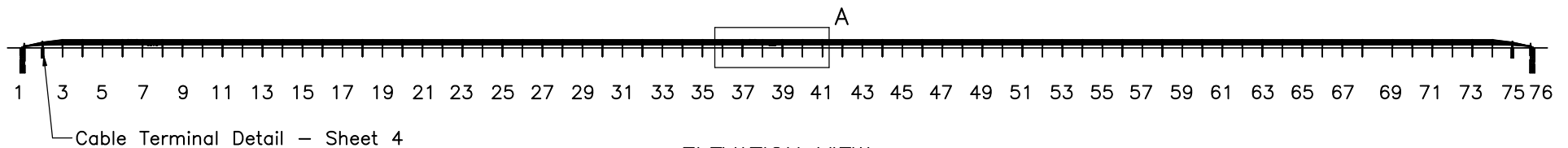


PLAN VIEW



ELEVATION VIEW

- Notes: (1) Test shall be performed according to test designation no. 3-10 of MASH criteria.
- (2) At a minimum, critical post nos. 26-48 are placed in 18" [457] diameter hole backfilled and tamped in well compacted soil.
- (3) Test cable tensions of 2500 ± 200 lb [11.1 ± 0.890 kN].
- (4) Bottom cable on impact side.
- (5) Span between posts 68 and 69 is 144" [3658].
- (6) Post nos. 22-53 are modified weak posts as shown on sheets 19-22.



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

System Layout

DWG. NAME:
MWP-8_R4

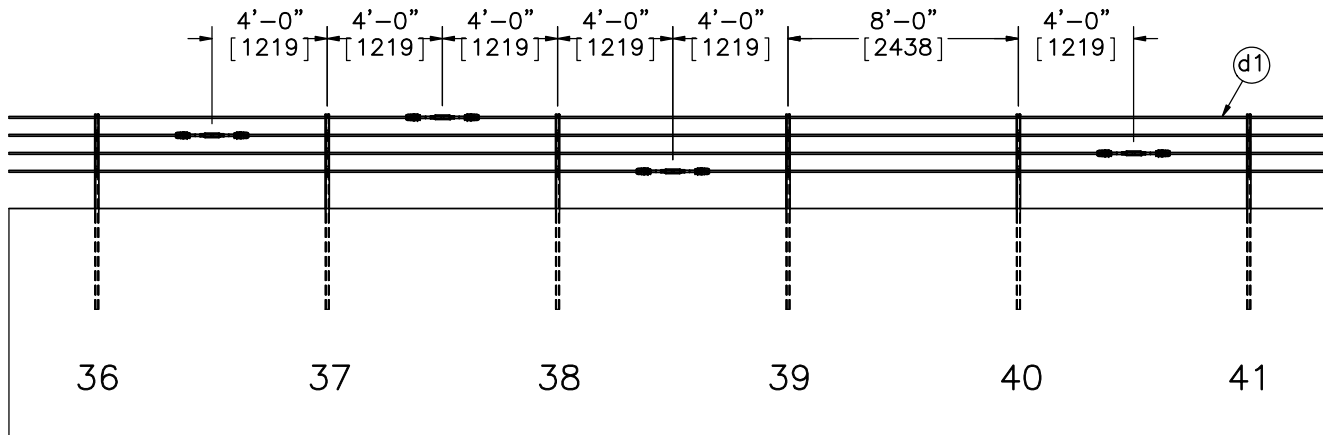
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UNITS: in.[mm]

SHEET:
1 of 24

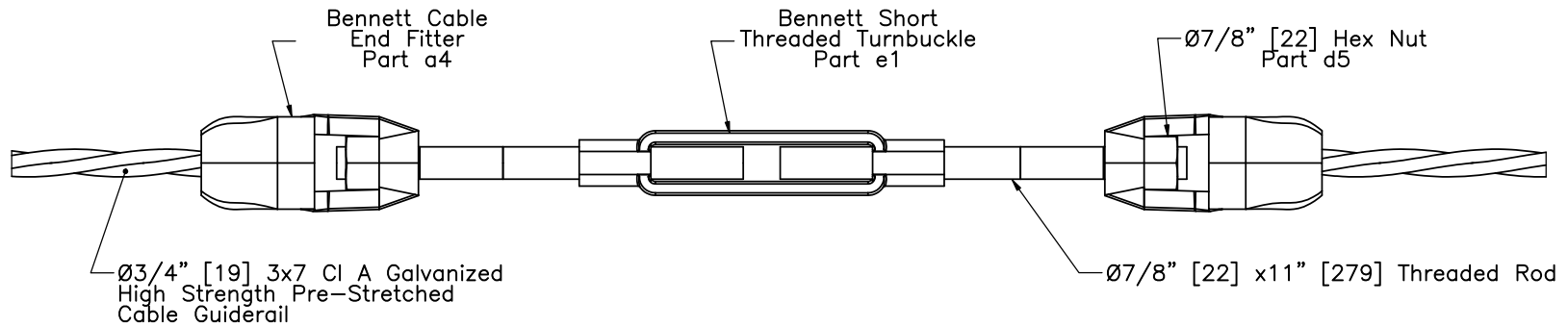
DATE:
11/01/2016

DRAWN BY:
JEK

REV. BY:
KAL




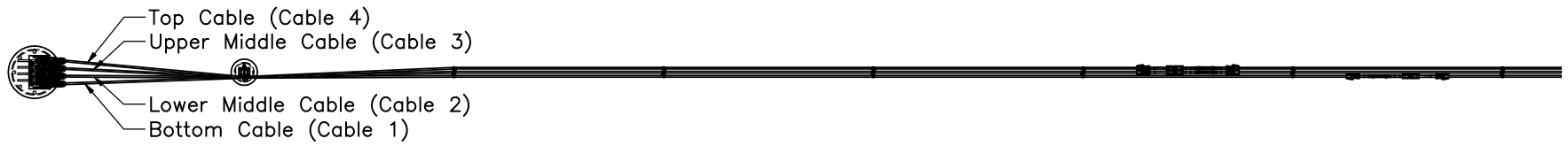
DETAIL A
Cable Splice Location Detail



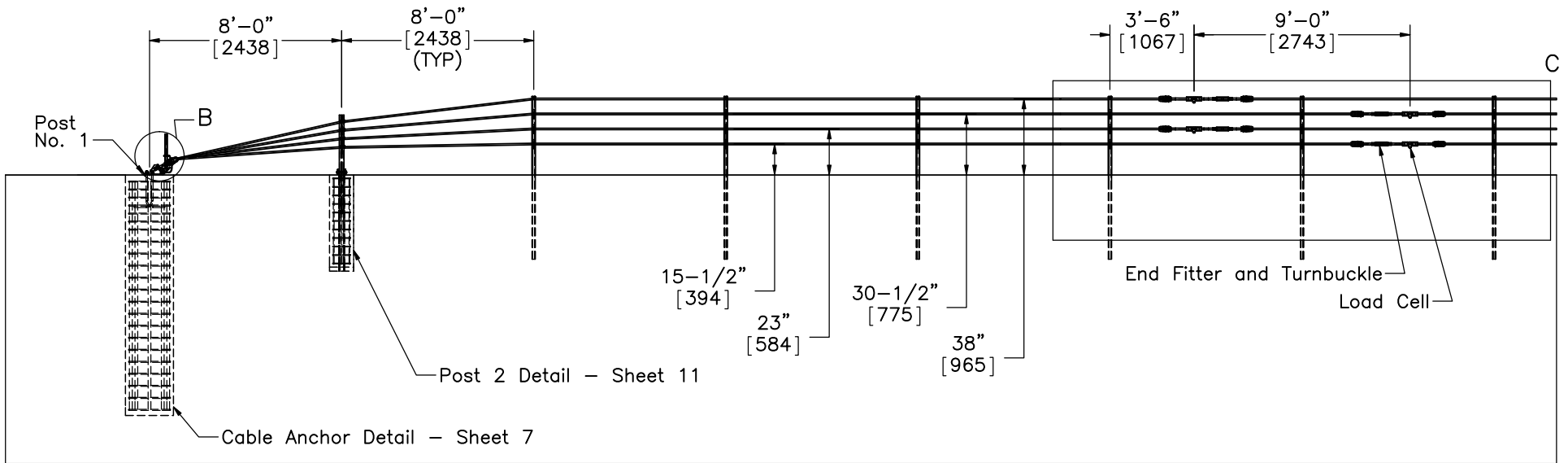
Cable Splice Detail
SCALE 1:6

Notes: (1) The splice locations may be moved as long as two adjacent cable splices are not located on top of one another.

	Midwest 4-Cable Barrier System		SHEET: 2 of 24
			DATE: 11/01/2016
Midwest Roadside Safety Facility	Cable Splice Location and Detail		DRAWN BY: JEK
	DWG. NAME: MWP-8_R4	SCALE: 1:80 UNITS: in.[mm]	REV. BY: KAL



PLAN VIEW



ELEVATION VIEW



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Cable Terminal Detail

DWG. NAME:
MWP-8_R4

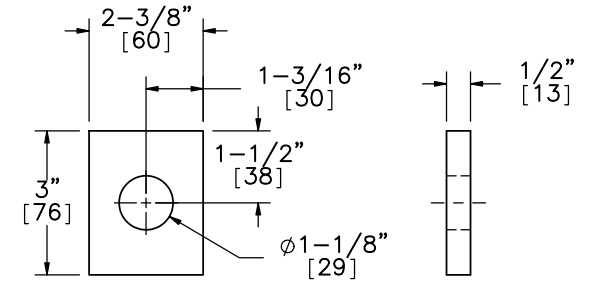
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UNITS: in.[mm]

SHEET:
3 of 24

DATE:
11/01/2016

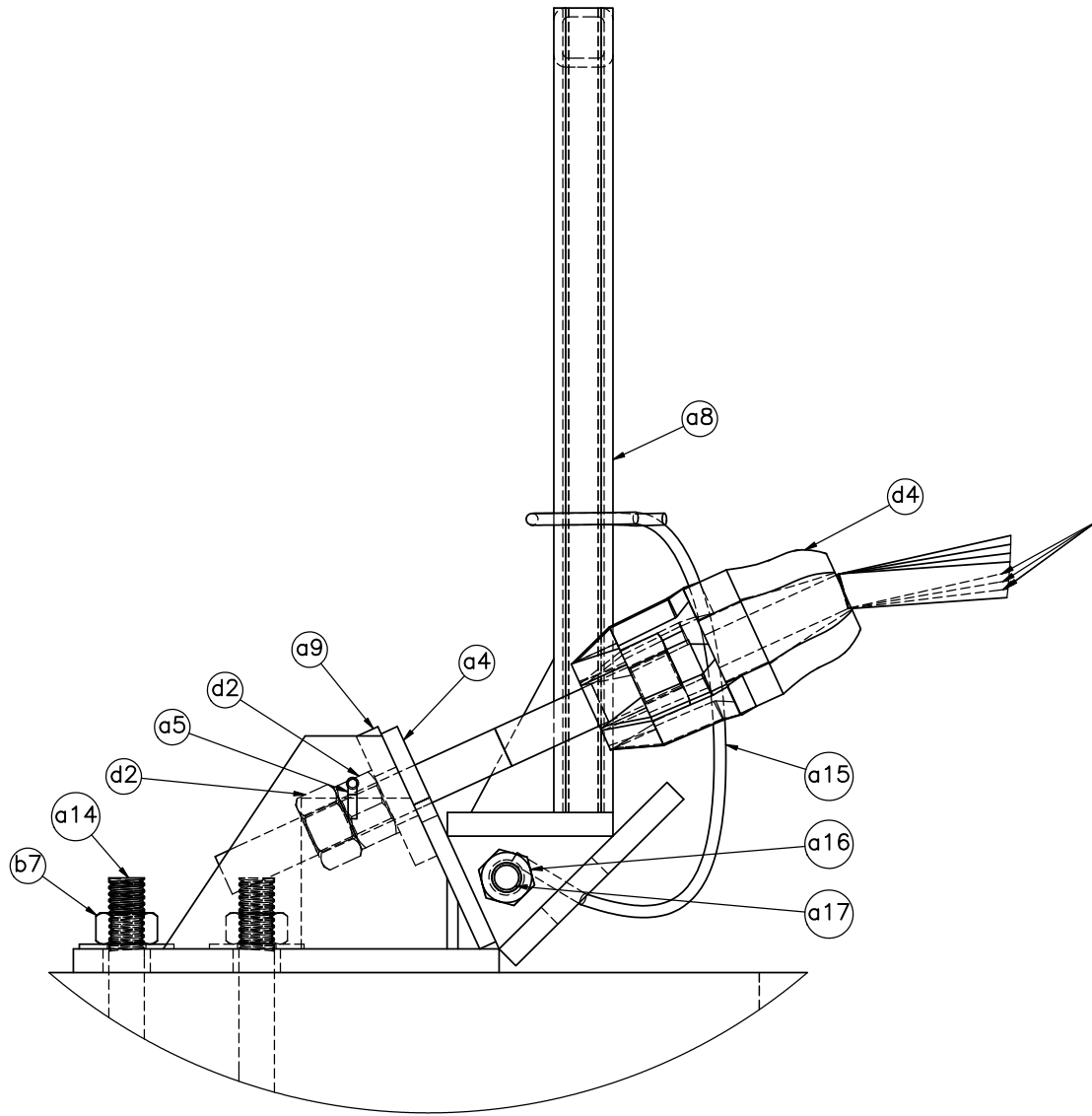
DRAWN BY:
JEK

REV. BY:
KAL



ELEVATION VIEW PROFILE VIEW

Part a9
Cable Anchor Plate Washer



All cables run over the foot of the cable release lever. The middle two cables run through the lever uprights.

DETAIL B



Midwest 4-Cable Barrier System

Midwest Roadside Safety Facility

Cable Anchor Detail

DWG. NAME:
MWP-8_R4

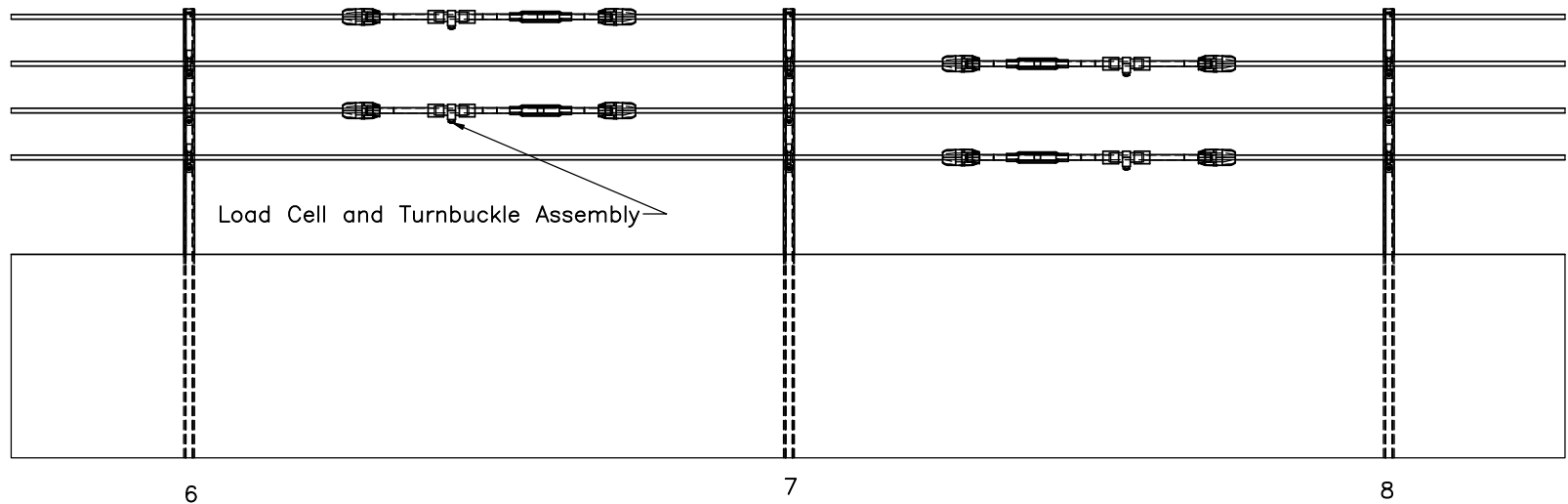
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UNITS: in.[mm]

SHEET:
4 of 24

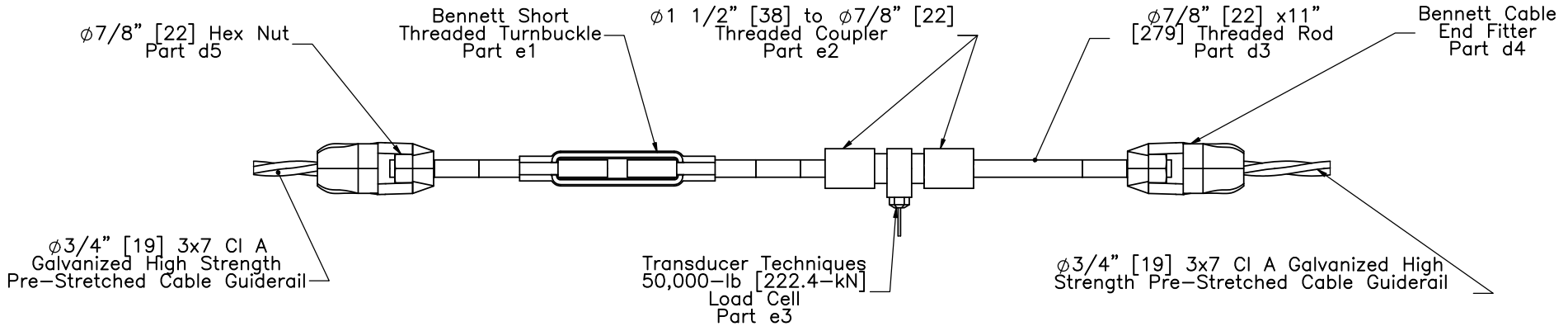
DATE:
11/01/2016

DRAWN BY:
JEK

REV. BY:
KAL



DETAIL C
SCALE 1 : 30



Notes: (1) Two RH-threaded rods and one LH-threaded rod required for load cell and turnbuckle assembly.



Midwest Roadside Safety Facility

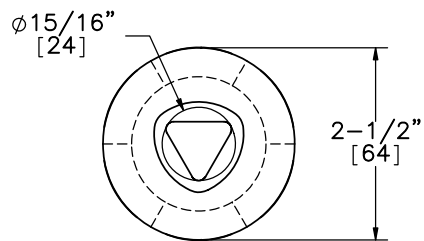
Midwest 4-Cable Barrier System

Load Cell and Turnbuckle Configuration

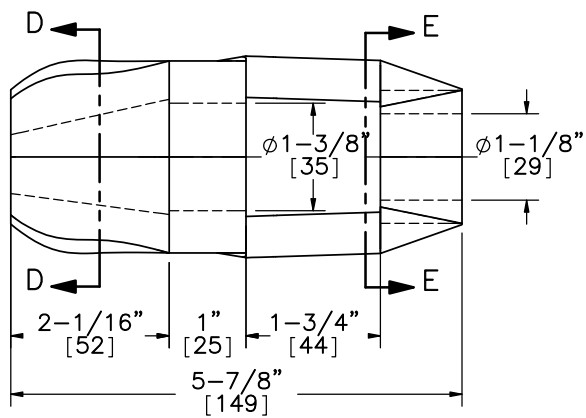
DWG. NAME:
MWP-8_R4

SCALE: 1:8
UNITS: in.[mm]

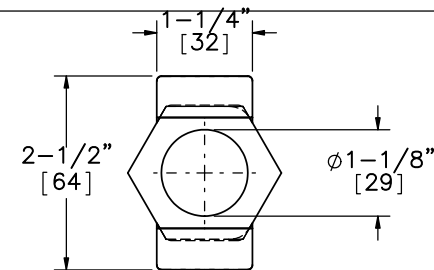
SHEET:
5 of 24
DATE:
11/01/2016
DRAWN BY:
JEK
REV. BY:
KAL



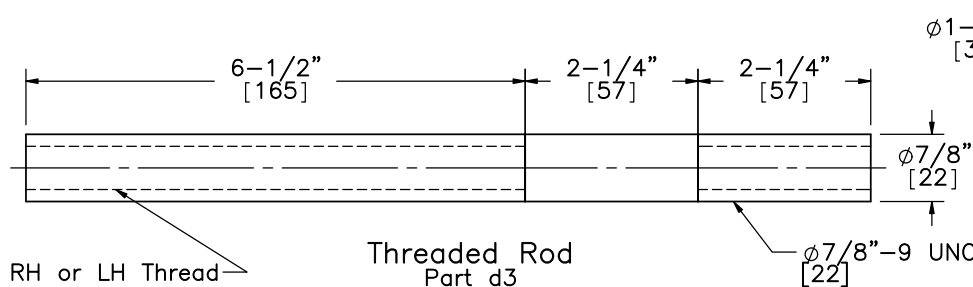
SECTION D-D



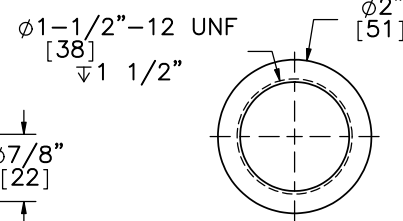
ELEVATION VIEW
Part d4



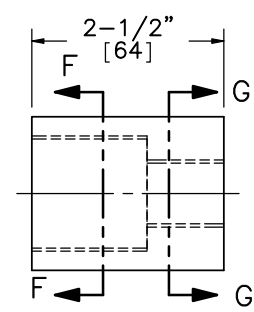
SECTION E-E



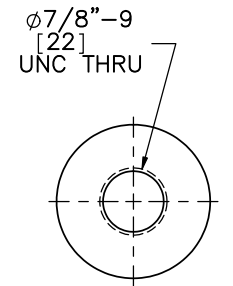
Threaded Rod
Part d3



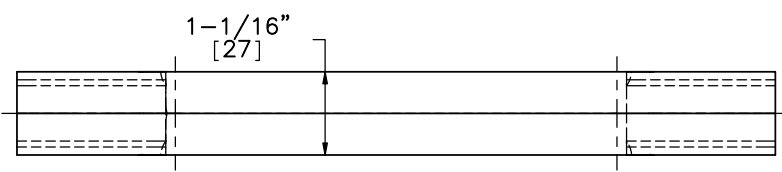
SECTION F-F



ELEVATION VIEW
Part e2

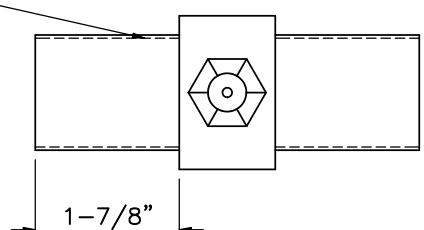


SECTION G-G

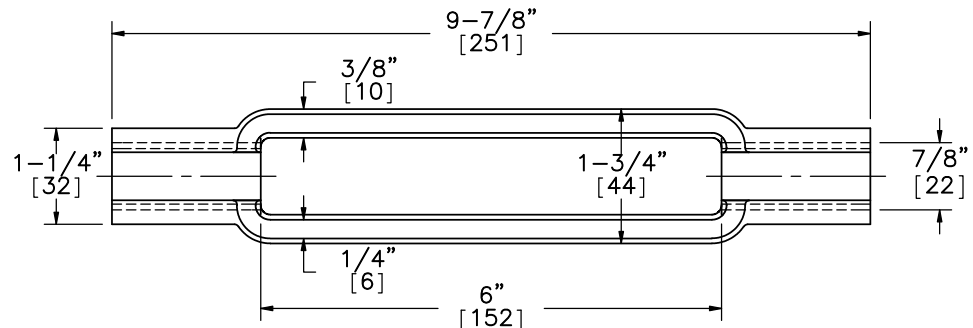
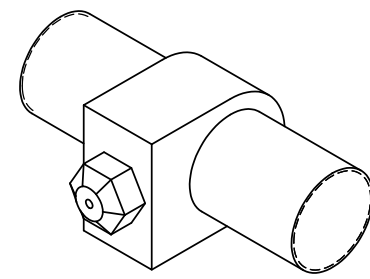


PLAN VIEW


1-1/2"-12 UNF Threaded Both Sides [38]

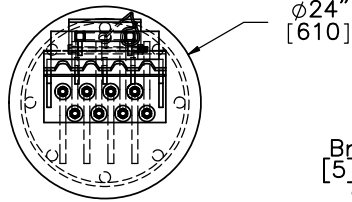


Transducer Techniques
50000-lb [222.4-kN] Rated Load Cell
Model# TLL-50K
Part e3

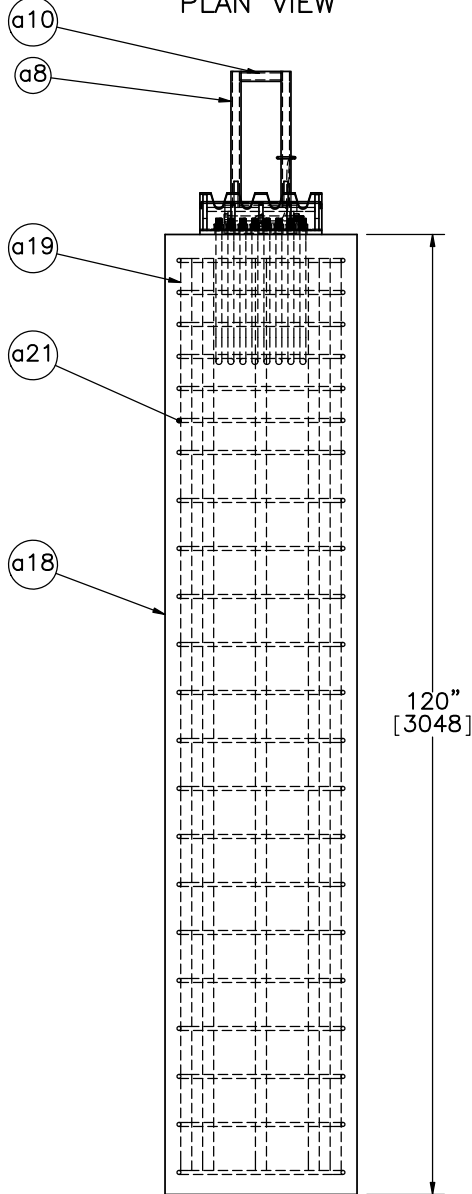


ELEVATION VIEW
Part e1

 Midwest Roadside Safety Facility	Midwest 4-Cable Barrier System	SHEET: 6 of 24
	Load Cell Assembly Component Details	DATE: 11/01/2016
DWG. NAME: MWP-8_R4	SCALE: 2:5 UNITS: in.[mm]	DRAWN BY: JEK
		REV. BY: KAL

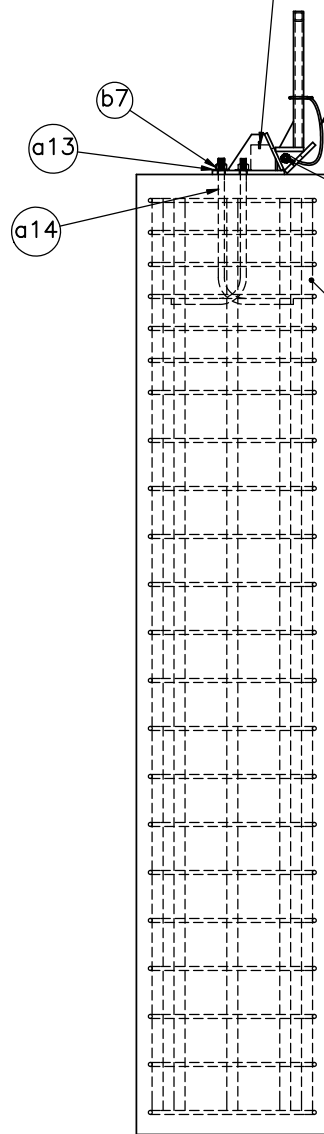


PLAN VIEW



PROFILE VIEW

Brass Keeper Rod $\phi 3/16"$
 $[5] \times 16"$ [406] long. Bend
 ends of rod to secure.
 Part a5



ELEVATION VIEW

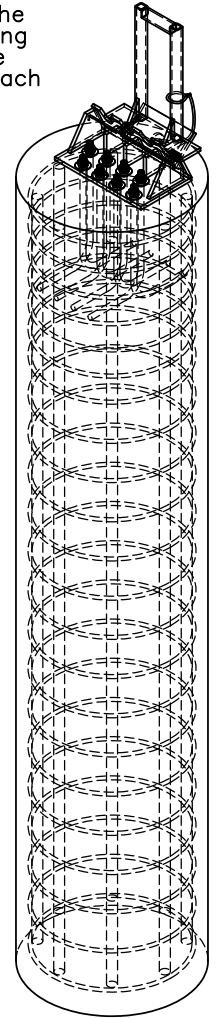
Note: Brass rod to be placed after all cables are installed and tensioned. Slide rod through the $1/4"$ [6] holes in the Anchor Bracket, leaving a minimum of $1"$ [25] on each side of the Anchor Bracket. Bend brass rod down on each side of Anchor Bracket to secure.

Aircraft Retaining Cable:
 $\phi 1/4"$ [6] 7x19 galvanized
 aircraft cable, $36"$ [914] long
 with $3, 1/2"$ [89] long loops
 and $1"$ [25] clips
 Part a15

$\phi 5/8"$ [16] hex bolt $9, 1/2"$
 $[241]$ long Part a17 with nut Part a16

Concrete

- Notes: (1) Grade 60 reinforcement, except bent anchor studs.
- (2) $1, 1/2"$ [38] clear cover on sides, $3"$ [76] on top clear cover, and $2, 1/2"$ [64] clear cover on bottom.
- (3) Eight No. 11 longitudinal bars.
- (4) 22 - No. 4 hoops with an inner diameter of $20"$ [508] at $4"$ [102] spacing for the top $24"$ [610] and subsequently at $6"$ [152] spacing until bottom clear cover.
- (5) Eight No. 6 A449 bent anchor studs having a length of $25, 9/16"$ [649].
- (6) Concrete mix for anchor and posts shall provide a minimum f'_c of 4000 psi [27.6 MPa].
- (7) The two outer bent anchor studs must be turned inward so they do not stick out of concrete cover.



ISOMETRIC VIEW



Midwest Roadside
 Safety Facility

Midwest 4-Cable Barrier
 System

Cable Anchor Detail Post Nos.
 1 & 76

DWG. NAME:
 MWP-8_R4

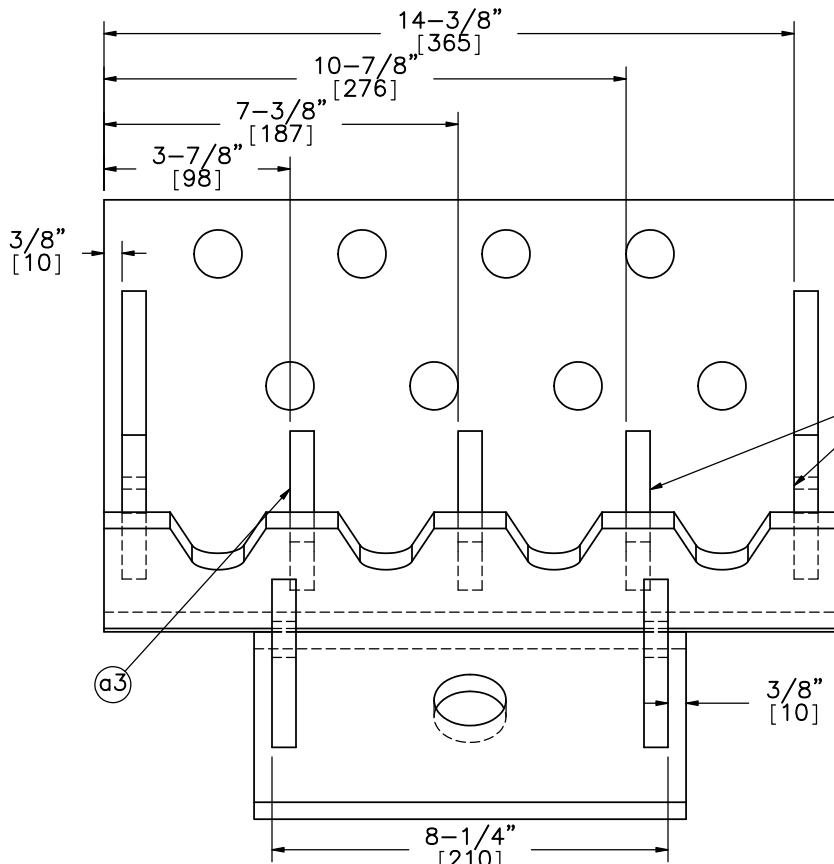
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 UNITS: in.[mm]

SHEET:
 7 of 24

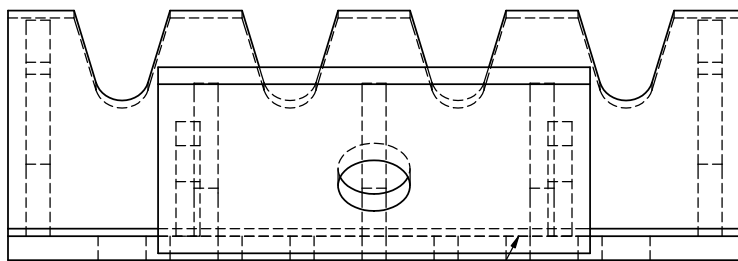
DATE:
 11/01/2016

DRAWN BY:
 JEK

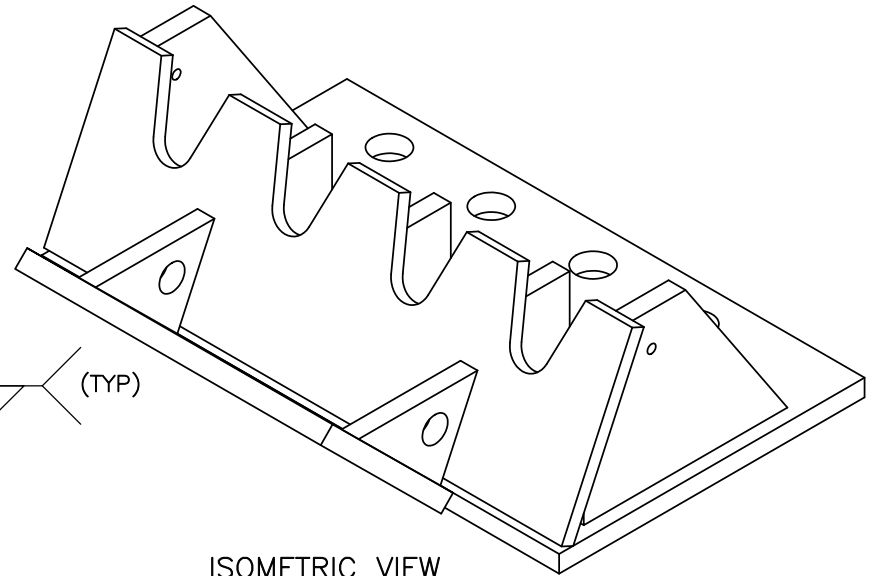
REV. BY:
 KAL



PLAN VIEW

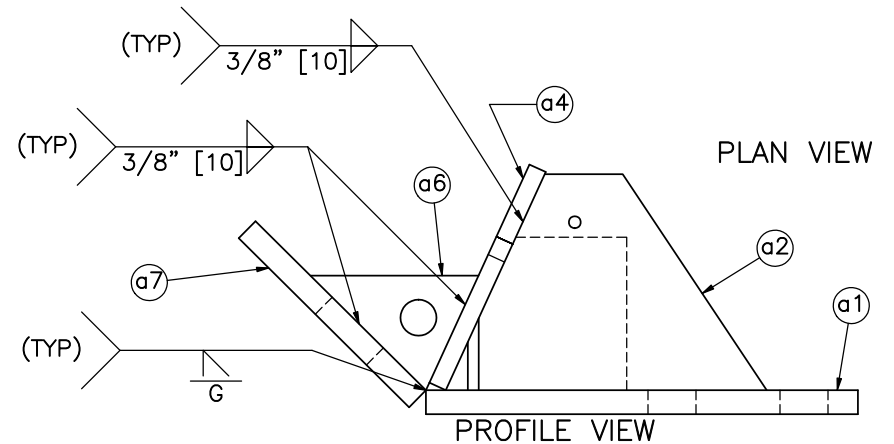


ELEVATION VIEW

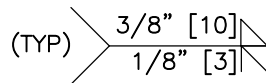


ISOMETRIC VIEW

- Notes: (1) All steel plates conform to ASTM A36.
 (2) The cable anchor bracket is to be galvanized following fabrication.



PROFILE VIEW



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Cable Anchor Bracket

DWG. NAME:
MWP-8_R4

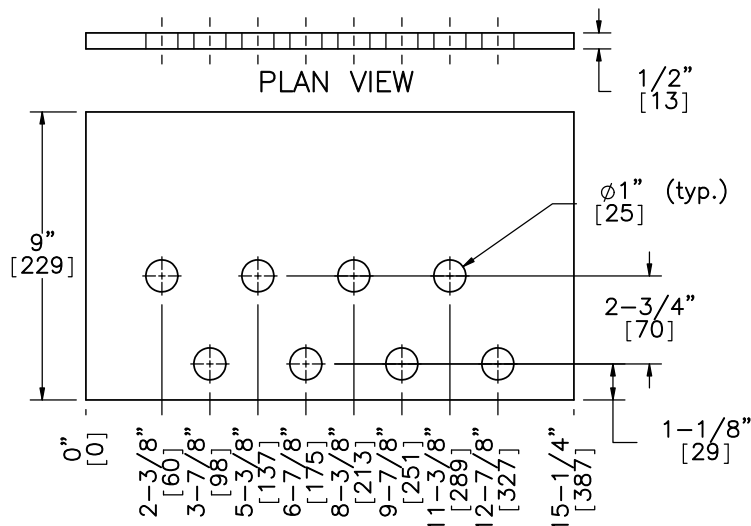
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SHEET:
8 of 24

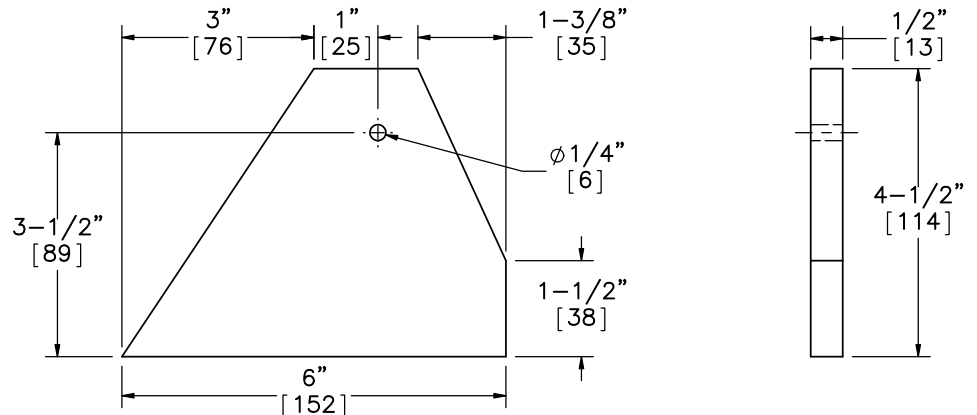
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11/01/2016

DRAWN BY:
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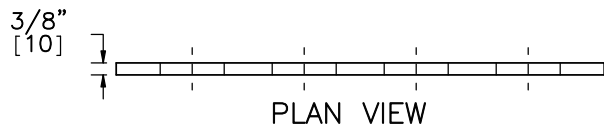
REV. BY:
KAL



Part a1



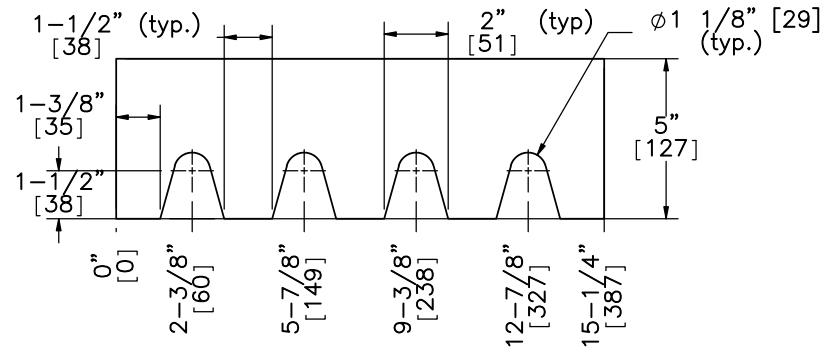
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Part a2



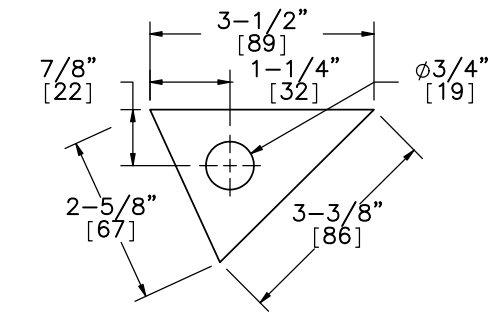
Part a3



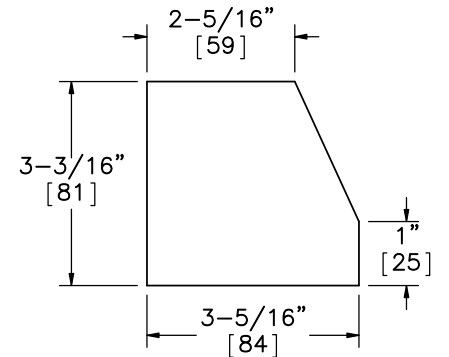
SCALE 1:3
Part a4



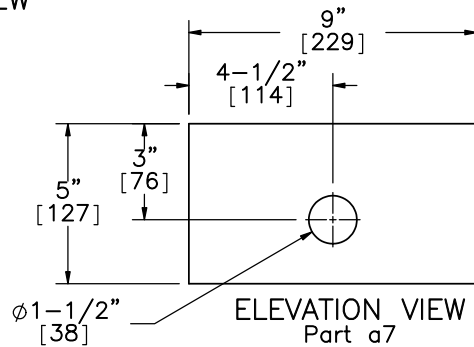
Part a5



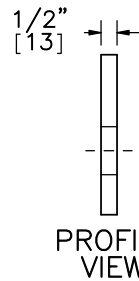
SCALE 1:3
Part a6



SCALE 1:3
Part a7



Part a8



Midwest Roadside Safety Facility

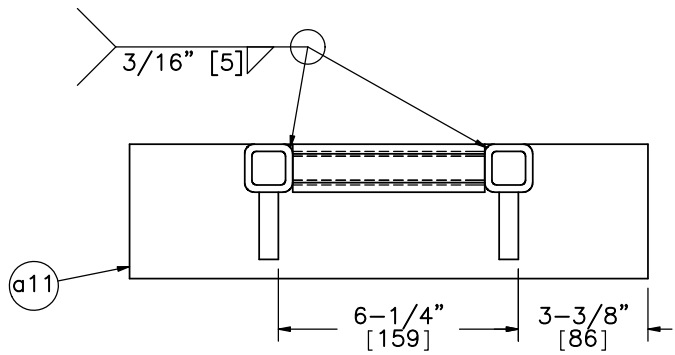
Midwest 4-Cable Barrier System

Cable Anchor Bracket Components

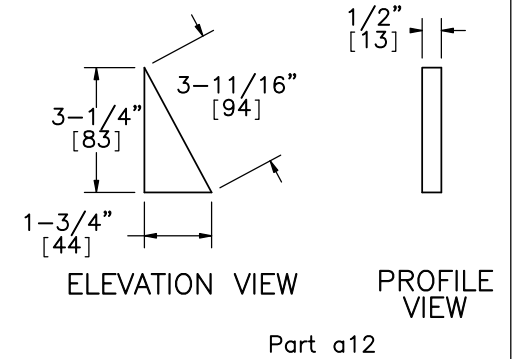
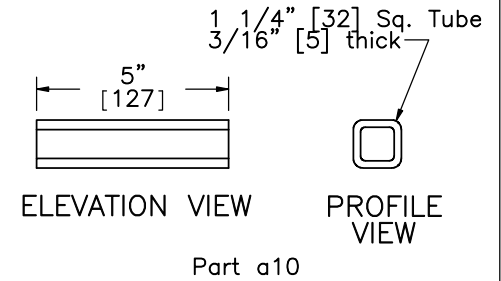
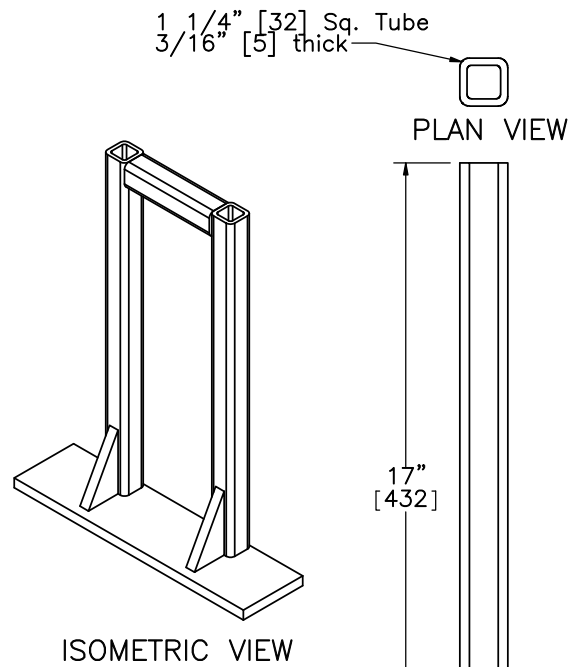
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MWP-8_R4

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UNITS: in.[mm]

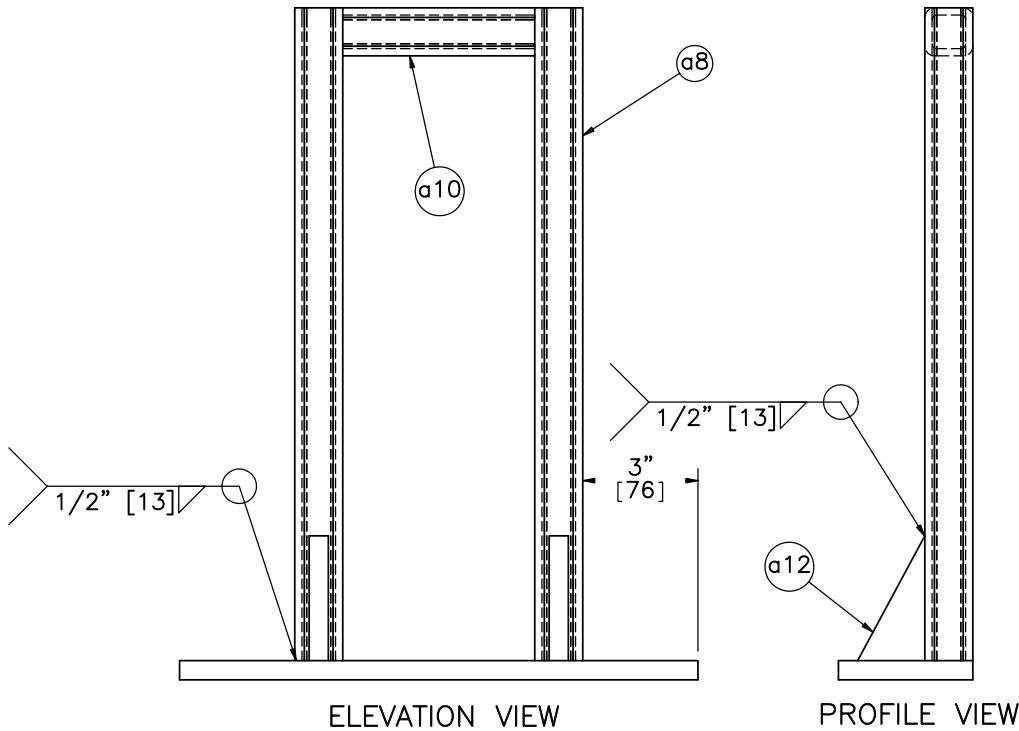
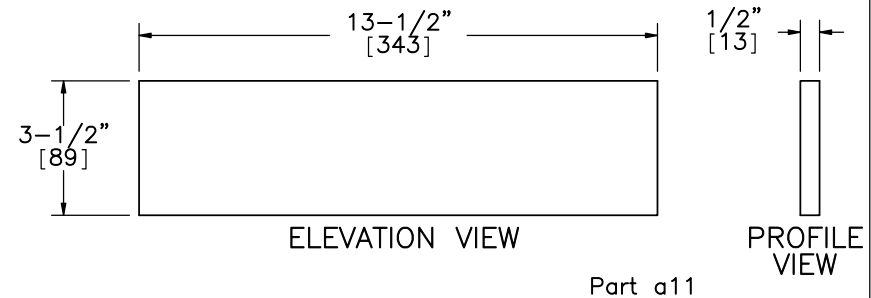
SHEET:
9 of 24
DATE:
11/01/2016
DRAWN BY:
JEK
REV. BY:
KAL



- Notes: (1) The kicker lever should be flush with the top of the kicker plate.
 (2) The 3 1/4" [83] leg of the kicker plate gusset should line up with the kicker lever.
 (3) The bottom of the cable release lever should rest upon part a6.
 (4) All steel plates conform to ASTM A36.
 (5) All steel tubing conforms to ASTM A500 Grade B.



ELEVATION VIEW
Part a8



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Cable Release Lever

DWG. NAME:
MWP-8_R4

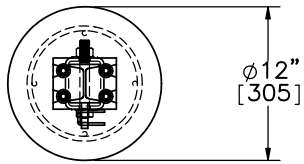
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SHEET:
10 of 24

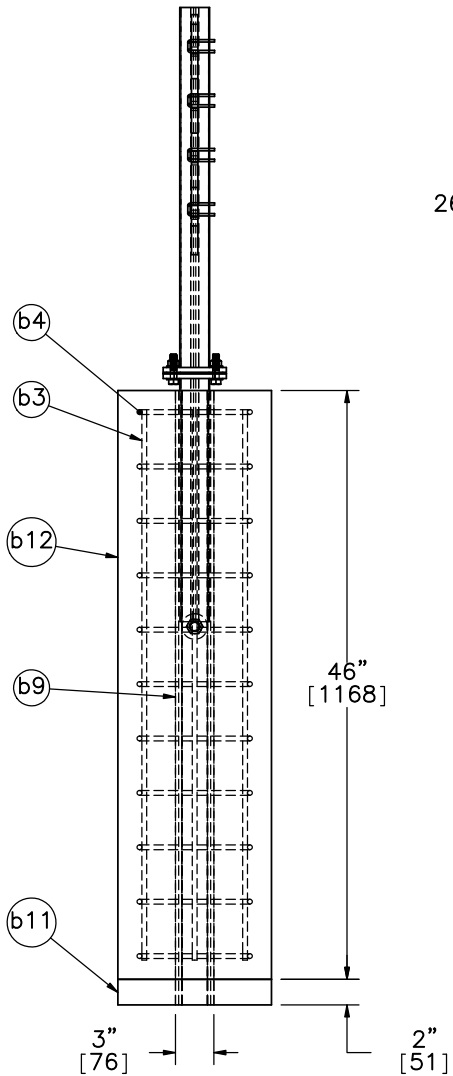
DATE:
11/01/2016

DRAWN BY:
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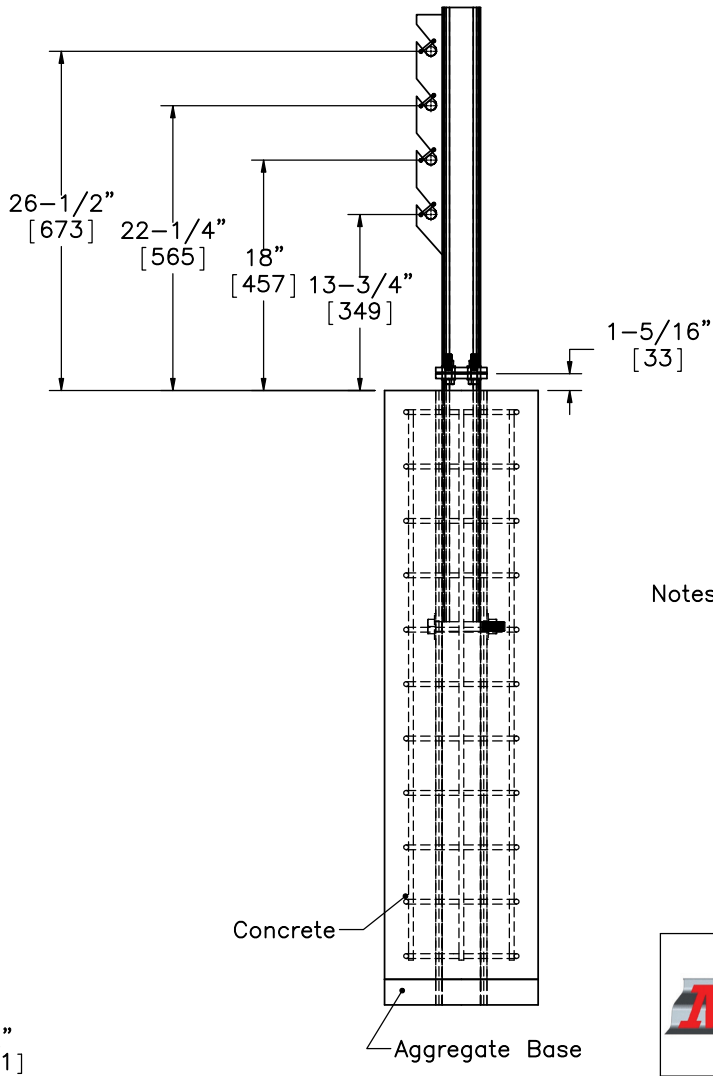
REV. BY:
KAL



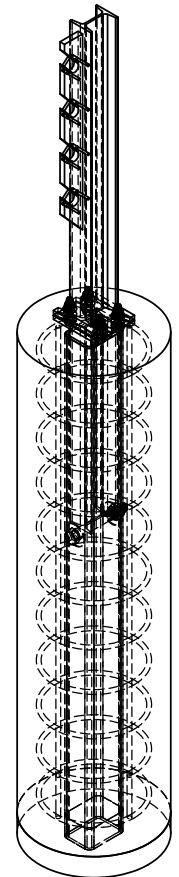
PLAN VIEW



ELEVATION VIEW



PROFILE VIEW



ISOMETRIC VIEW

- Notes:
- (1) Grade 60 Reinforcement.
 - (2) 1 1/2" [38] clear cover.
 - (3) 11 No. 3 hoops with an inner diameter of 7 1/4" [184] and a vertical spacing of 4 1/4" [108].
 - (4) 4 No. 3 longitudinal bars.
 - (5) Concrete mix for anchor posts shall provide a minimum f'_c of 4000 psi [27.6 MPa].

Cable Support Post
Post 2 & 39 Only



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Second Post Detail
Post Nos. 2 & 75

DWG. NAME:
MWP-8_R4

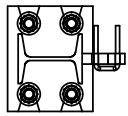
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UNITS: in.[mm]

SHEET:
11 of 24

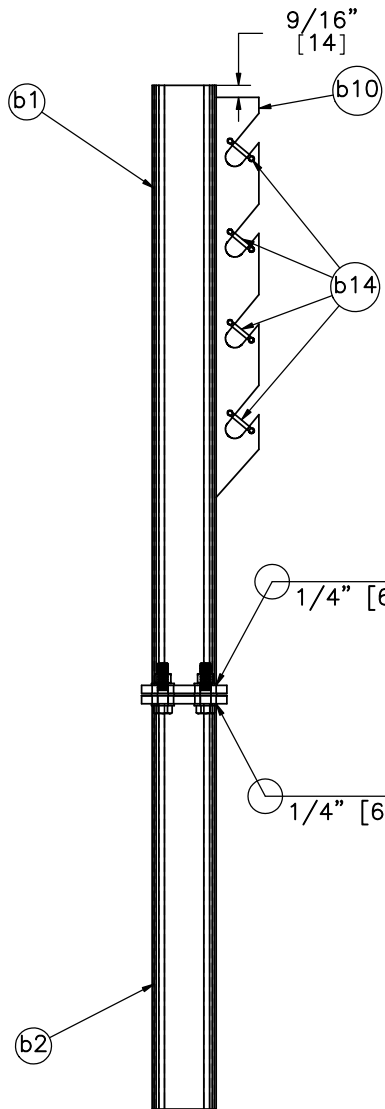
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11/01/2016

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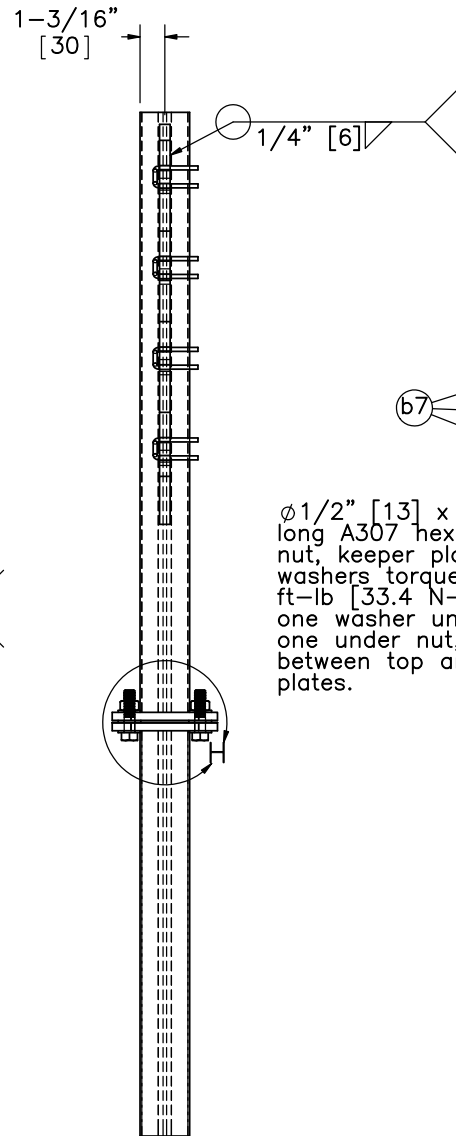
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KAL



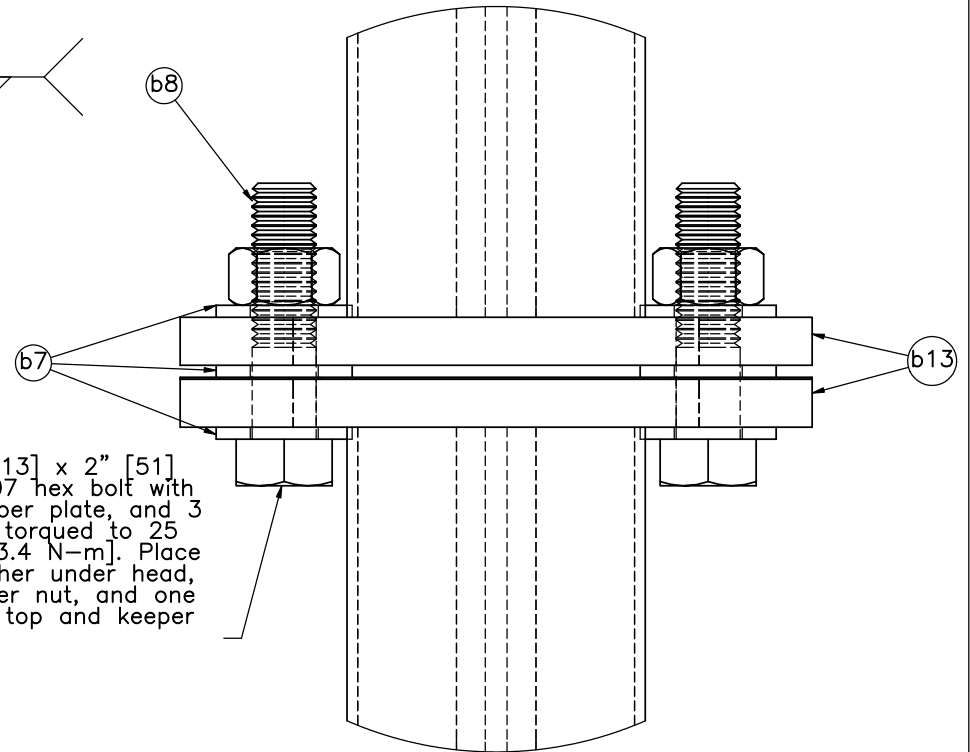
PLAN VIEW



ELEVATION VIEW



PROFILE VIEW



Ø1/2" [13] x 2" [51] long A307 hex bolt with nut, keeper plate, and 3 washers torqued to 25 ft-lb [33.4 N-m]. Place one washer under head, one under nut, and one between top and keeper plates.

DETAIL 1
SCALE 2:3

Notes: (1) Brass cable retainers (b14) should be inserted into designated holes, and the ends of the retainers should be bent to retain retainers in the holes.



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Cable Hanger Assembly Post Nos. 2 & 75

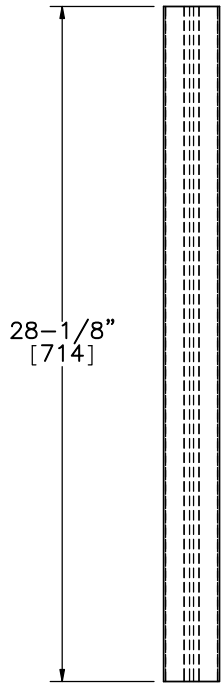
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MWP-8_R4

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UNITS: in.[mm]

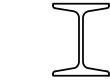
SHEET:
12 of 24
DATE:
11/01/2016
DRAWN BY:
JEK
REV. BY:
KAL



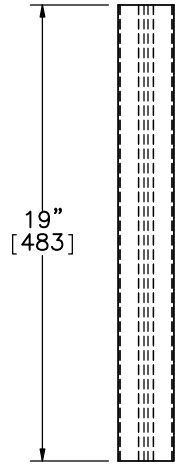
PLAN VIEW



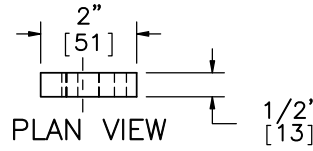
ELEVATION VIEW
Part b1



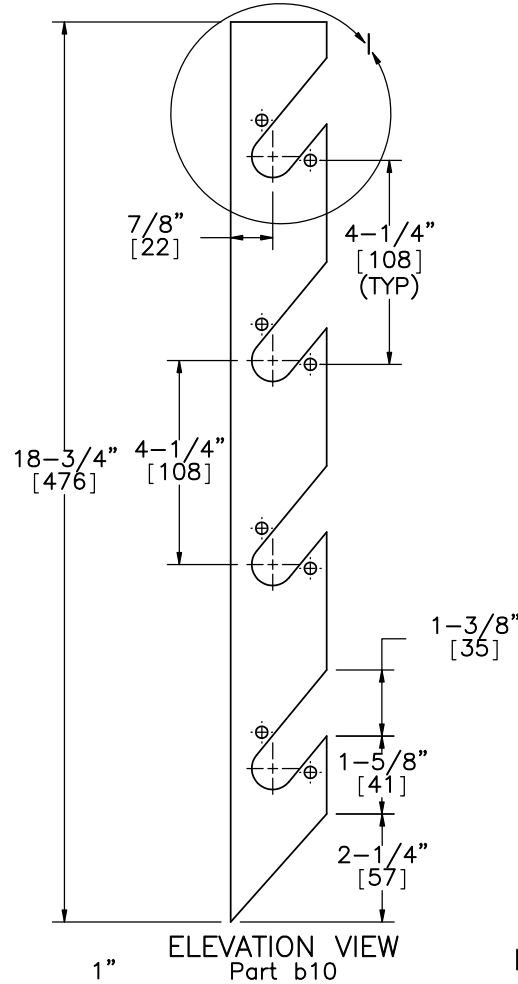
PLAN VIEW



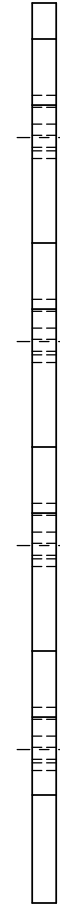
ELEVATION VIEW
Part b2



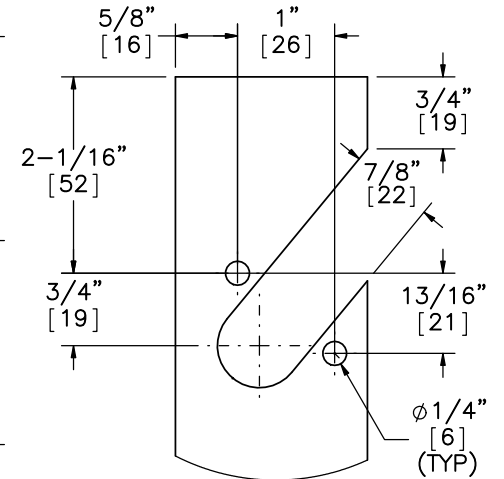
PLAN VIEW



ELEVATION VIEW
Part b10



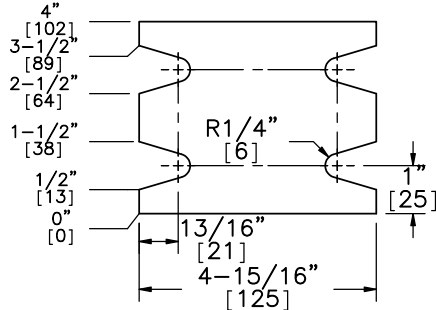
PROFILE VIEW



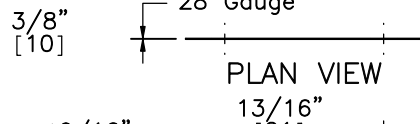
DETAIL 1
SCALE 1 : 2



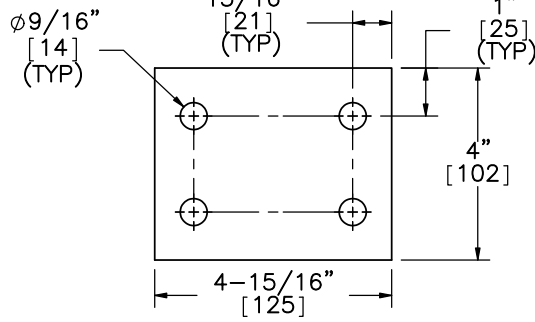
PLAN VIEW



ELEVATION VIEW
Part b13



PLAN VIEW



ELEVATION VIEW
Part b5



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Cable Hanger Assembly
Post Nos. 2 & 75

DWG. NAME:
MWP-8_R4

SCALE: 1:8
UNITS: in.[mm]

SHEET:
13 of 24

DATE:
11/01/2016

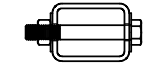
DRAWN BY:
JEK

REV. BY:
KAL

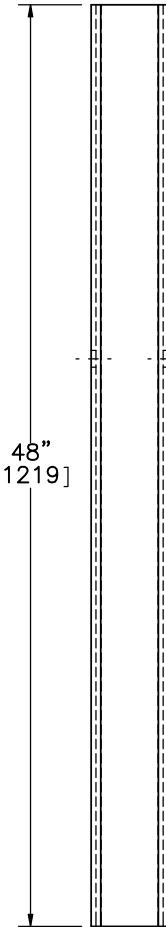
4" [102] x 3" [76] x 1/4" [6] tube
 ASTM A500 Grade B



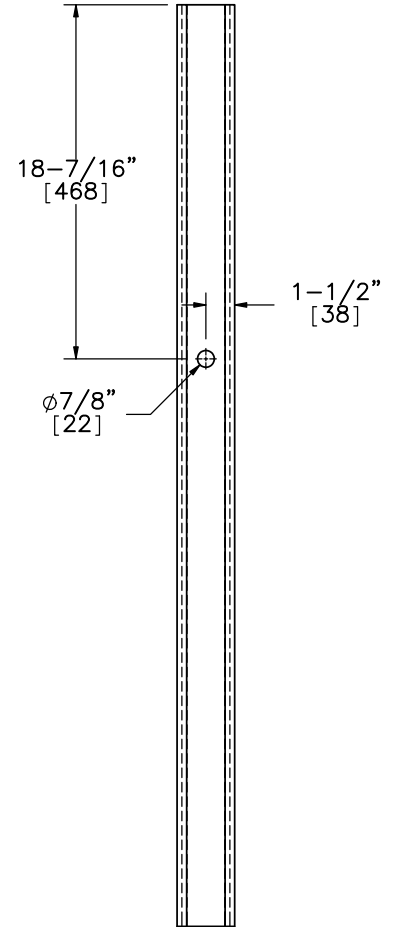
PLAN VIEW



PLAN VIEW

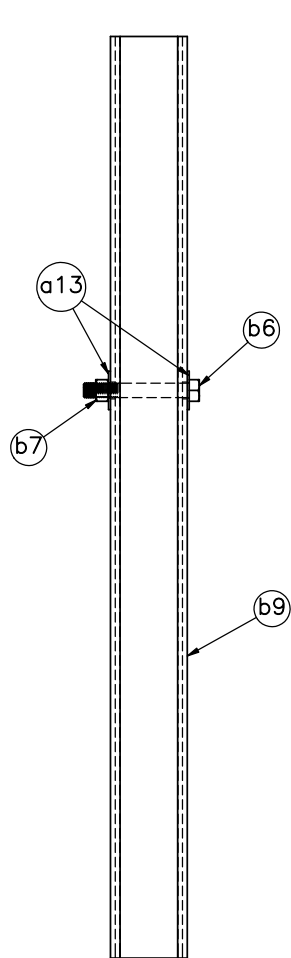


ELEVATION VIEW

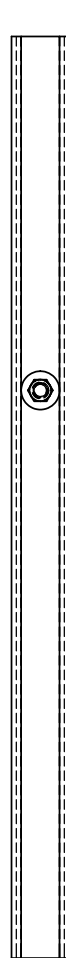


PROFILE VIEW

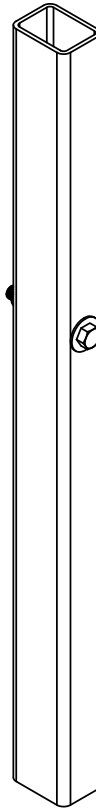
Part b9



ELEVATION VIEW



PROFILE VIEW



ISOMETRIC VIEW



Midwest Roadside
 Safety Facility

Midwest 4-Cable Barrier
 System

Foundation Tube Assembly
 Post Nos. 2 & 75

DWG. NAME:
 MWP-8_R4

SCALE: 1:10
 UNITS: in.[mm]

SHEET:
 14 of 24

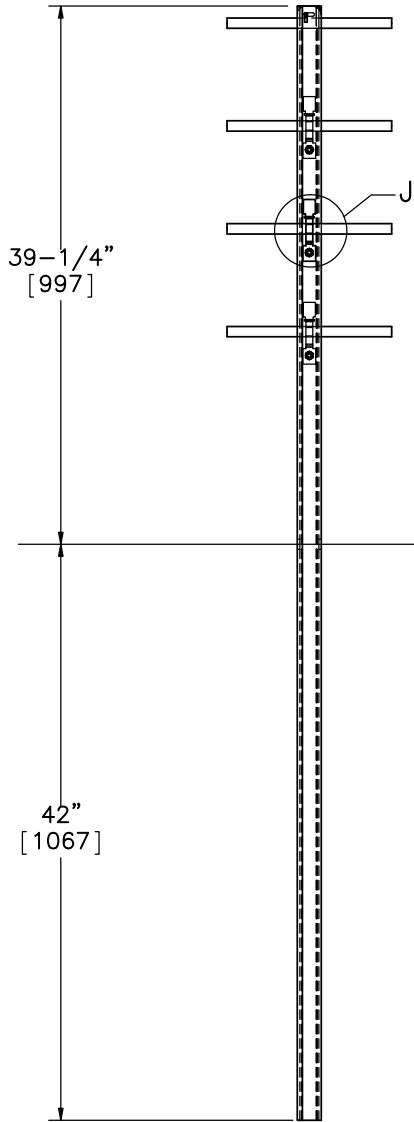
DATE:
 11/01/2016

DRAWN BY:
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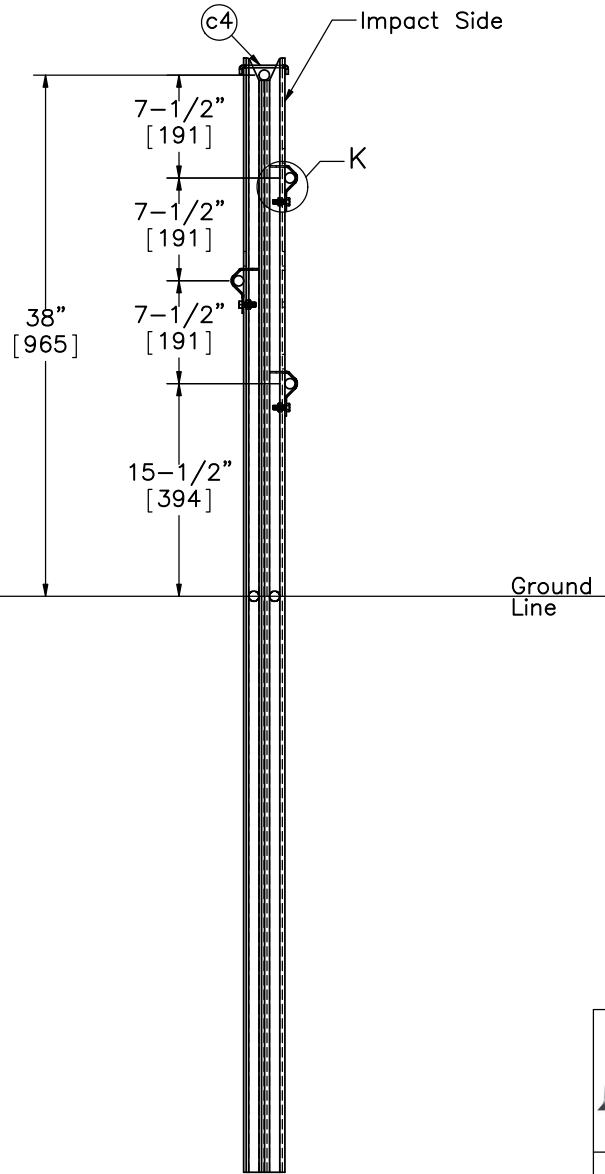
REV. BY:
 KAL



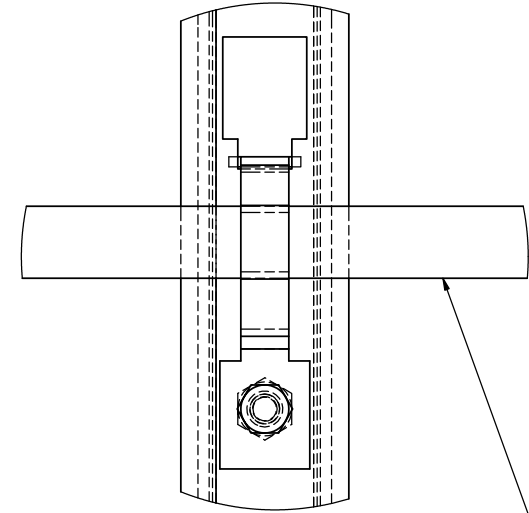
PLAN VIEW



ELEVATION VIEW

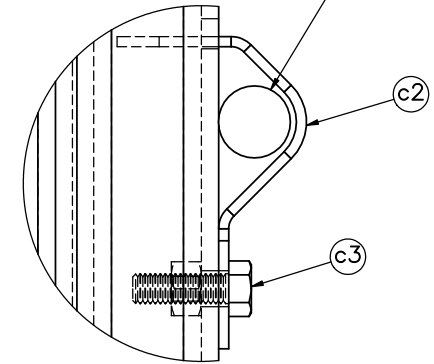


PROFILE VIEW



DETAIL J
SCALE 1 : 2

Cable



DETAIL K
SCALE 1 : 2



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Weak Post

DWG. NAME.
MWP-8_R4

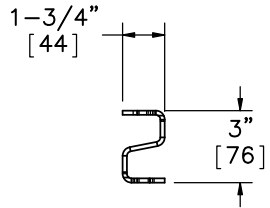
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11/01/2016

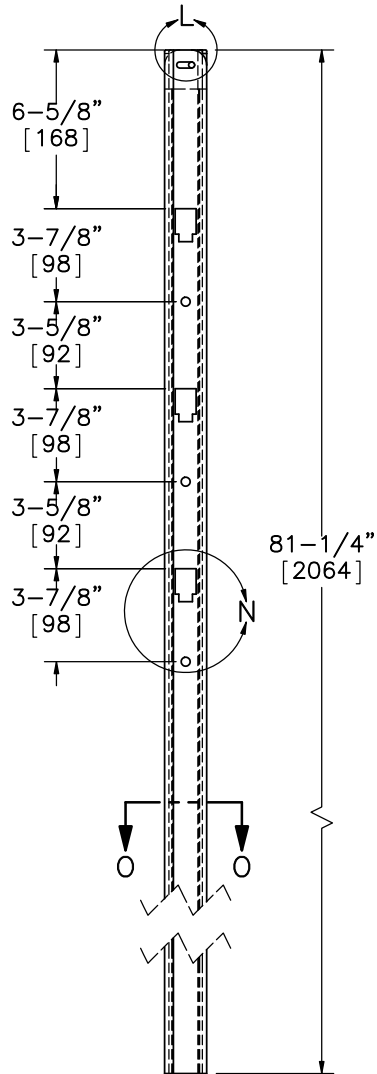
DRAWN BY:
JEK

REV. BY:
KAL

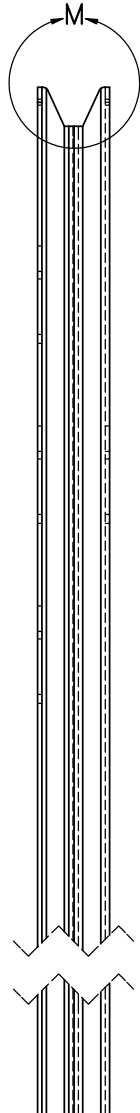


PLAN VIEW

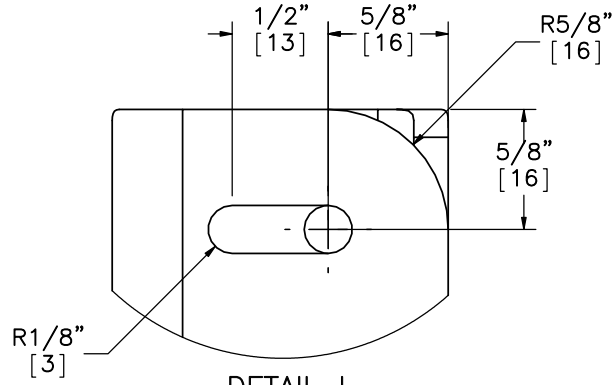
Unbent width = 7.0453"



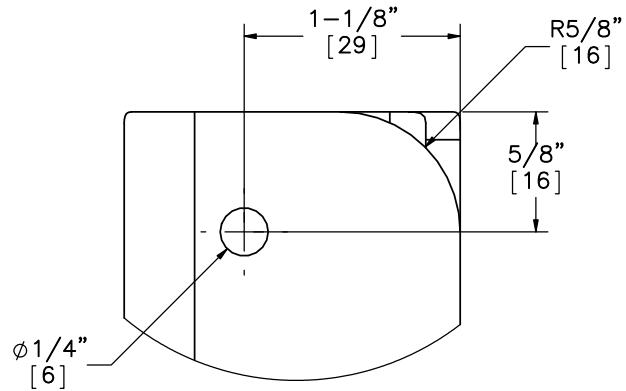
ELEVATION VIEW



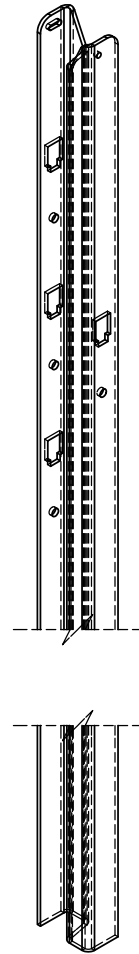
PROFILE VIEW



DETAIL L
SCALE 1 : 1



DETAIL L BACKSIDE
SCALE 1 : 1



ISOMETRIC VIEW



Midwest 4-Cable Barrier System

Midwest Roadside Safety Facility

Post Nos. 3-74

DWG. NAME.
MWP-8_R4

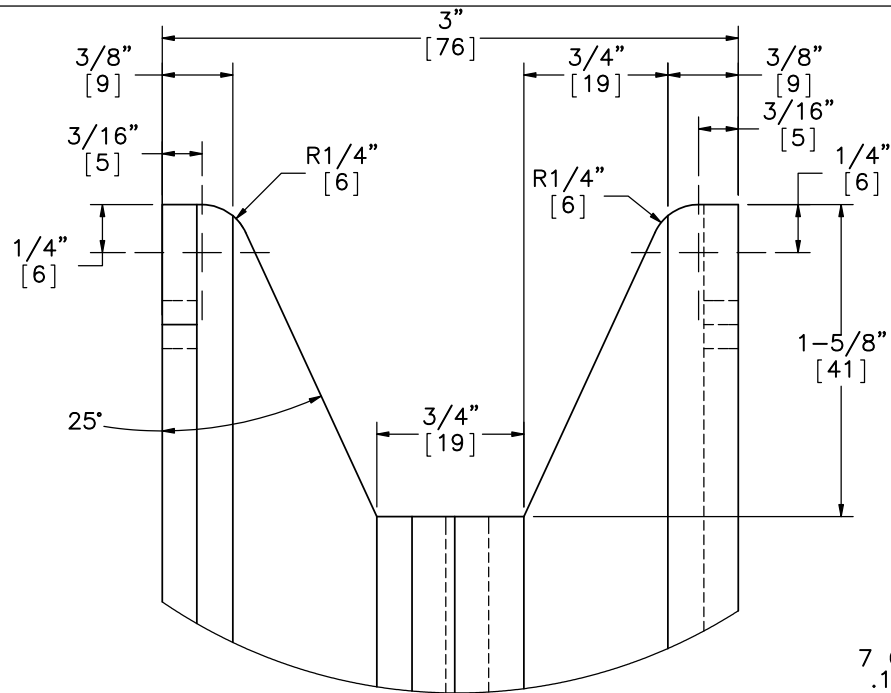
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SHEET:
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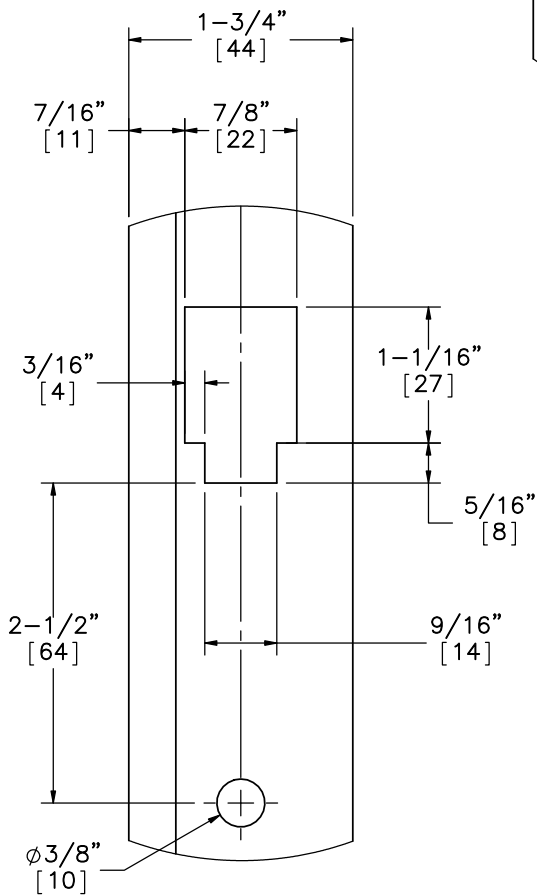
DATE:
11/01/2016

DRAWN BY:
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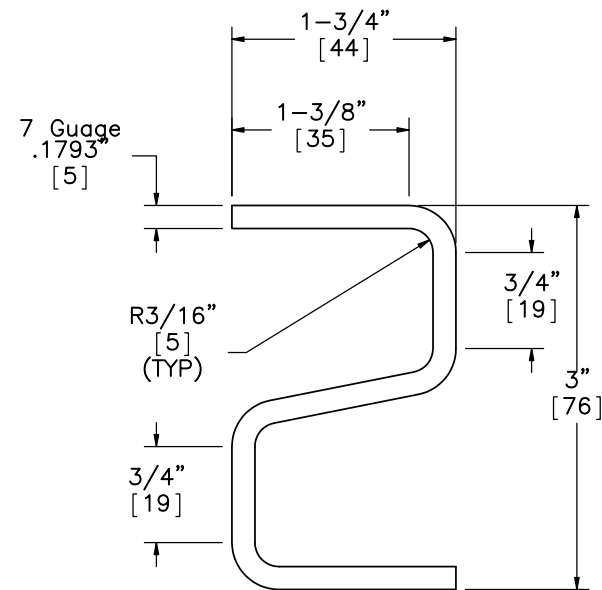
REV. BY:
KAL



DETAIL M
SCALE 1 : 1



DETAIL N



SECTION 0-0



Midwest 4-Cable Barrier System

Midwest Roadside Safety Facility

Post Nos. 3-74

DWG. NAME.
MWP-8_R4

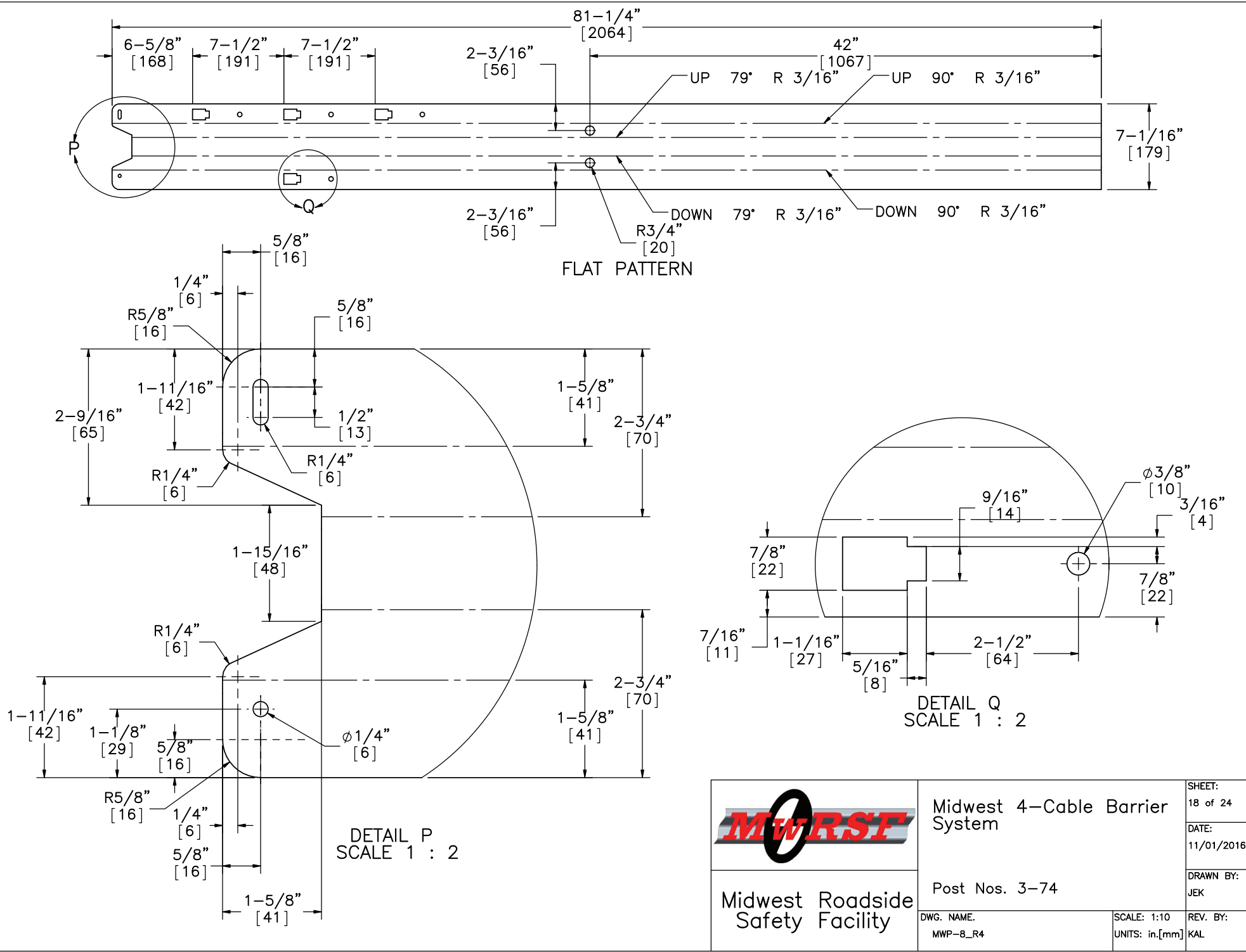
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UNITS: in.[mm]

SHEET:
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DATE:
11/01/2016

DRAWN BY:
JEK

REV. BY:
KAL



Midwest 4-Cable Barrier System

Midwest Roadside Safety Facility

Post Nos. 3-74

DWG. NAME.
MWP-8_R4

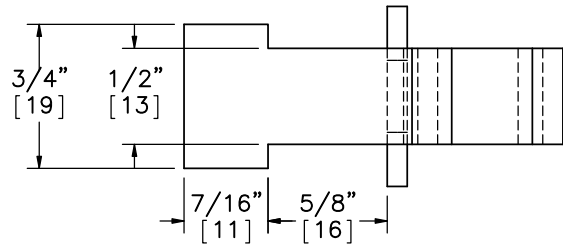
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SHEET:
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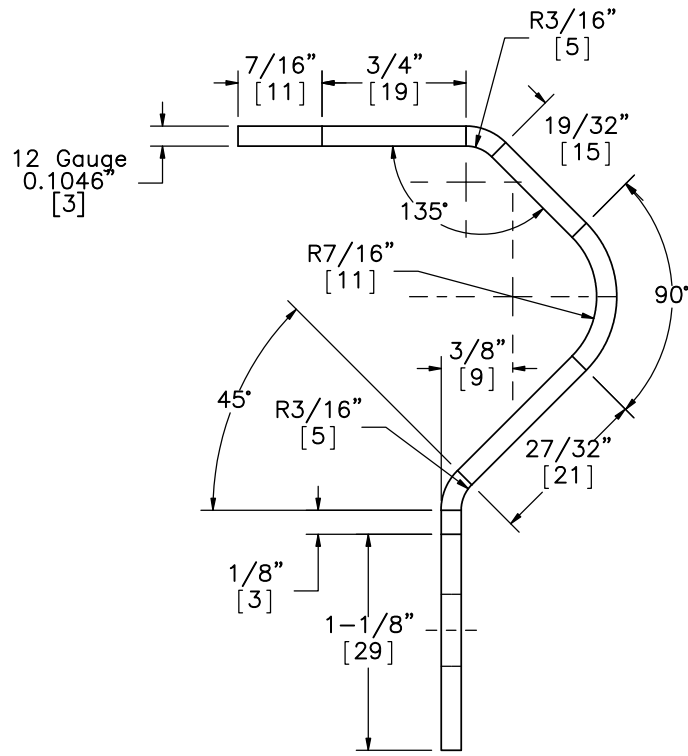
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11/01/2016

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JEK

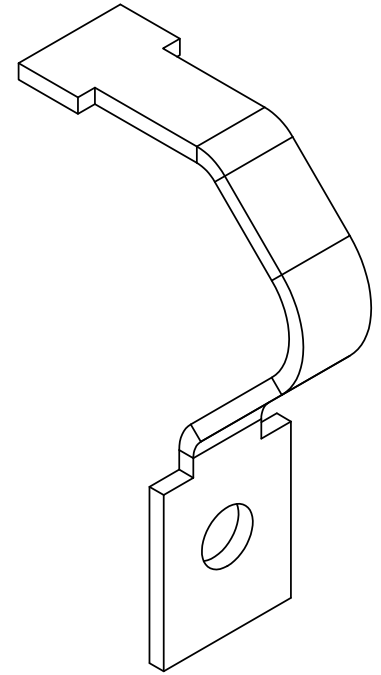
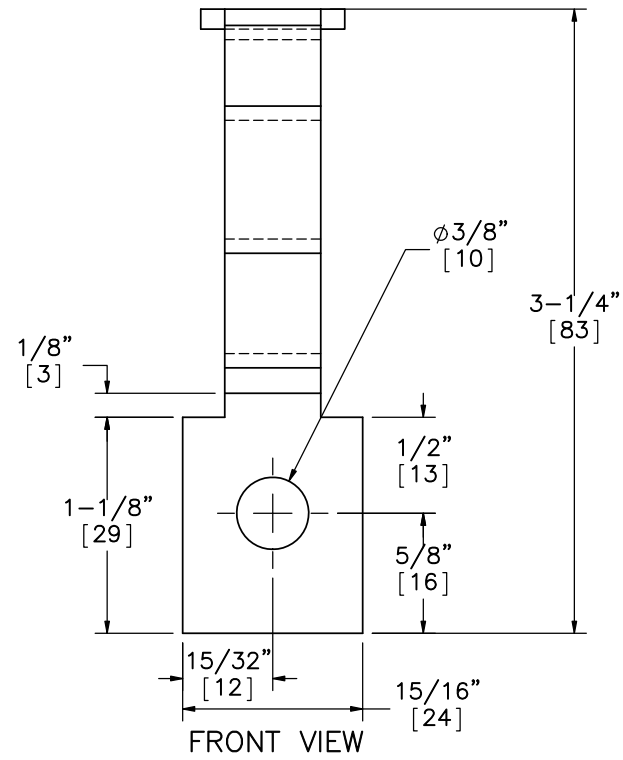
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KAL



TOP VIEW



SIDE VIEW
Tabbed Bracket Version 10
Part c2



ISOMETRIC VIEW



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Tabbed Bracket Version 10
(12 Gauge)

DWG. NAME:
MWP-8_R4

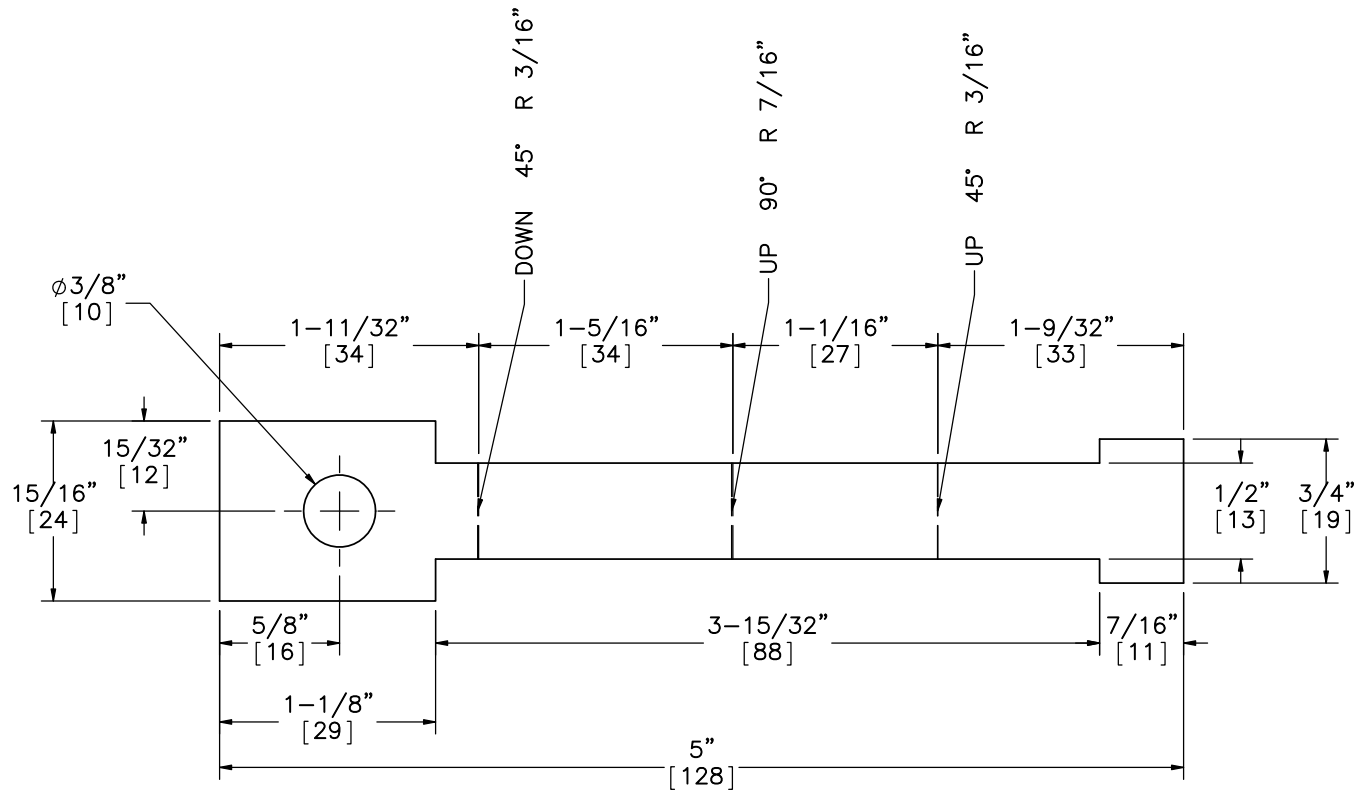
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UNITS: in.[mm]

SHEET:
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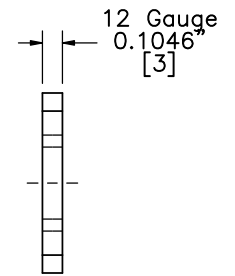
DATE:
11/01/2016

DRAWN BY:
JEK

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KAL



FLAT PATTERN FRONT/BACK
 Tabbed Bracket Version 10
 Part c2



FLAT PATTERN
 SIDE VIEW



Midwest Roadside
 Safety Facility

Midwest 4-Cable Barrier
 System

Tabbed Bracket Version 10
 Flat Pattern

DWG. NAME:
 MWP-8_R4

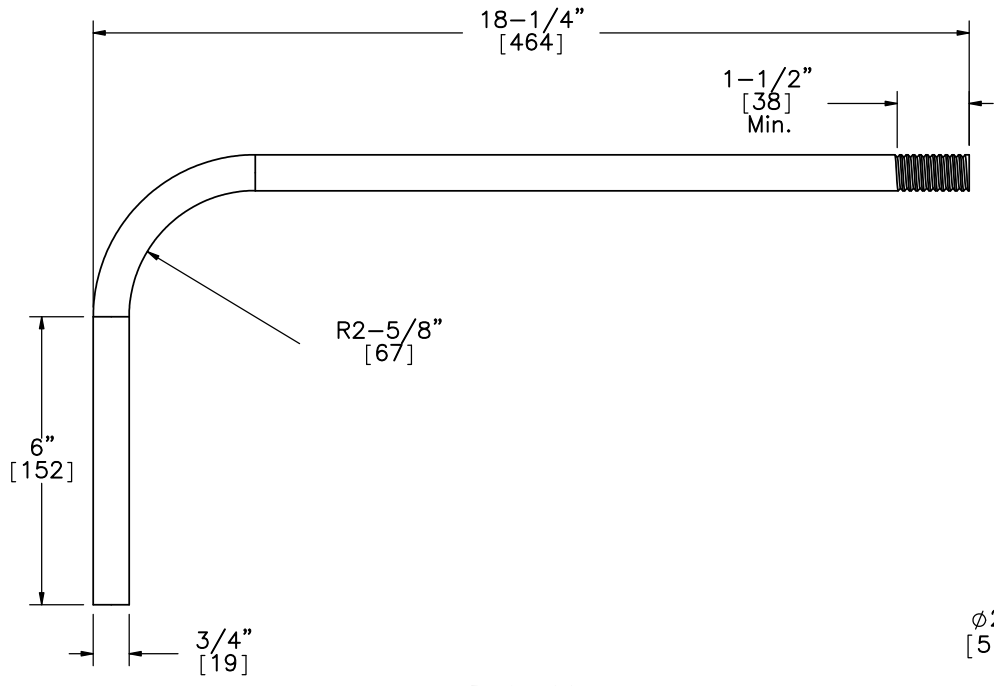
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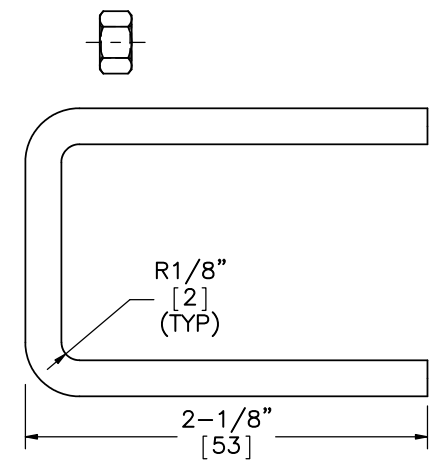
DATE:
 11/01/2016

DRAWN BY:
 JEK

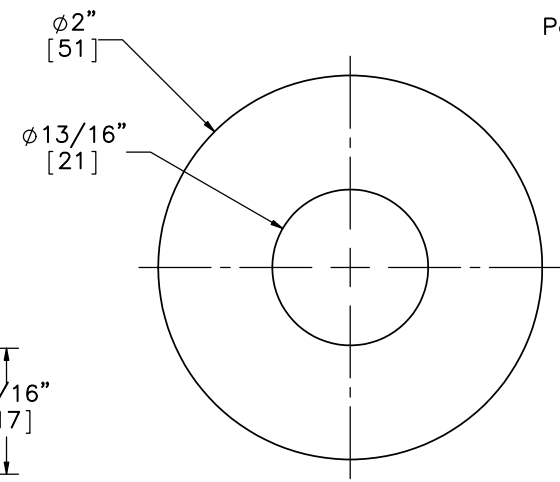
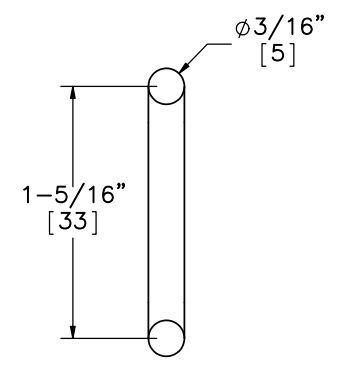
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 KAL



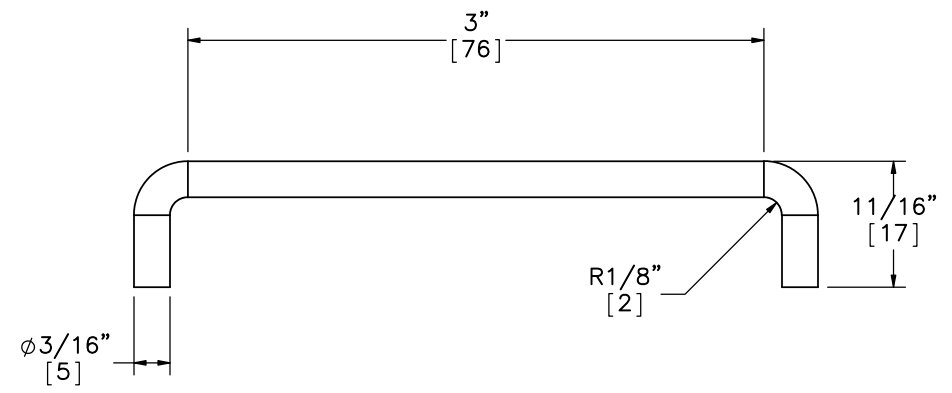
Part a14
SCALE 1:4



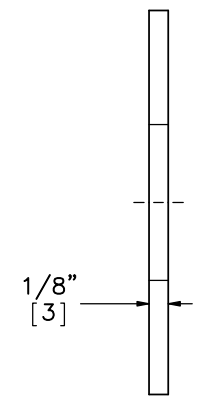
Part b14




Part a13

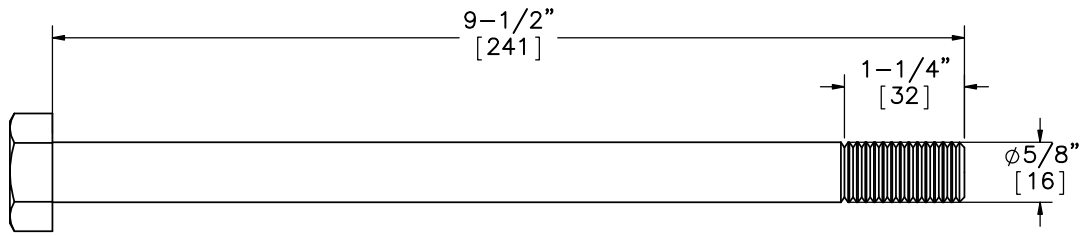


Part c4

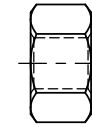


Note: (1) Total length of part a14 is 25 9/16" [649].
 (2) Total length of part c4 is 4 1/4" [108].

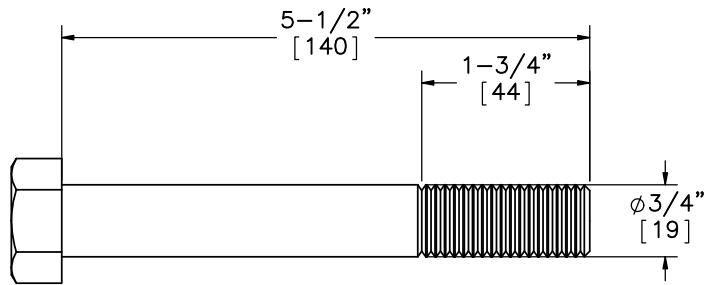
	Midwest 4-Cable Barrier System	SHEET: 21 of 24
		DATE: 11/01/2016
Midwest Roadside Safety Facility	J-Hook Anchor and Brass Cable Clip	DRAWN BY: JEK
DWG. NAME: MWP-8_R4	SCALE: 1:1 UNITS: in.[mm]	REV. BY: KAL



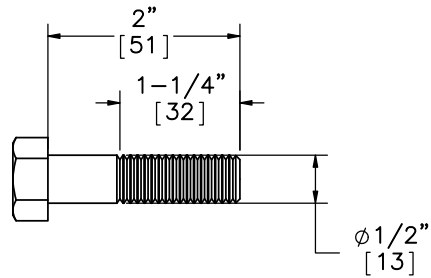
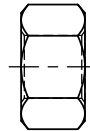
Part a17



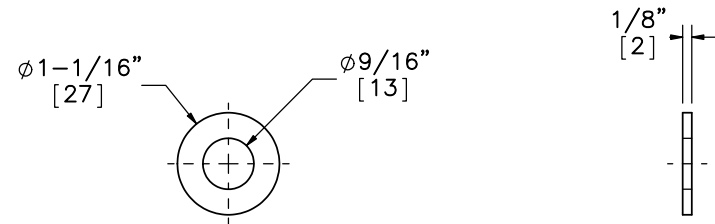
Part a16



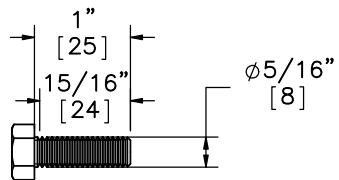
Part b6



Part b8



Part b7



Part c3



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Hardware

DWG. NAME:
MWP-8_R4

SCALE: 1:2
UNITS: in.[mm]

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11/01/2016

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JEK

REV. BY:
KAL

Item No.	QTY.	Description	Material Specification
a1	2	Cable Anchor Base Plate	ASTM A36
a2	4	Exterior Cable Plate Gusset	ASTM A36
a3	6	Interior Cable Plate Gusset	ASTM A36
a4	2	Anchor Bracket Plate	ASTM A36
a5	2	3/16" [5] Dia. Brass Keeper Rod, 14" [356] long	Brass
a6	4	Release Gusset	A36 Steel
a7	2	Release Lever Plate	A36 Steel
a8	4	1.25x1.25x0.1875" [32x32x5] TS CT Kicker Lever Tube	ASTM A500 Gr. B
a9	8	CMB High Tension Anchor Plate Washer	ASTM A36
a10	2	1.25x1.25x0.1875" [32x32x5] TS CT Kicker Lever Connecting Tube	ASTM A 500 Gr. B
a11	2	3x10x0.5" [76x254x13] Kicker Plate	ASTM A36
a12	4	CT kicker – gusset	ASTM A36
a13	20	3/4" [19] Dia. Flat Washer	ASTM F844
a14	16	3/4" [19] Dia. UNC J–Hook Anchor and Hex Nut	J–Hook ASTM A449/Nut ASTM A563 DH
a15	2	1/4" [6] Dia. Aircraft Retaining Cable, 36" [914] long	7x19 Galv.
a16	2	5/8" [16] Dia. Heavy Hex Nut	ASTM A563C
a17	2	5/8" [16] Dia. UNC, 9 1/2" [241] Long Hex Bolt	ASTM A449 or SAE J429 Gr. 5
a18	2	24" [610] Dia. Concrete Anchor, 120" [3048] long	4,000 psi f'c
a19	16	#11 Straight Rebar, 114" [2896] long	Grade 60
a20	44	#4 Anchor Hoop Rebar with 21" [533] Dia.	Grade 60
b1	2	S3x5.7 [S76x8.5] Post by 28 1/8" [714]	ASTM A572 GR50–07, ASTM A709 GR50–09A, ASTM A992–06A
b2	2	S3x5.7 [S76x8.5] Post by 19" [483]	ASTM A572 GR50–07, ASTM A709 GR50–09A, ASTM A992–06A
b3	8	#3 Straight Rebar, 43" [1092] long	Grade 60
b4	22	7 1/4" [184] Dia. No. 3 Hoop Reinforcement	Grade 60
b5	2	2nd Post Keeper Plate, 28 Gauge	ASTM A36
b6	2	3/4" [19] Dia. UNC, 5 1/2" [140] Long Hex Bolt and Nut	Bolt ASTM A307 Gr. A/Nut ASTM A563A
b7	24	1/2" [13] Dia. Washer with 1 1/16" [27] OD	ASTM F844
b8	8	1/2" [13] Dia. UNC, 2" [51] long Hex Bolt and Nut	Bolt ASTM A307 Gr. A/Nut ASTM A563A
b9	2	4x3x1/4" [102x76x6] Foundation Tube, 48" [1168] long	ASTM A500 Grade B
b10	2	2nd Post Cable Hanger	ASTM A36
b11	2	2nd Post Anchor Aggregate 12 in, Depth	–
b12	2	12" Dia. 2nd Post Concrete Anchor, 46" long	4,000 psi f'c
b13	4	2nd Post Base Plate	ASTM A36
b14	8	3/16" [5] Dia. 5 1/4" [133] Long Brass Rod	ASTM B16–00



Midwest Roadside
Safety Facility

Midwest 4–Cable Barrier
System

Bill of Materials

DWG. NAME.
MWP–8_R4

SCALE: NONE
UNITS: in.[mm]

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11/01/2016
DRAWN BY:
JEK
REV. BY:
KAL

Item No.	QTY.	Description	Material Spec
c1	72	3"x1-3/4"x7 Gauge [76x44x4.6], 81 1/4" [2064] Long Midwest Weak Post w/Holes	Hot-Rolled ASTM A1011 HSLA Gr. 50
c2	216	12 Gauge Tabbed Bracket – Version 10	Hot-Rolled ASTM A1011 HSLA Grade 50
c3	216	5/16" [8] Dia. UNC, 1" [25] Long Hex Cap Screw and Nut	Bolt SAE J429 Gr. 5 or ASTM A449/Nut ASTM A563 DH
c4	72	Straight Rod – ϕ 3/16" [5] Cable Clip	ASTM B16 Brass C36000 Half Hard (H02), ROUND. TS \geq 68.0 ksi, YS \geq 52.0 ksi
d1	1	3/4" [19] Dia. 3x7 Cable Guiderail	AASHTO M30-92(2000)/ASTM A741-98 Type 1 Class A coating except with Type 1 minimum breaking strength = 39 kips [173.5 kN]
d2	16	7/8" [22] Dia. Hex Nut	ASTM A563C
d3	28	Cable End Threaded Rod	ASTM A449
d4	24	Bennett Cable End Fitter	ASTM A47
d5	24	7/8" [22] Dia. Hex Nut	SAE J429 Gr. 5
e1	8	Bennett Short Threaded Turnbuckle	Not Specified
e2	8	Threaded Load Cell Coupler	N/A
e3	4	50,000-lb [222.4-kN] Load Cell	N/A



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Bill of Materials

DWG. NAME.
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JEK
REV. BY:
KAL

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	8/27/2015	-	Originated from drawing MWP-7_R2.	-	JEK
1	8/27/2015	18	Post groundline hole dimension added.	KAL	JEK
		24	Part c1 description change.		
2	2/15/2015	-	Corrected several misspelled words	CG	JAH
3	9/30/2016	-	General text edits.	KAL	JEK
		15	Label added to part c4.		
4	11/1/2016	1	Corrected impact location.	KAL	JEK