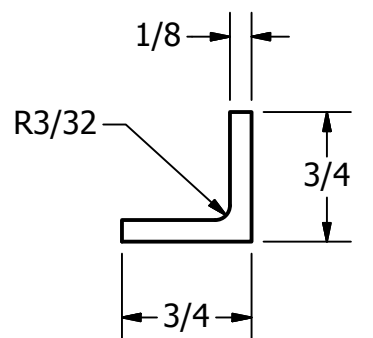
  

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 6</b>	
QA		SIZE D	DWG NO HE-2016-29
MFG		SCALE 1	REV
APPROVED		SHEET 1 OF 1	





31 3/8



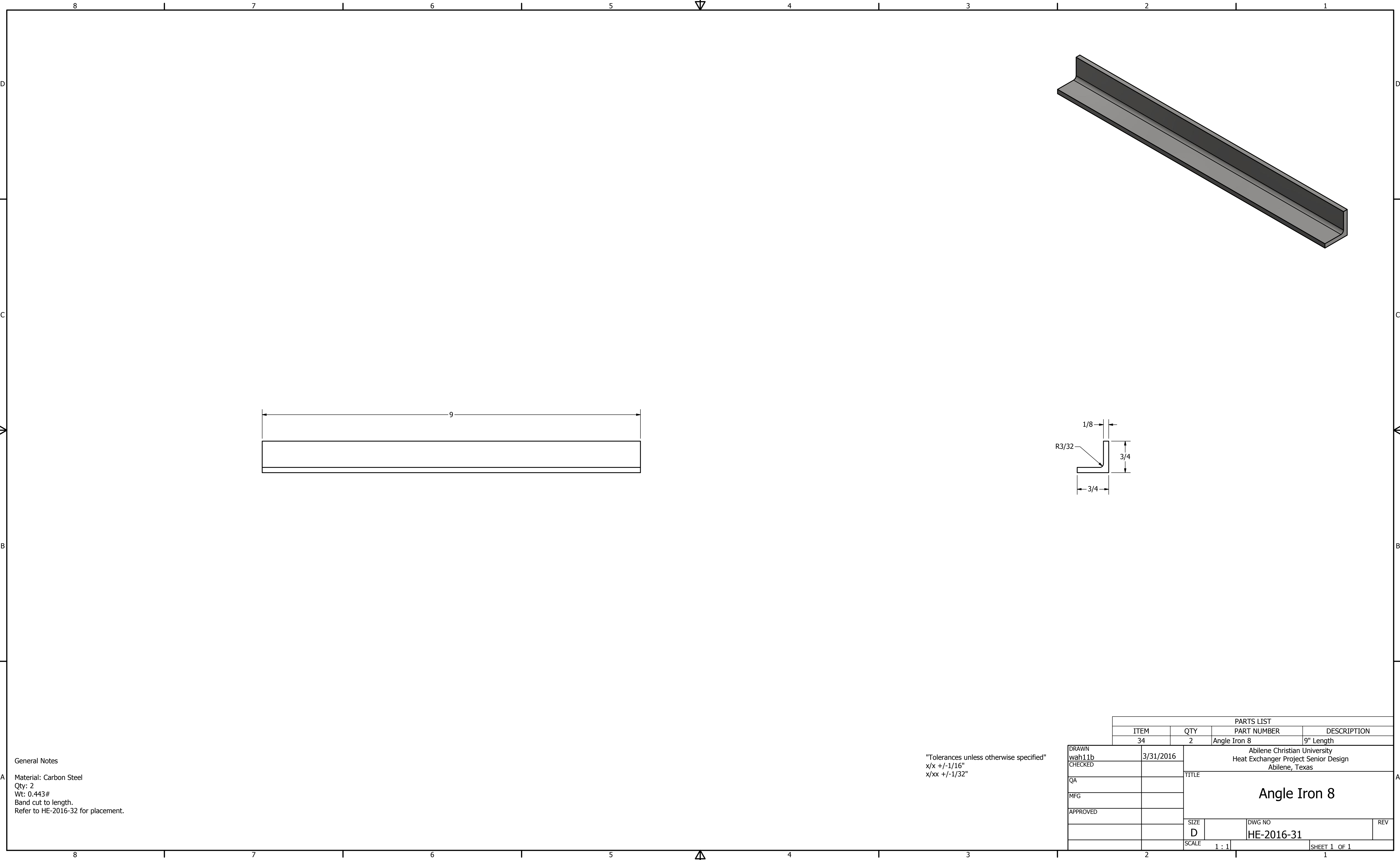
"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 1.543#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
33	2	Angle Iron 7	31 3/8" Length

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 7</b>	
QA		SIZE D	DWG NO HE-2016-30
MFG		SCALE .9	REV
APPROVED		SHEET 1 OF 1	



General Notes  
 Material: Carbon Steel  
 Qty: 2  
 Wt: 0.443#  
 Band cut to length.  
 Refer to HE-2016-32 for placement.

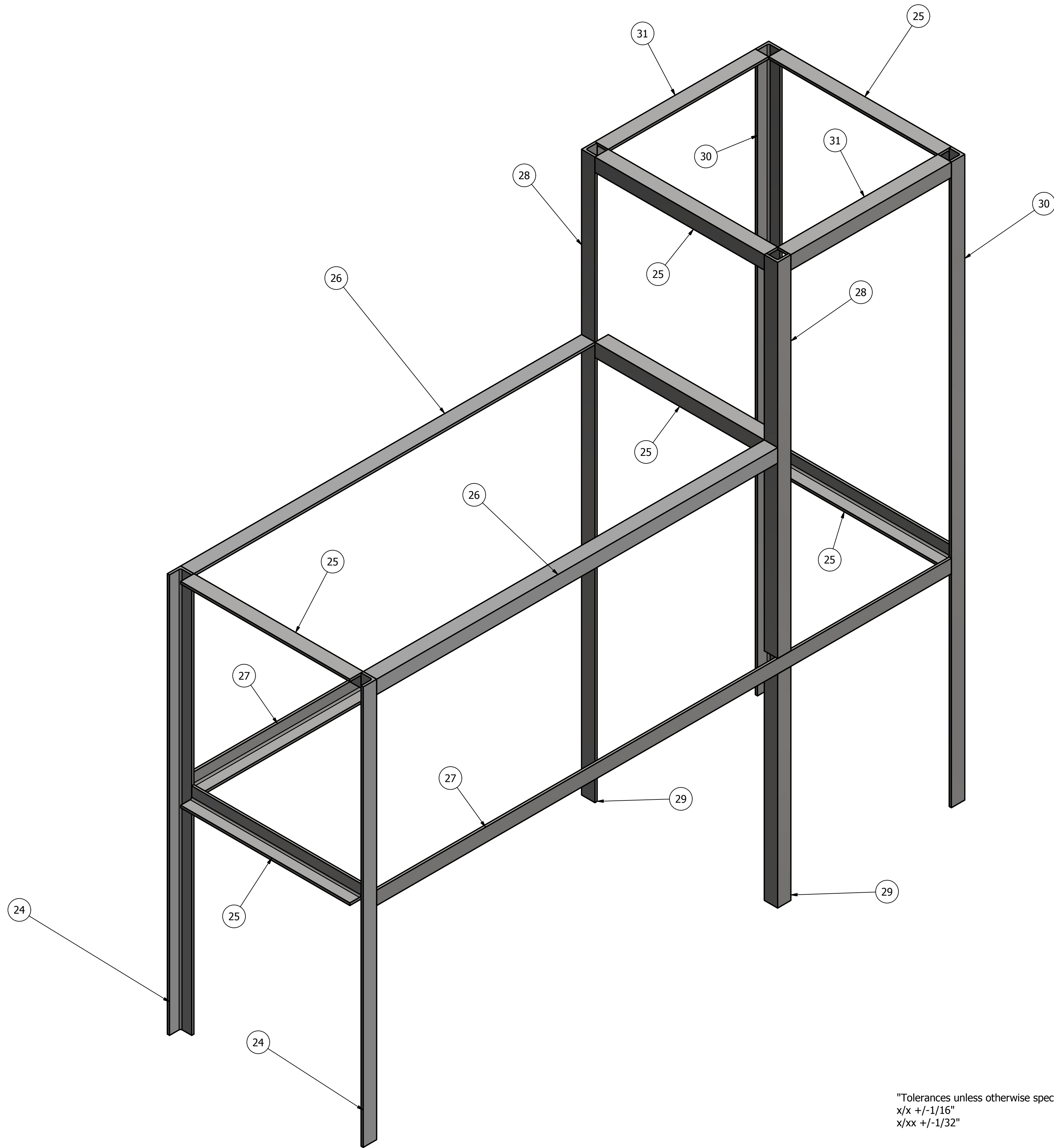
"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
34	2	Angle Iron 8	9" Length

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Angle Iron 8</b>	
QA		SIZE D	DWG NO HE-2016-31
MFG		SCALE 1 : 1	REV
APPROVED		SHEET 1 OF 1	

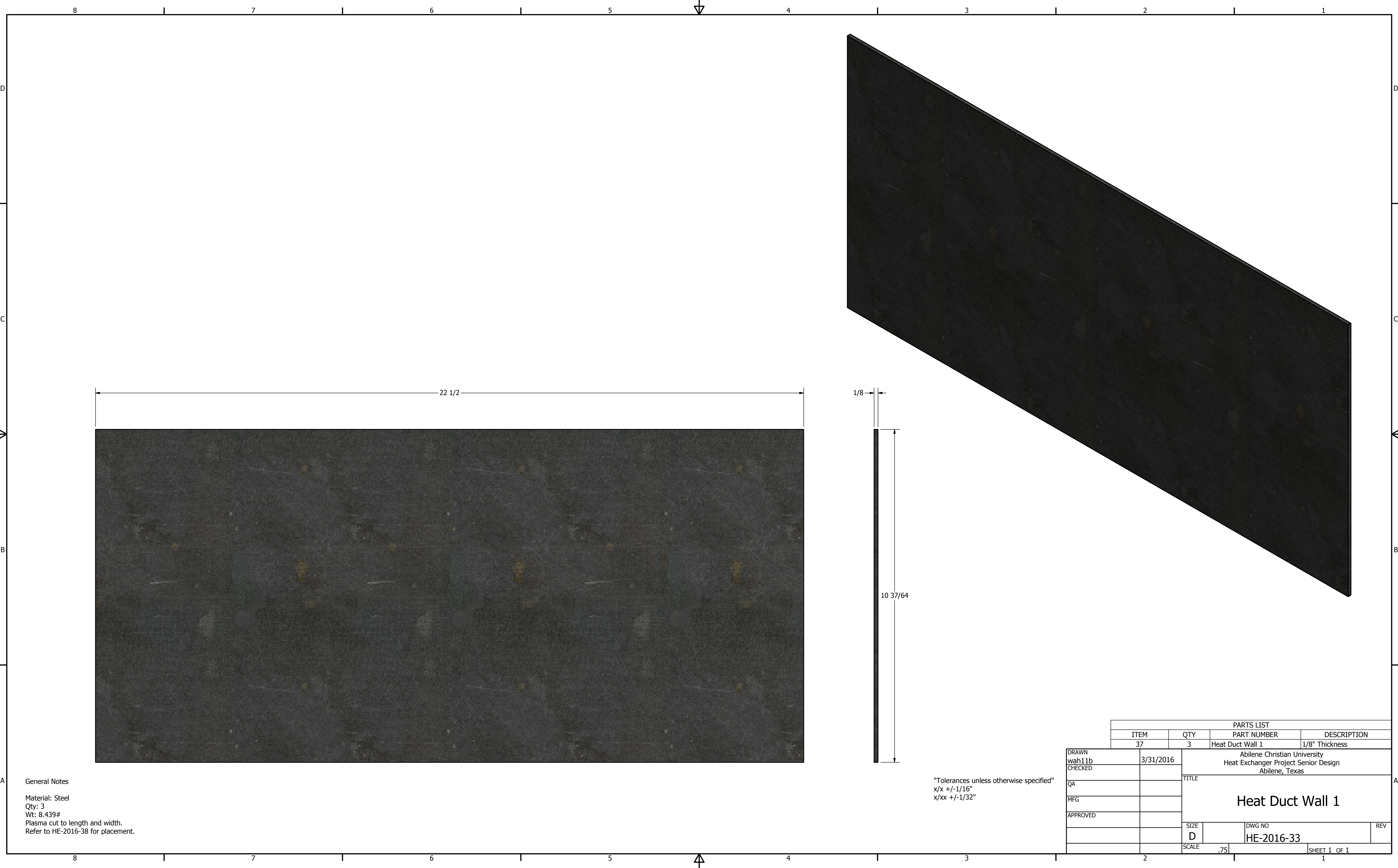
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
24	2	Angle Iron 1	22 3/8" Length
25	6	Angle Iron 2	9 1/2" Length
26	2	Angle Iron 3	22 1/2" Length
27	2	Angle Iron 4	32 1/4" Length
28	2	Angle Iron 5	19 1/4" Length
29	2	Angle Iron 6	11 3/8" Length
30	2	Angle Iron 7	31 3/8" Length
31	2	Angle Iron 8	9" Length



General Notes:  
 All corners are welded.  
 Assembly process generally follows in order of the number of the parts.  
 Refer to HE-2016-38 for the complete Heat Duct Assembly.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Duct Frame</b>	
QA		SIZE D	DWG NO HE-2016-32
MFG		SCALE .4	REV
APPROVED		SHEET 1 OF 1	



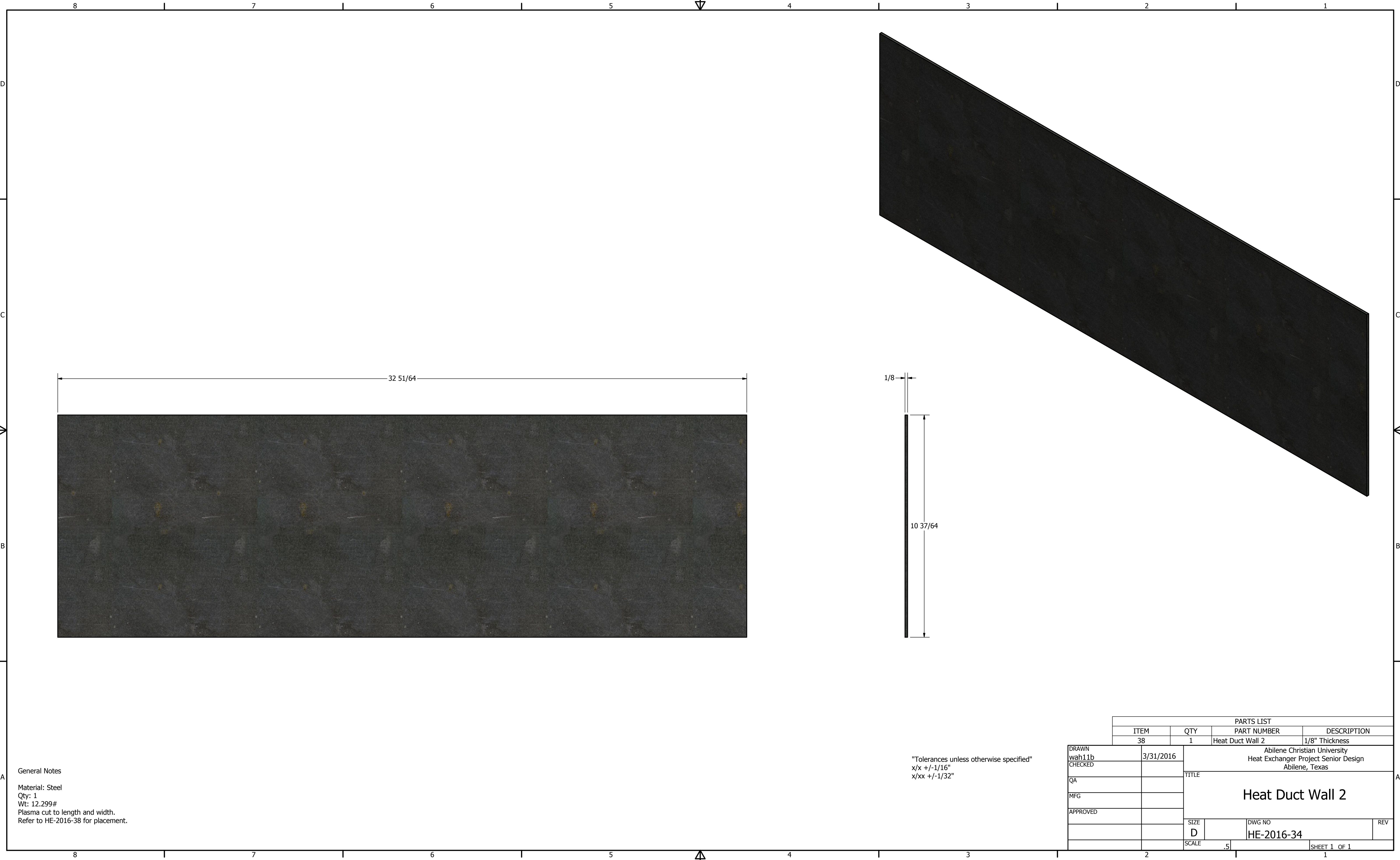
General Notes  
 Material: Steel  
 Qty: 3  
 Wt: 8.439#  
 Plasma cut to length and width.  
 Refer to HE-2016-38 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
37	3	Heat Duct Wall 1	1/8" Thickness

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Duct Wall 1</b>	
QA		SIZE D	DWG NO HE-2016-33
MFG		SCALE .75	REV
APPROVED		SHEET 1 OF 1	



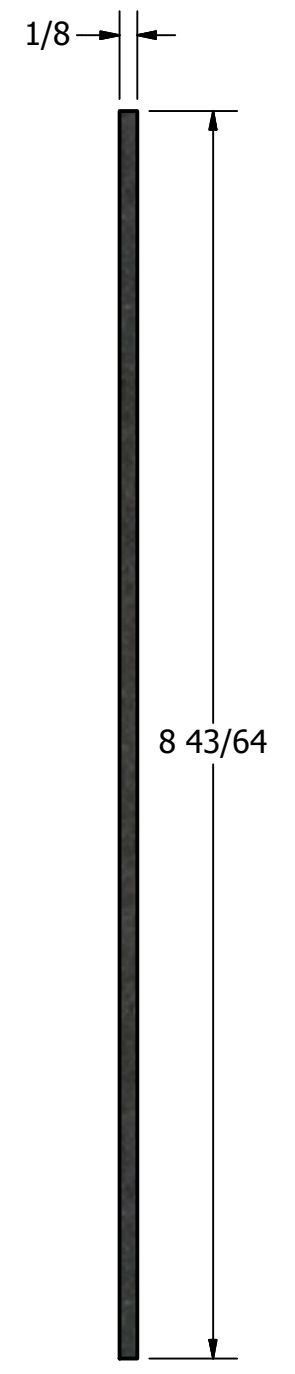
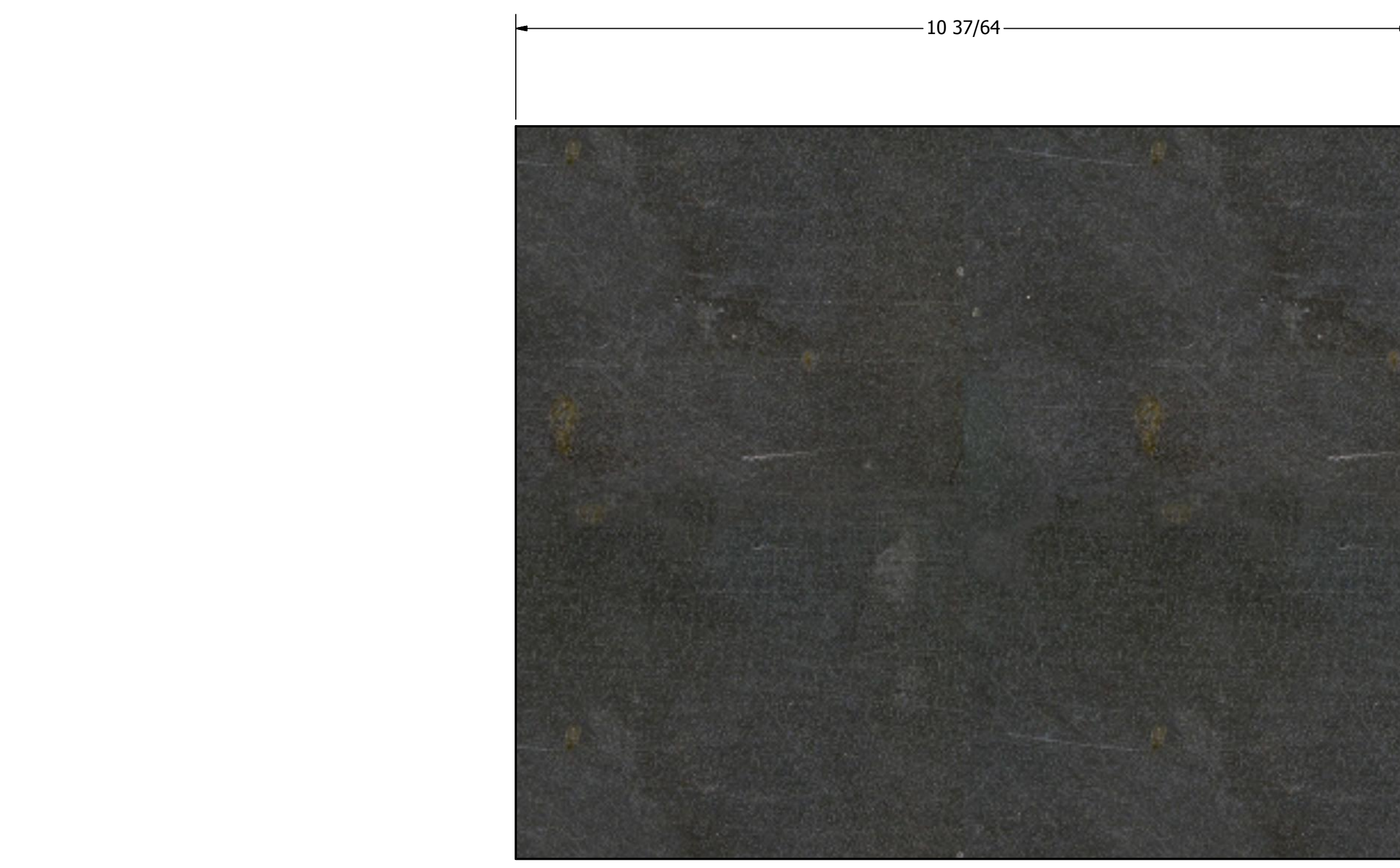
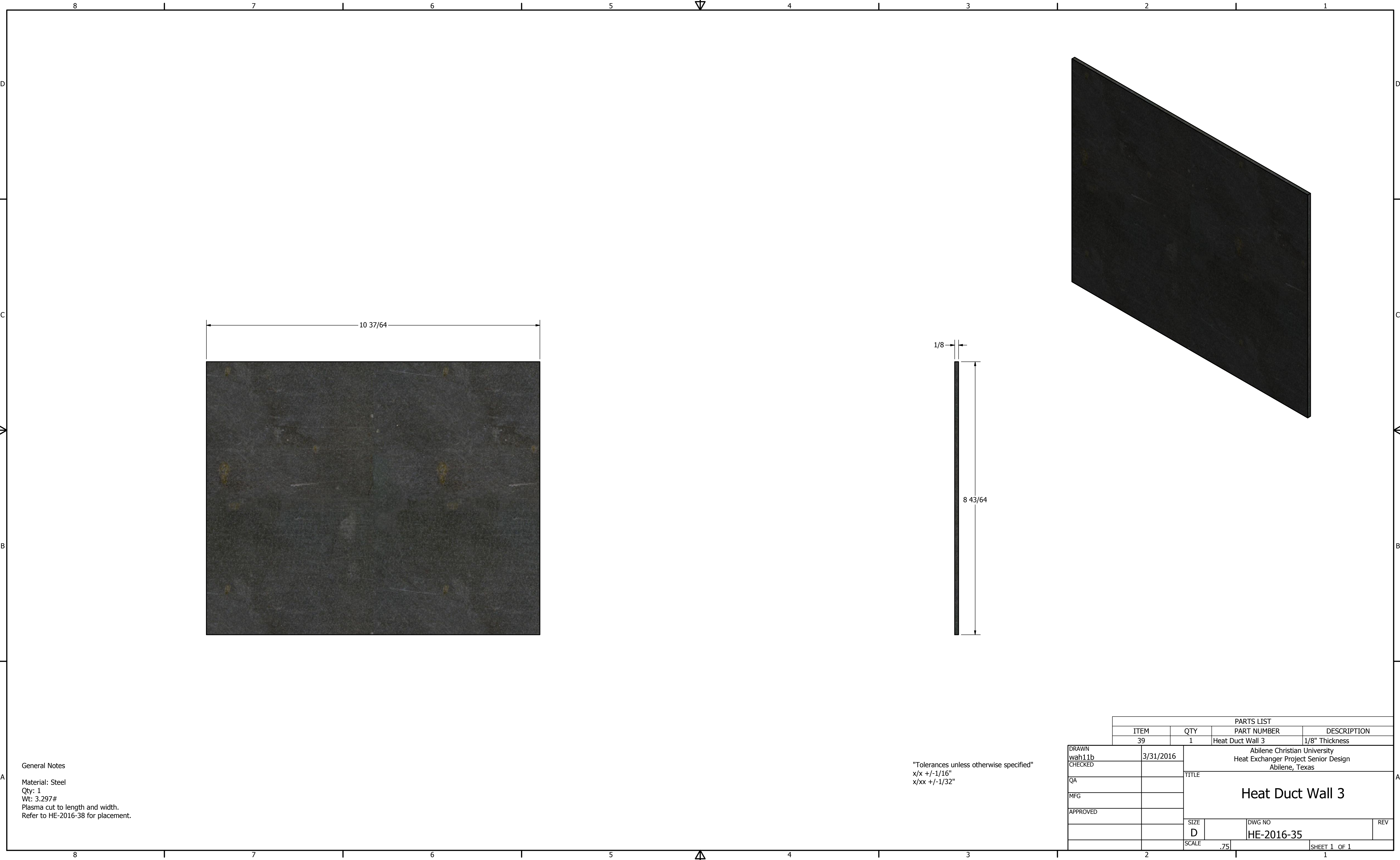
General Notes  
 Material: Steel  
 Qty: 1  
 Wt: 12.299#  
 Plasma cut to length and width.  
 Refer to HE-2016-38 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
38	1	Heat Duct Wall 2	1/8" Thickness

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Duct Wall 2</b>	
QA		SIZE D	DWG NO HE-2016-34
MFG		SCALE .5	REV
APPROVED		SHEET 1 OF 1	



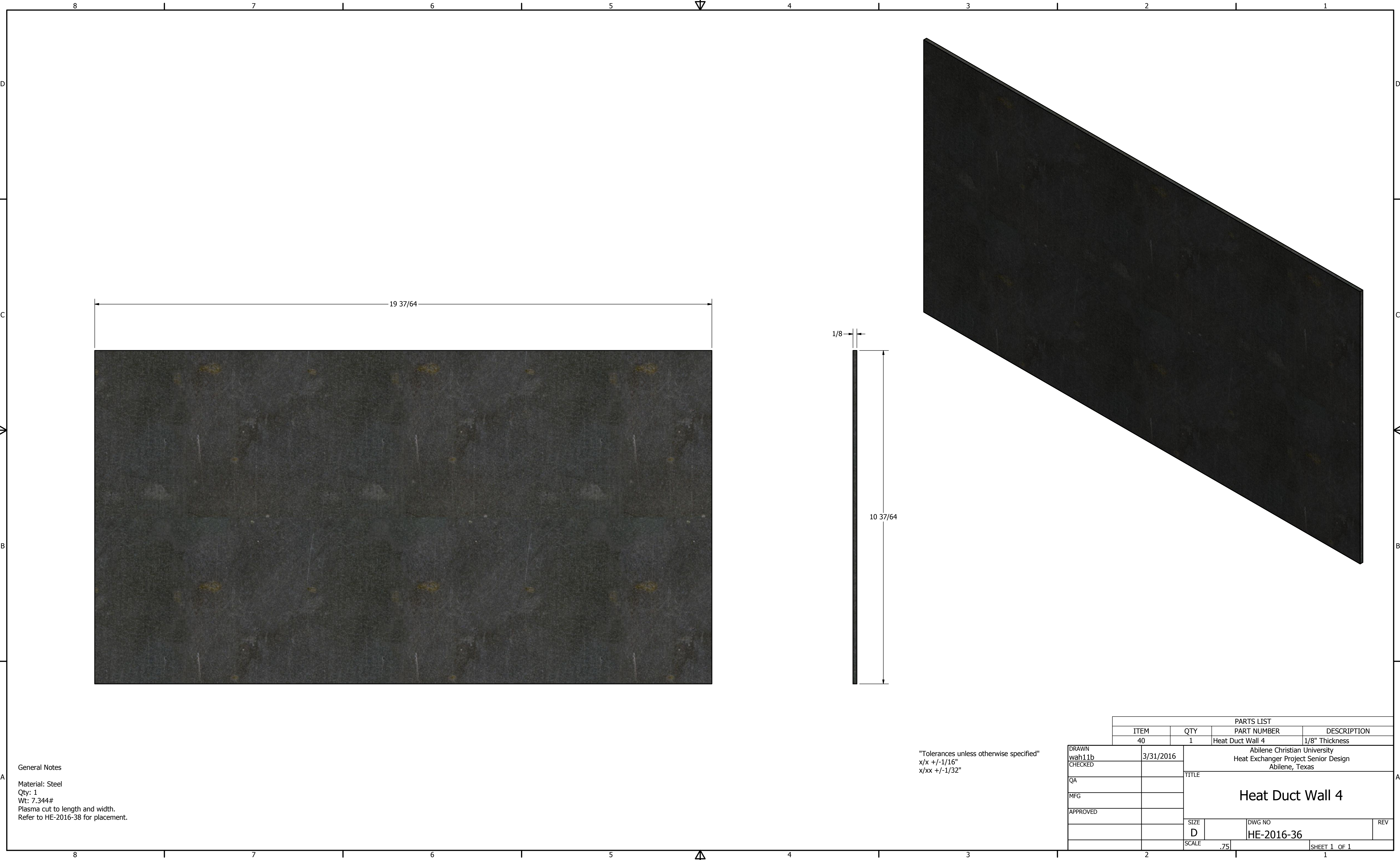
General Notes  
 Material: Steel  
 Qty: 1  
 Wt: 3.297#  
 Plasma cut to length and width.  
 Refer to HE-2016-38 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
39	1	Heat Duct Wall 3	1/8" Thickness

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Duct Wall 3</b>	
QA		SIZE D	DWG NO HE-2016-35
MFG		SCALE .75	REV
APPROVED		SHEET 1 OF 1	



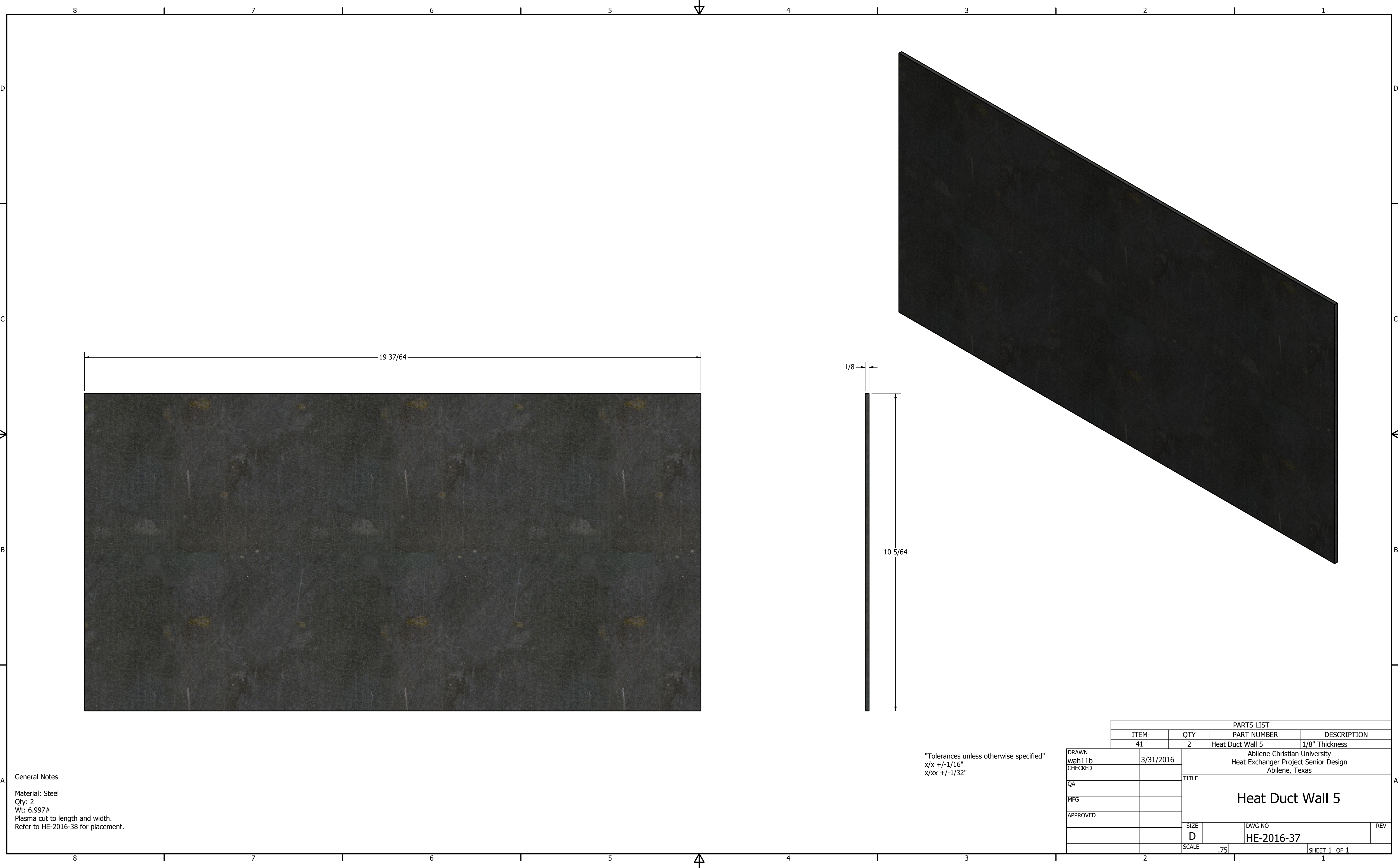
General Notes  
 Material: Steel  
 Qty: 1  
 Wt: 7.344#  
 Plasma cut to length and width.  
 Refer to HE-2016-38 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
40	1	Heat Duct Wall 4	1/8" Thickness

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Duct Wall 4</b>	
QA		SIZE D	DWG NO HE-2016-36
MFG		SCALE .75	REV
APPROVED		SHEET 1 OF 1	



General Notes  
 Material: Steel  
 Qty: 2  
 Wt: 6.997#  
 Plasma cut to length and width.  
 Refer to HE-2016-38 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
41	2	Heat Duct Wall 5	1/8" Thickness

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Duct Wall 5</b>	
QA		SIZE D	DWG NO HE-2016-37
MFG		SCALE .75	REV
APPROVED		SHEET 1 OF 1	



PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
32	1	Heat Duct Frame	3/4" x 3/4" x 1/8"
33	3	Heat Duct Wall 1	1/64" Thickness
34	1	Heat Duct Wall 2	1/64" Thickness
35	1	Heat Duct Wall 3	1/64" Thickness
36	1	Heat Duct Wall 4	1/64" Thickness
37	2	Heat Duct Wall 5	1/64" Thickness



General Notes

Material: Various Steels  
 Wt: 75.727#  
 Walls are seem welded along angle iron on outside of the frame.  
 Refer to HE-2016-41 for Testing Procedure placement.

DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas		
CHECKED		TITLE <b>Heat Duct Assembly</b>		
QA		SIZE D	DWG NO HE-2016-38	REV
MFG		SCALE .4		
APPROVED				SHEET 1 OF 1

8 7 6 5 4 3 2 1

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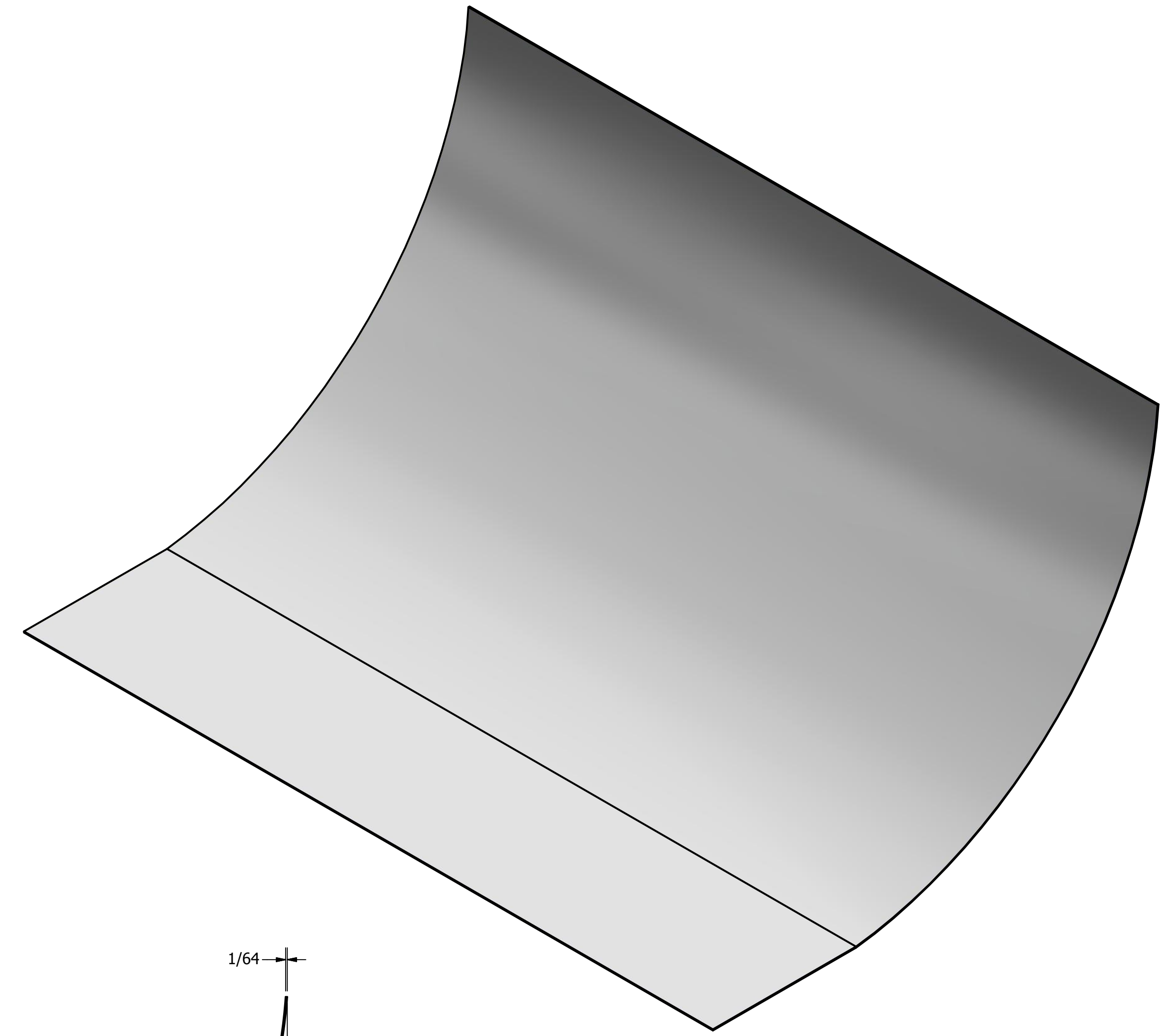
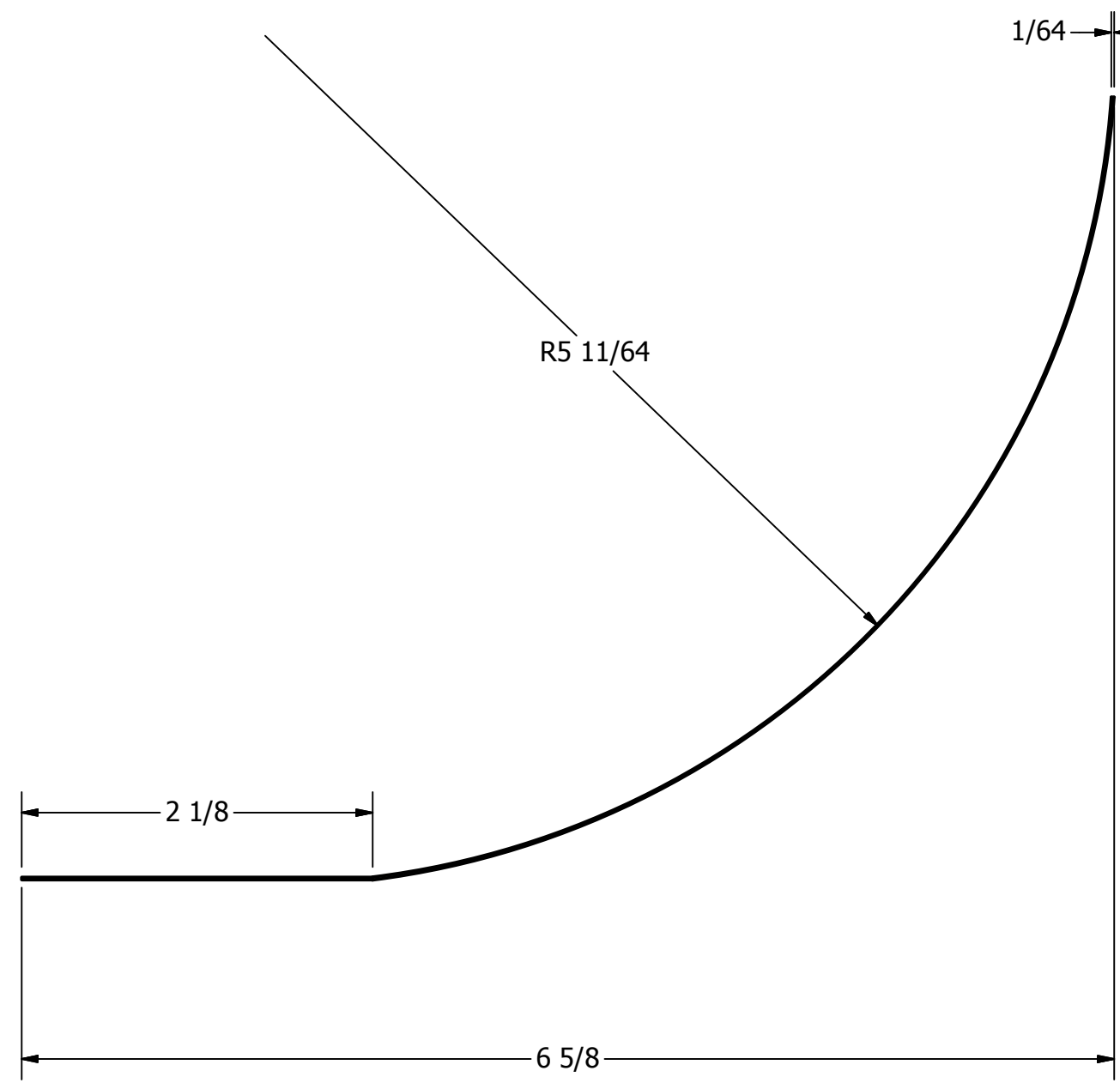
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General Notes  
 Material: Aluminum  
 Qty: 1  
 Wt: 0.112#  
 Scrap metal (exact dimensions are not necessary).  
 This is meant to help direct the heat flow upward toward the Heat Exchanger  
 Refer to HE-2016-41 for placement.

"Tolerances unless otherwise specified"  
 x/x +/-1/16"  
 x/xx +/-1/32"

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
45	1	Heat Director	1/64" Thickness

DRAWN wah11b	4/8/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Director</b>	
QA		SIZE D	DWG NO HE-2016-39
MFG		SCALE 1 : 1	REV
APPROVED		SHEET 1 OF 1	

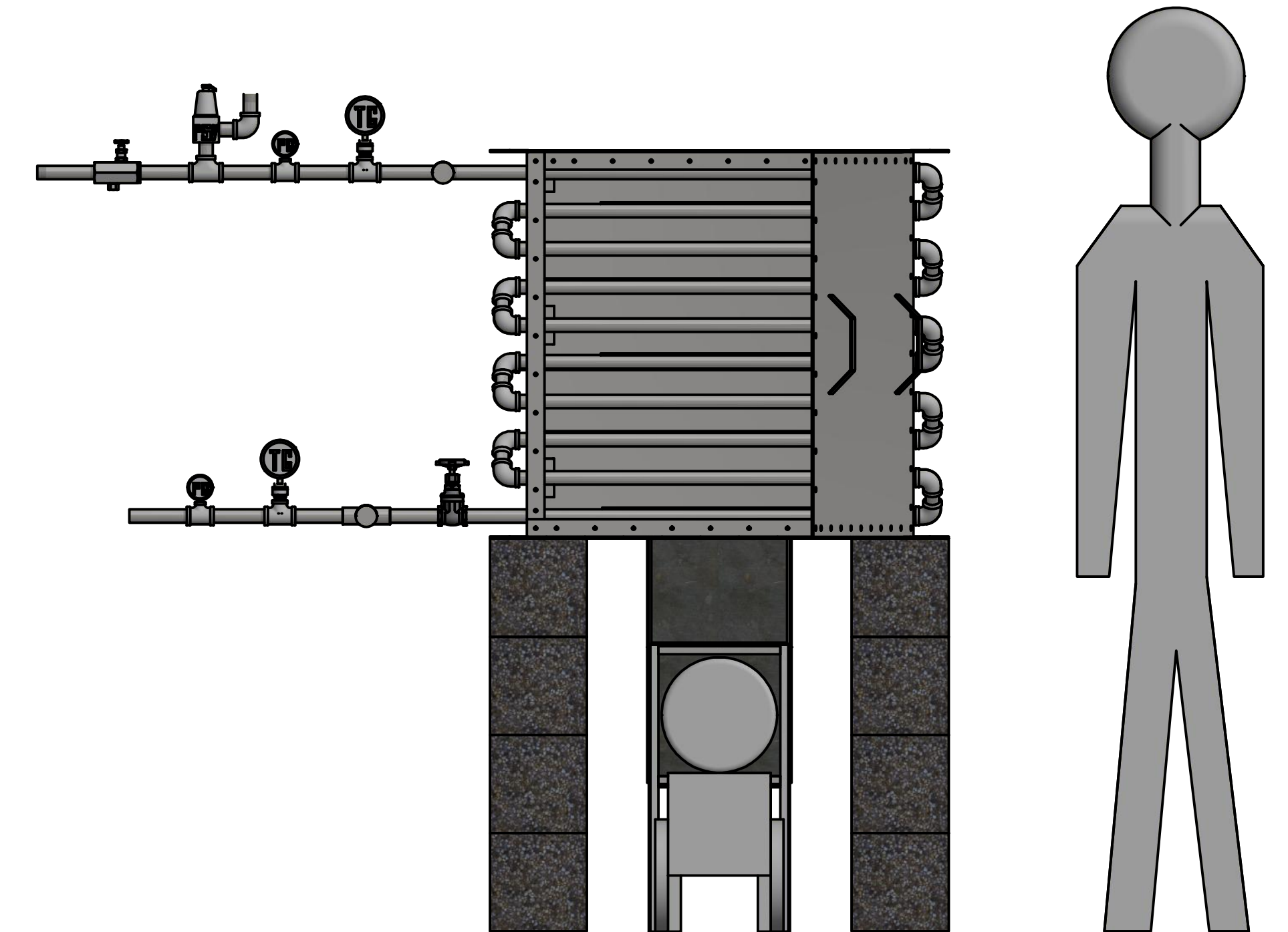
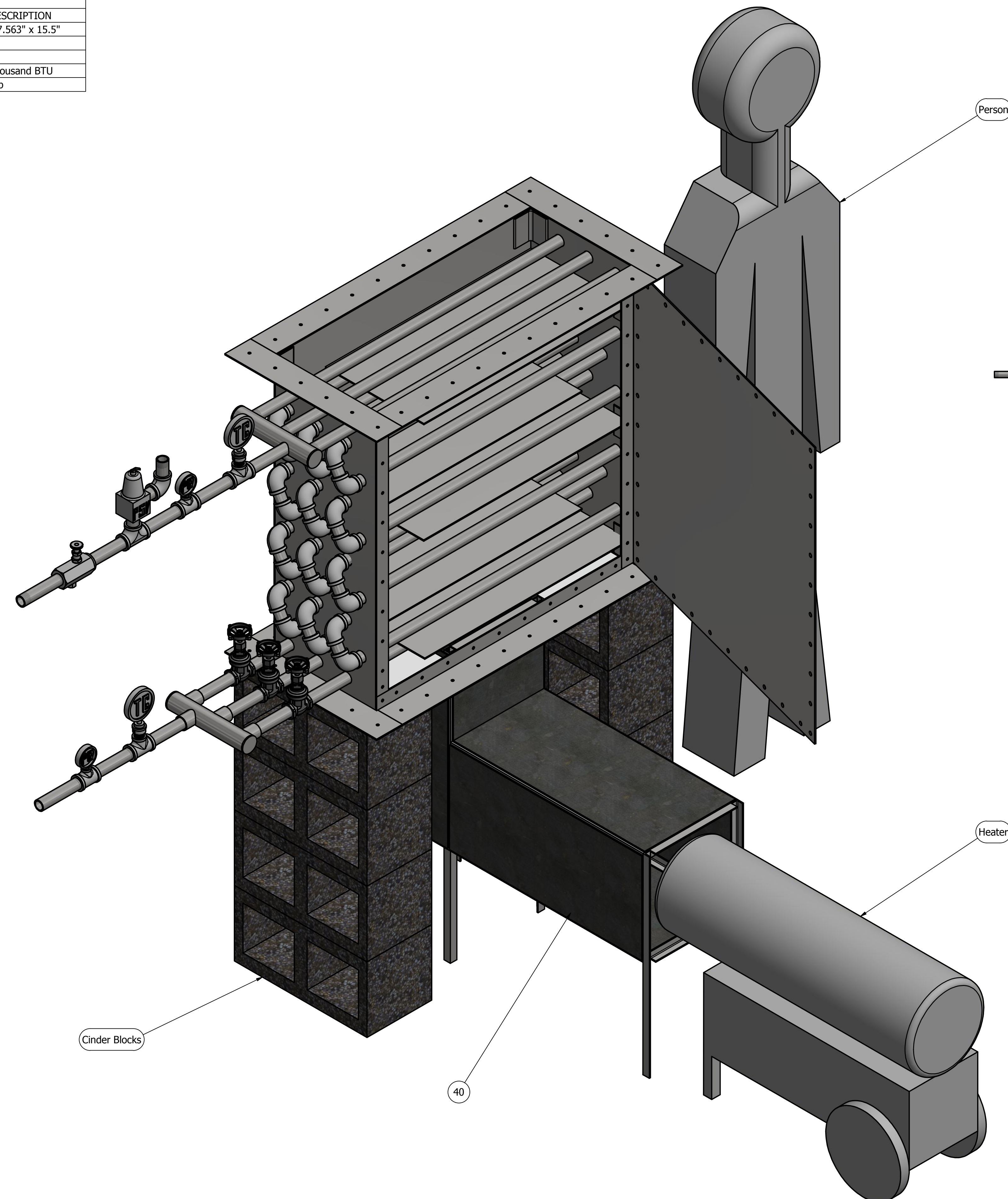
8 7 6 5 4 3 2 1

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
38	1	Heat Duct Assembly	75.838 lb
39	1	Heat Director	1/64" Thickness



DRAWN wah11b	4/8/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Heat Duct Assembly As Built</b>	
QA		SIZE D	DWG NO HE-2016-40
MFG		SCALE 1 / 4	REV
APPROVED		SHEET 1 OF 1	

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
Cinder Blocks	8	Cinder Blocks	7.656" x 7.563" x 15.5"
40	1	Heat Duct Assembly As Built	75.727 lb
Person	1	Person	6' Tall
Heater	1	Heater	20-135 thousand BTU
23	1	Heat Exchanger	280.706 lb



DRAWN wah11b	3/31/2016	Abilene Christian University Heat Exchanger Project Senior Design Abilene, Texas	
CHECKED		TITLE <b>Testing Procedure Assembly</b>	
QA		SIZE D	DWG NO HE-2016-41
MFG		SCALE 2	REV
APPROVED		SHEET 1 OF 1	