TEST REPORT ON

26 GA. PBR PANELS
AT 5' 0" PURLIN SPACING
WITH 26 GA. SEALED 'N' SAFE™ THERMAL BLOCKS
USING 10" DEEP, 12 GA. ZEE PURLINS
IN ACCORDANCE WITH AISI S908-08

TESTED FOR:
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TEST WITNESSED BY:
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TESTING DATE: October 31, 2013
REPORTING DATE: November 14, 2013
ENCON® Project C1935-1

ACCREDITED
TL-327

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TEST SUMMARY

1.1 SUMMARY

Tests were conducted on PBR metal roof panels at ENCON® Technology, Inc. Test Facility, Tulsa, Oklahoma. The purpose of the tests was to obtain the modification factor 'R_t' to be used in determining the nominal flexural strength of the purlin supporting the PBR roof system fastened to the purlins through blanket insulation and Sealed 'N' Safe™ thermal block. These tests meet the provisions of AISI S908-08 *"Base Test Method for Purlins Supporting a Standing Seam Roof System"*. The tests are listed below according to their configurations and date tested.

Test #1: Nom. 10" x 2.5" x 12 ga., 55 ksi zee purlin supporting PBR panel at 5' 0" purlin spacing and 30' 0" purlin span. The purlins were attached to the support beam with CO Building's anti-roll purlin clips, plate and (2) bolts. Plate (7" x 5" x 0.25" thick) was inserted between purlin and anti-roll clip. Bracing option 4 was bolted to the purlins at midspan with 2 bolts. The gravity load test was conducted on October 31, 2013.

Test #2: Nom. 10" x 2.5" x 12 ga., 55 ksi zee purlin supporting PBR panel at 5' 0" purlin spacing and 30' 0" purlin span. The purlins were attached to the support beam with CO Building's anti-roll purlin clips, plate and (2) bolts. Plate (7" x 5" x 0.25" thick) was inserted between purlin and anti-roll clip. Bracing option 5 was bolted to the purlins at midspan with 2 bolts. The gravity load test was conducted on October 31, 2013.

The zee purlins were manufactured by Alliance Steel, Inc. and provided by CO Building Systems, Inc. The above defined tests were witnessed by Bala Sockalingam, Ph.D., P.E., of ENCON Technology.

1.2 ROOF SYSTEM DESCRIPTION

PBR panels are 26 ga., 1-1/4" high and 36" wide through fastened panels. Each panel consists of four major ribs spaced at 12" o.c. as shown on Page 3.

The panels were attached to zee purlins through the 4" thick blanket insulation and Sealed 'N' Safe™ thermal block with #12 x 2" long hex head self-drilling screws with washers. The sidelap fasteners were #14 x 7/8" long hex head self-drilling screws with washers and spaced at 12" o.c. for all tests. Each panel spanned over a simple span of 5' 0" with an overhang of 12" on either side. The purlin flanges faced the same direction and the top of the flange was not braced externally. Two types of midspan bracing were used in these testing as shown on Page 4.

Sealed 'N' Safe™ thermal blocks consisted of two 26 ga. steel profiles with polyurethane foam injected between the profiles to form a 1" thick block. The length and width of these thermal blocks were 72" and 2.5", respectively. The blocks were fastened to the supports with #12 x 1-5/8" long pancake head self-drilling screws located at each end of the blocks.

1.3 TEST RESULTS

Load was applied incrementally and horizontal and vertical deflections of the test construction were recorded for 'no load' condition and at each load increment. The test results and the modification factor 'R_t' for above tests are shown on Table 1.

Table 1: Purlin Base Test Results

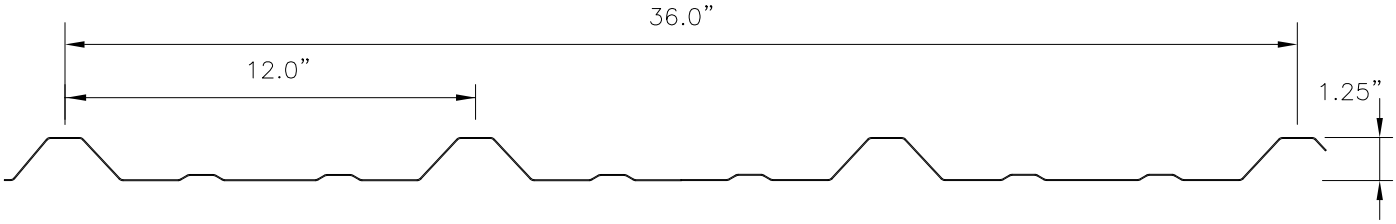
No.	Purlin	Span (ft)	Loading	Bracing	Purlin Attachment At Support	Failure Mode	Modification Factor R_t
1	10Z12	30	Gravity	Bracing 4	PS2	Top flange buckled	0.88
2	10Z12	30	Gravity	Bracing 5	PS2	Top flange buckled	0.91

Notes:

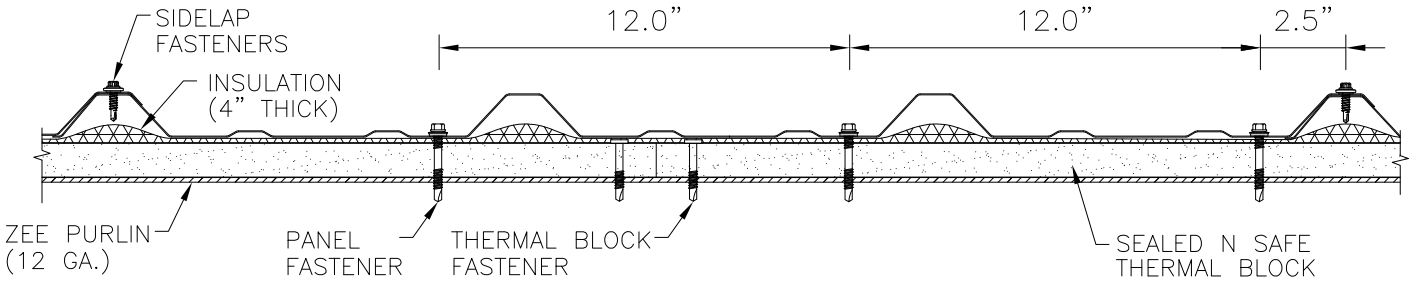
PS2: CO Building anti-roll purlin clip and plate (7" x 5" x 0.25" thick) with 2 bolts.

Bracing 4: consisted of plate (10.5" x 2.5" x 0.375" thick) and bar (0.25" x 1.25")

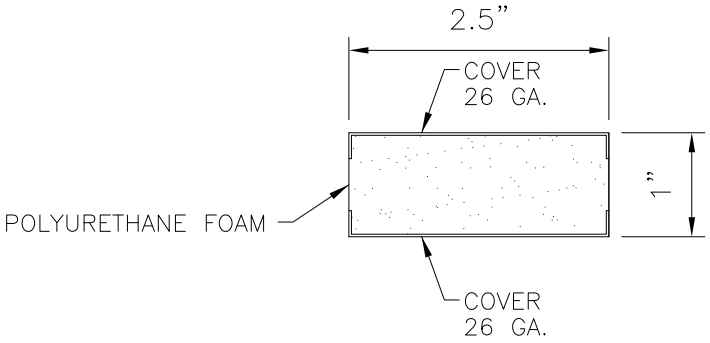
Bracing 5: consisted of plate (10.5" x 3.5" x 0.3125" thick) and bar (0.25" x 1.25")



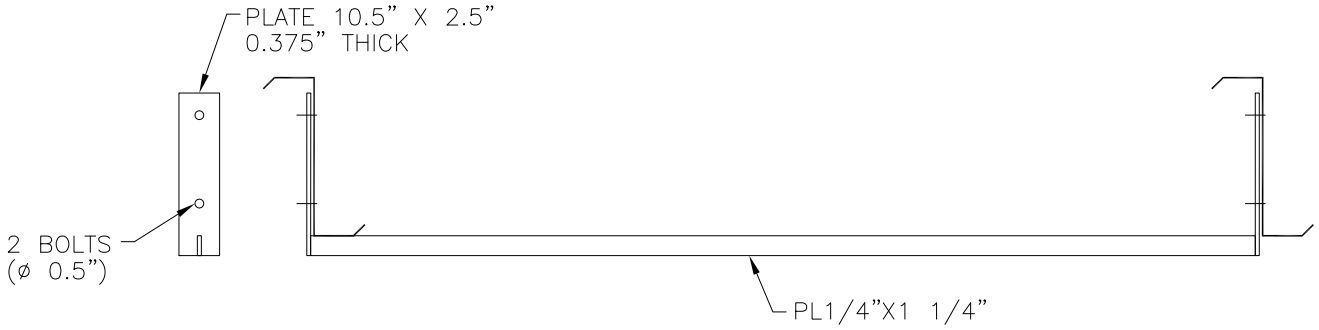
26 GA., PBR PANEL



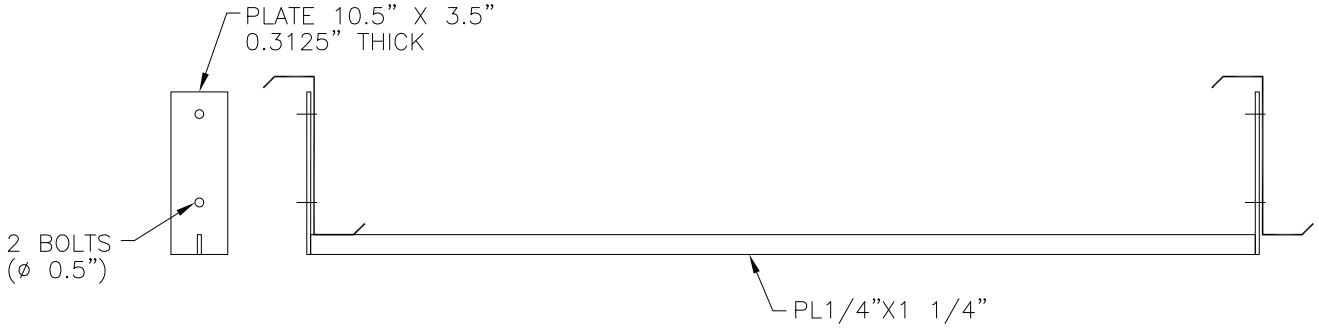
FASTENER PATTERN



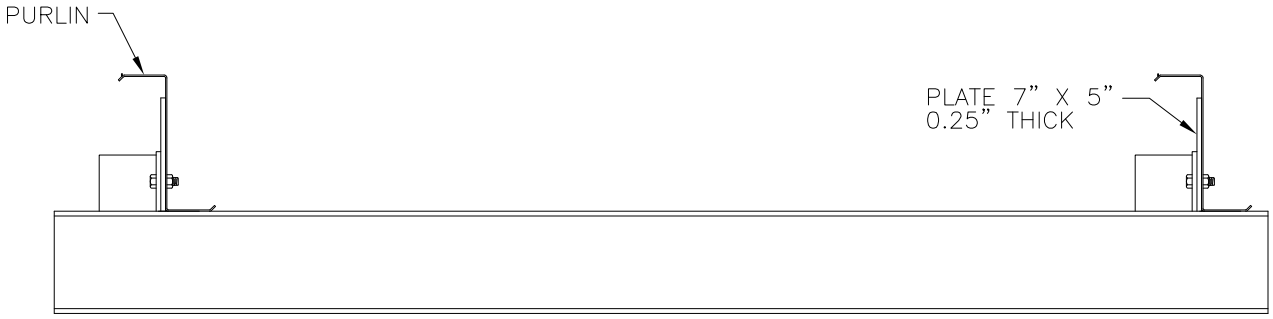
SEALED 'N' SAFE THERMAL BLOCKS



BRACING OPTION 4



BRACING OPTION 5



ANTI-ROLL CLIP WITH PLATE

2.1 DESCRIPTION OF TEST

OBJECTIVES

The purpose of this test is to obtain the reduction factor to be used in determining the nominal flexural strength of the purlin supporting a through fastened roof system. The test method consisted of the following:

1. assembling the test panels on two simply supported zee purlins;
2. loading the test panels incrementally; and
3. observing, measuring, and recording the deflections, deformations, and nature of any failures of principal or critical elements of the test construction.

The increments of load application were chosen such that a sufficient number of readings were obtained to determine the load deformation curve of the system. This test method applies to an assembly consisting of the standing seam panel, purlin and attachment devices used in the system being tested.

TEST CHAMBER

The test chamber consisted of a box as shown in the applicable drawings in the appendix. It contains one open surface in which the test specimen is installed. Two static pressure taps are located at corners to measure the chamber pressure in such a manner that the readings are not affected by the velocity of the air supply to or from the chamber or other air movement. The air supply openings into the chamber are arranged so that the air does not impinge directly on the test specimen with significant velocity.

AIR SYSTEM

The suction air supply consists of a number of individual units capable of maintaining a constant suction pressure difference for the required test period. A water manometer is used to measure the test pressure difference with accuracy of 1/10."

DEFLECTION MEASUREMENT

Vertical measurements at the midspan of both purlins were taken by means of a level and staffs calibrated to 1/100 of an inch. Horizontal measurements were taken by means of dial gauge calibrated to 1/1000 of an inch, at the seam joint nearest the center of the test specimen.

PANEL LENGTH

The length of the panels was 7' 0", which provided the necessary length for purlin spacing of 5' 0" with an overhang of 12" on either side.

DESCRIPTION OF TEST

TEST SPECIMEN

The purlins were connected to the supporting beams with anti-roll purlin clips. There were no external discrete bracings used in these tests. The panels were attached to the purlins with standard fastener system. The overall dimension of the specimen was in excess of 7' x 31' for 10" deep purlins

Plastic sheeting (max 6 mil thick) was used to keep the air pressure chamber airtight. The sheeting was placed on top of the panels for gravity load tests and between the panel and insulation for uplift load test. The sheeting between panel ribs was pleated to allow the sheeting to conform to into the panel sidelap when pressure was applied to the panels.

TEST PROCEDURE

An initial load equal to 5 psf was applied and removed to record the zero readings. The loading procedure on the test system consisted of suction pressure applied in increments. Deflection measurements and pressures were recorded at every pressure interval. Pressure intervals did not exceed 20% of the anticipated failure load.

TEST DURATION

The test was stopped when the test system was unable to carry additional load or buckling failure of purlins occurred. The pressure at which the system fails was recorded as the failure load of the system.

2.2 CALCULATIONS

For Z purlins tested with the flange facing the same direction and with the top flanges of the purlins not braced externally, then

$w_{ts} = (p_{ts} \pm p_d)s + 2P_L(d/B)$ if the eave purlin fails and (1)

$= (p_{ts} \pm p_d)s$ if the ridge purlin fails (2)

where

- w_{ts} = failure load (lb/ft) of the single span purlins tested,
- p_{ts} = failure load (psf) of the single span purlins tested,
- p_d = weight of the specimen (psf),
- s = tributary width of purlins tested (ft),
- d = purlin depth (in),
- B = maximum anticipated purlin spacing (in).
- P_L = lateral anchorage force (lb/ft) in accordance with Section D6.3.1 of the AISI Specifications,

$$0.5\left(\frac{C2}{1000}\frac{I_{xy}L}{I_x d} + C3\frac{0.25bt}{d^2}\right)(p_{ts} + p_d)s \quad (3)$$

b = flange width of the purlin (in),
t = purlin thickness (in),
I_x = moment of inertia of full unreduced section (in^4):
I_{xy} = product moment of inertia of full unreduced section (in^4):
L = purlin span (in)
C2 = 8.3
C3 = 33.

From the single span failure load, W_{ts}, the maximum single span failure moment M_{ts} is calculated as

$$M_{ts} = w_{ts} L^2/8 \quad (4)$$

Using Section C3.1.1(a) of the AISI Specification, the flexural strength of each tested purlin, M_{nt}, of a fully constrained beam is calculated as

$$M_{nt} = S_{et}F_{yt} \quad (5)$$

where S_{et} is the section modulus of the effective section calculated using the measured cross-sectional dimensions and F_{yt} is the measured yield strength.

The modification factor, R_t, is calculated for each purlin tested as

$$R_t = M_{ts}/M_{nt} \quad (6)$$

TEST RESULTS

3.1 SPECIMEN IDENTIFICATION

Panel Manufacturer:	CO Building Systems, Inc.
Model Type:	PBR Panel
Dimensions:	36" wide with 1.25" high major ribs at 12" o.c.
Panel Gauge:	26 ga.
Panel Fasteners:	#12 x 2" long hex head self-drilling screws with washers (DB Building Fasteners, Inc.)
Sidelap Fasteners:	#14 x 7/8" long hex head self-drilling screws with washers
Sidelap Fasteners Spacing:	12" o.c.
Thermal Blocks:	Sealed 'N' Safe™ - consisted of two 26 ga. steel profiles with polyurethane foam injected between the plates to form a 1" thick block. The length and width of the thermal block were 72" and 2.5", respectively. Polyurethane foam was manufactured by Utah Foam and designated as X10324.
Thermal Blocks Fasteners:	#12 x 1-5/8" long pancake head self-drilling screws (DB Building Fasteners, Inc.)
Insulation:	4" thick blanket insulation
Purlin Manufacturer:	Alliance Steel, Inc.
Purlin Profile:	Z 10" x 2.5" (Typical)
Purlin Thickness:	12 Ga.

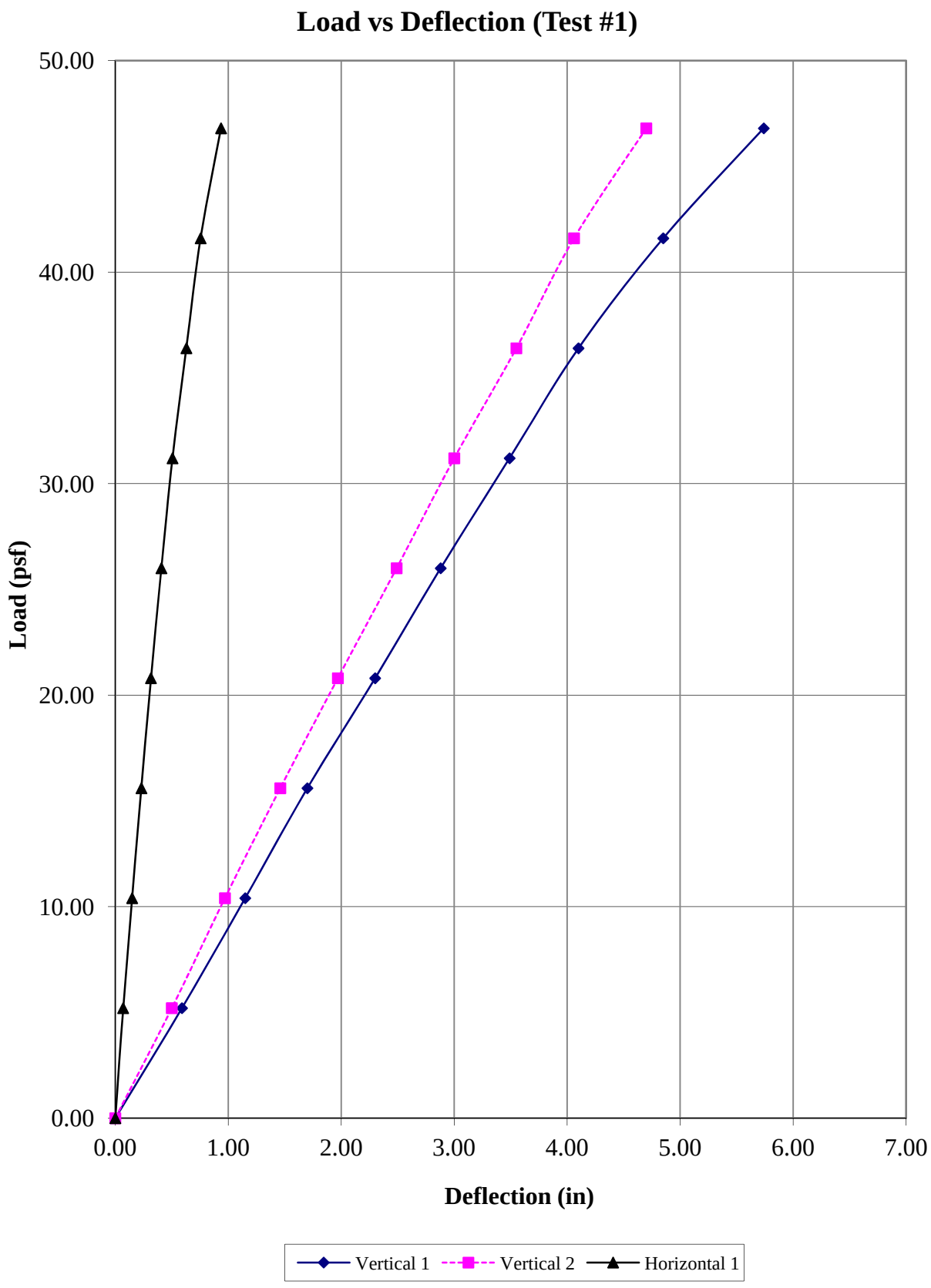
Note: All the test materials were supplied by CO Building Systems, Inc. and Sealed 'N' Safe and were not sampled by ENCON.

3.2 Test #1: 10Z12 with Bracing Option 4

Date:	10.31.13
Test Number:	1
Panel Type:	CO Buildings PBR Panel
Panel Fasteners:	#12 x 2" long SDS @ 12" o.c.
Sidelap Fasteners	#14 x 7/8" long SDS @ 12" o.c.
Panel Span (ft):	5' 0"
Panel Length (ft):	7' 0"
Insulation:	4" Insulation, 26 ga. Sealed N Safe
Purlin Size:	Zee 10" x 2.5"
Purlin Thickness:	12 ga.
Yield Stress (ksi):	69.8
Purlin Span (ft):	30
Panel Weight (psf):	0.88
Purlin Weight (lb/ft):	5.62
Purlin-Frame Attachment:	Welded anti roll clip at eave & ridge
Bracing:	Brace (2.5" x 3/8" thick) at mid span

No	Pressure (psf)	Deflection Reading (in)			Remarks
		Vertical 1	Vertical 2	Horizontal 1	
1	0.00	0.00	0.00	0.000	
2	5.20	0.59	0.50	0.069	
3	10.40	1.15	0.97	0.149	
4	15.60	1.70	1.46	0.231	
5	20.80	2.30	1.97	0.315	
6	26.00	2.88	2.49	0.408	
7	31.20	3.49	3.00	0.506	
8	36.40	4.10	3.55	0.629	
9	41.60	4.85	4.06	0.755	
10	46.80	5.74	4.70	0.936	
11	49.87				Failure Load

Failure Mode: Top flange of eave purlin buckled near mid span

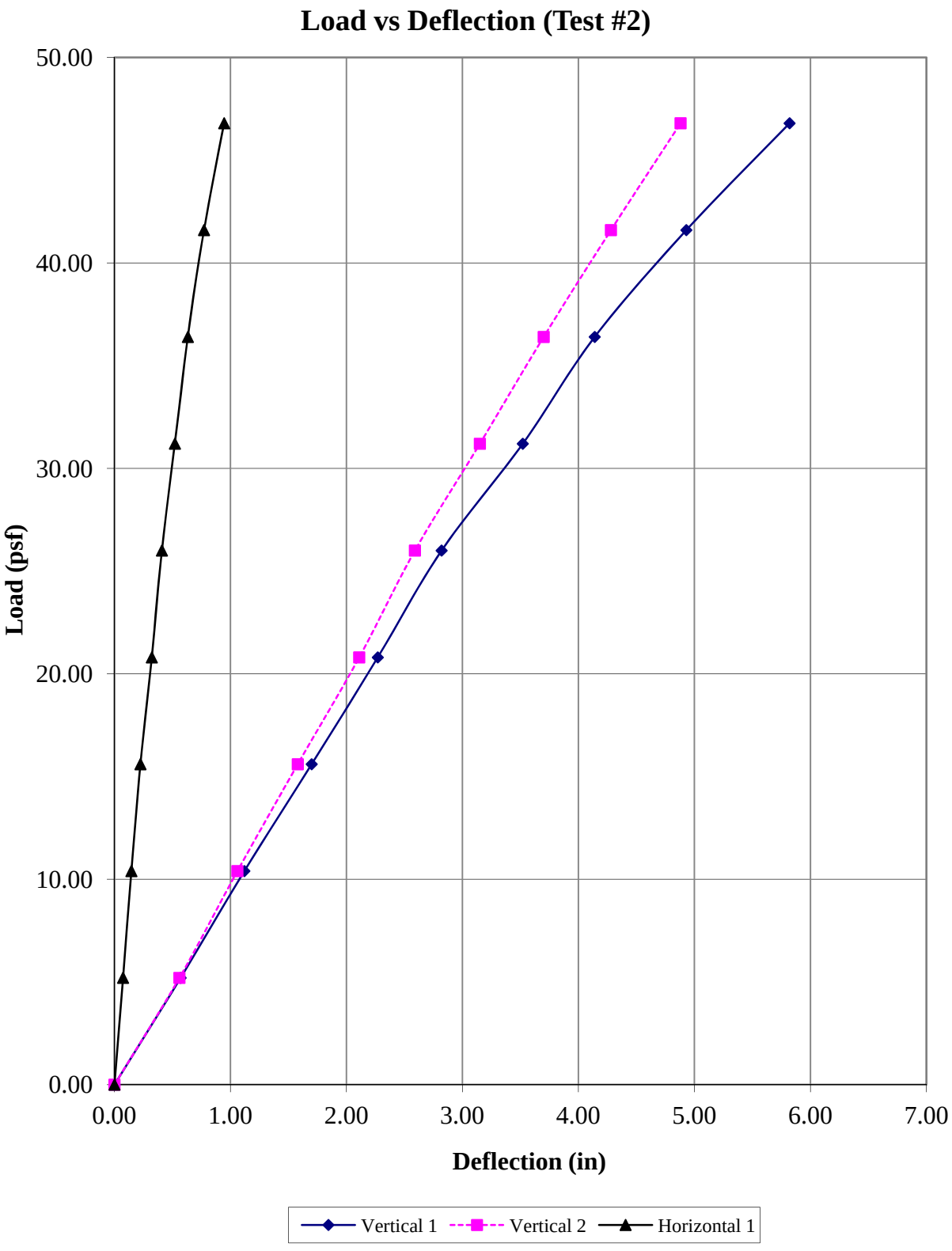

Load vs Deflection (Test #1)
50.00
40.00
30.00
20.00
10.00
0.00
Load (psf)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
Deflection (in)
Vertical 1
Vertical 2
Horizontal 1

3.3 Test #2: 10Z12 with Bracing Option 5

Date:	10.31.13
Test Number:	2
Panel Type:	CO Buildings PBR Panel
Panel Fasteners:	#12 x 2" long SDS @ 12" o.c.
Sidelap Fasteners	#14 x 7/8" long SDS @ 12" o.c.
Panel Span (ft):	5' 0"
Panel Length (ft):	7' 0"
Insulation:	4" Insulation, 26 ga. Sealed N Safe
Purlin Size:	Zee 10" x 2.5"
Purlin Thickness:	12 ga.
Yield Stress (ksi):	68.2
Purlin Span (ft):	30
Panel Weight (psf):	0.88
Purlin Weight (lb/ft):	5.60
Purlin-Frame Attachment:	Welded anti roll clip at eave & ridge
Bracing:	Brace (3.5" x 5/16" thick) at mid span

No	Pressure (psf)	Deflection Reading (in)			Remarks
		Vertical 1	Vertical 2	Horizontal 1	
1	0.00	0.00	0.00	0.000	
2	5.20	0.57	0.56	0.074	
3	10.40	1.12	1.06	0.146	
4	15.60	1.70	1.58	0.224	
5	20.80	2.27	2.11	0.322	
6	26.00	2.82	2.59	0.409	
7	31.20	3.52	3.15	0.521	
8	36.40	4.14	3.70	0.633	
9	41.60	4.93	4.28	0.772	
10	46.80	5.82	4.88	0.946	
11	49.45				Failure Load

Failure Mode: Top flange of eave purlin buckled near mid span


Load vs Deflection (Test #2)
50.00
40.00
30.00
20.00
10.00
0.00
Load (psf)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
Deflection (in)
Vertical 1
Vertical 2
Horizontal 1

3.7 MODIFICATION FACTOR CALCULATION
3.7.1 MODIFICATION FACTOR FOR TEST #1

Purlin depth 'd' (in):		10.000
Purlin flange width 'b' (in):		2.563
Purlin thickness 't' (in):		0.103
Measured yield stress 'F_{yt}' (ksi):		69.8
Purlin span 'L' (ft):		30.000
Maximum anticipated purlin spacing 'B' (ft):		5.000
Tributary width of purlin tested 's' (ft):		3.737
Failure load of single span system tested 'p_{ts}' (psf):		49.868
Specimen weight 'p_d' (psf):		2.485
Effective section modulus 'S_{et}' (in^3):		4.376
Moment of inertia of full unreduced section I_x (in^4):		23.488
Product moment of inertia of full unreduced section I_{xy} (in^4):		4.900
C2	from Specification Table D6.3.1-1	8.2
C3	from Specification Table D6.3.1-1	33.0
P_L (lb/ft)	$0.5\left(\frac{C2}{1000}\frac{I_{xy}L}{I_x d}+C3\frac{0.25bt}{d^2}\right)(p_{ts}+p_d)s$	8.15
w_{ts} (lb/ft)	$(p_{ts}+p_d)s+2P_L(d/B)$	198.36
M_{ts} (kip.in)		267.79
M_{nt} (kip.in)		305.44
Modification Factor 'R_t':		0.877

3.7.2 MODIFICATION FACTOR FOR TEST #2

Purlin depth 'd' (in):		9.875
Purlin flange width 'b' (in):		2.563
Purlin thickness 't' (in):		0.103
Measured yield stress 'F_{yt}' (ksi):		68.2
Purlin span 'L' (ft):		30.000
Maximum anticipated purlin spacing 'B' (ft):		5.000
Tributary width of purlin tested 's' (ft):		3.737
Failure load of single span system tested 'p_{ts}' (psf):		49.452
Specimen weight 'p_d' (psf):		2.479
Effective section modulus 'S_{et}' (in^3):		4.299
Moment of inertia of full unreduced section I_x (in^4):		23.277
Product moment of inertia of full unreduced section I_{xy} (in^4):		5.382
C2	from Specification Table D6.3.1-1	8.2
C3	from Specification Table D6.3.1-1	33.0
P_L (lb/ft)	$0.5\left(\frac{C2}{1000}\frac{I_{xy}L}{I_x d}+C3\frac{0.25bt}{d^2}\right)(p_{ts}+p_d)s$	8.87
w_{ts} (lb/ft)	$(p_{ts}+p_d)s+2P_L(d/B)$	196.99
M_{ts} (kip.in)		265.93
M_{nt} (kip.in)		293.22
Modification Factor 'R_t':		0.907

PHOTOGRAPHS

PHOTO 1 View of the purlin-frame attachment.
(DSCN1374)

PHOTO 2 View of attachment of bracing option 4 at midspan (Test #1).
(DSCN1375)

PHOTOGRAPHS

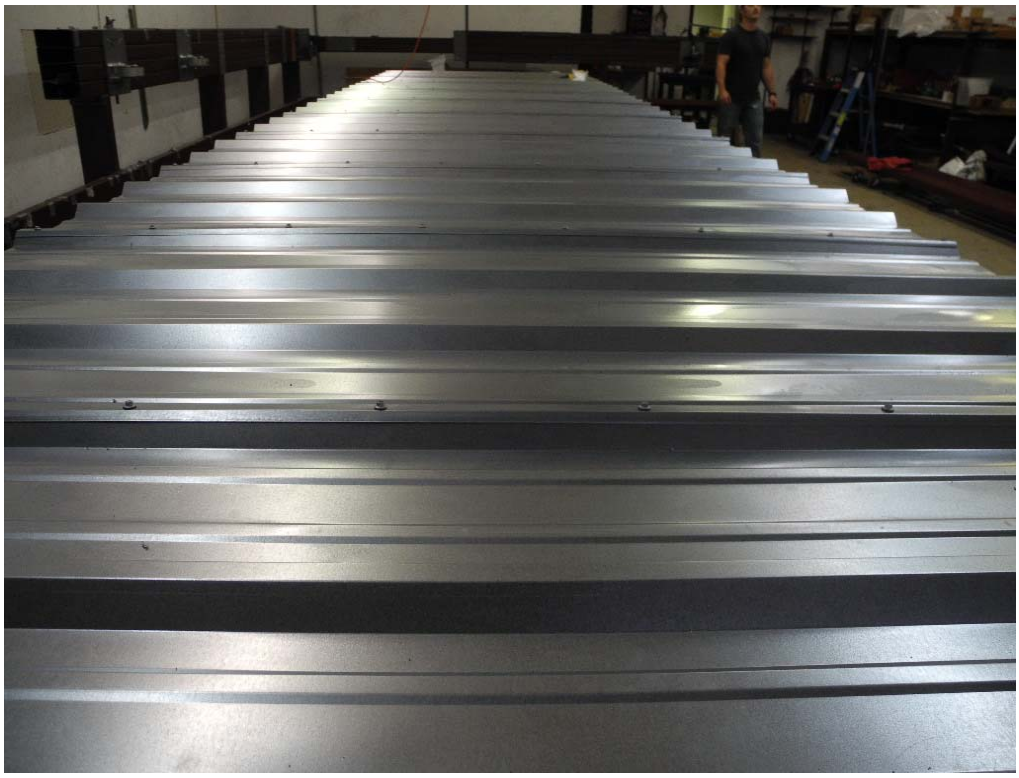


PHOTO 3 View of the panel attachment.
(DSCN1377)

PHOTO 4 View of the test setup prior to failure (Test #1).
(DSCN1381)

PHOTOGRAPHS

PHOTO 5 View of the test setup at failure (Test #1).
(DSCN1385)

PHOTO 6 View of the flange buckling failure of 12 ga. 10" deep Zee purlin (Test #1).
(DSCN1387)

PHOTOGRAPHS

PHOTO 7 View of attachment of bracing option 5 at midspan (Test #2). (DSCN1394)

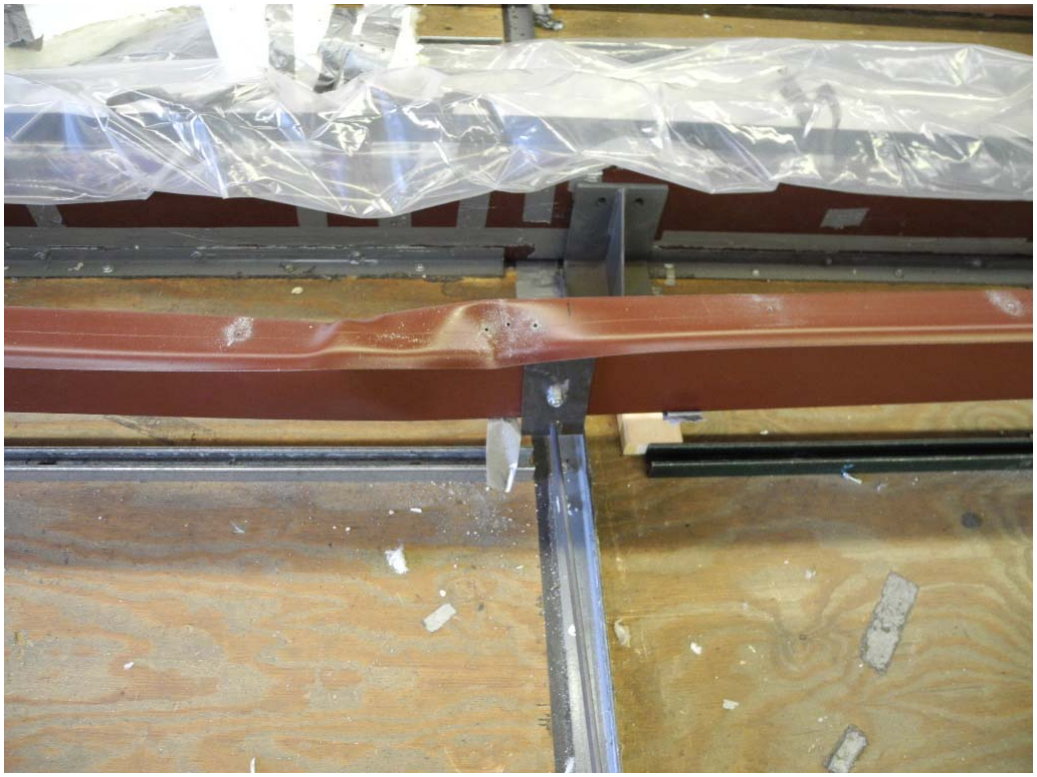
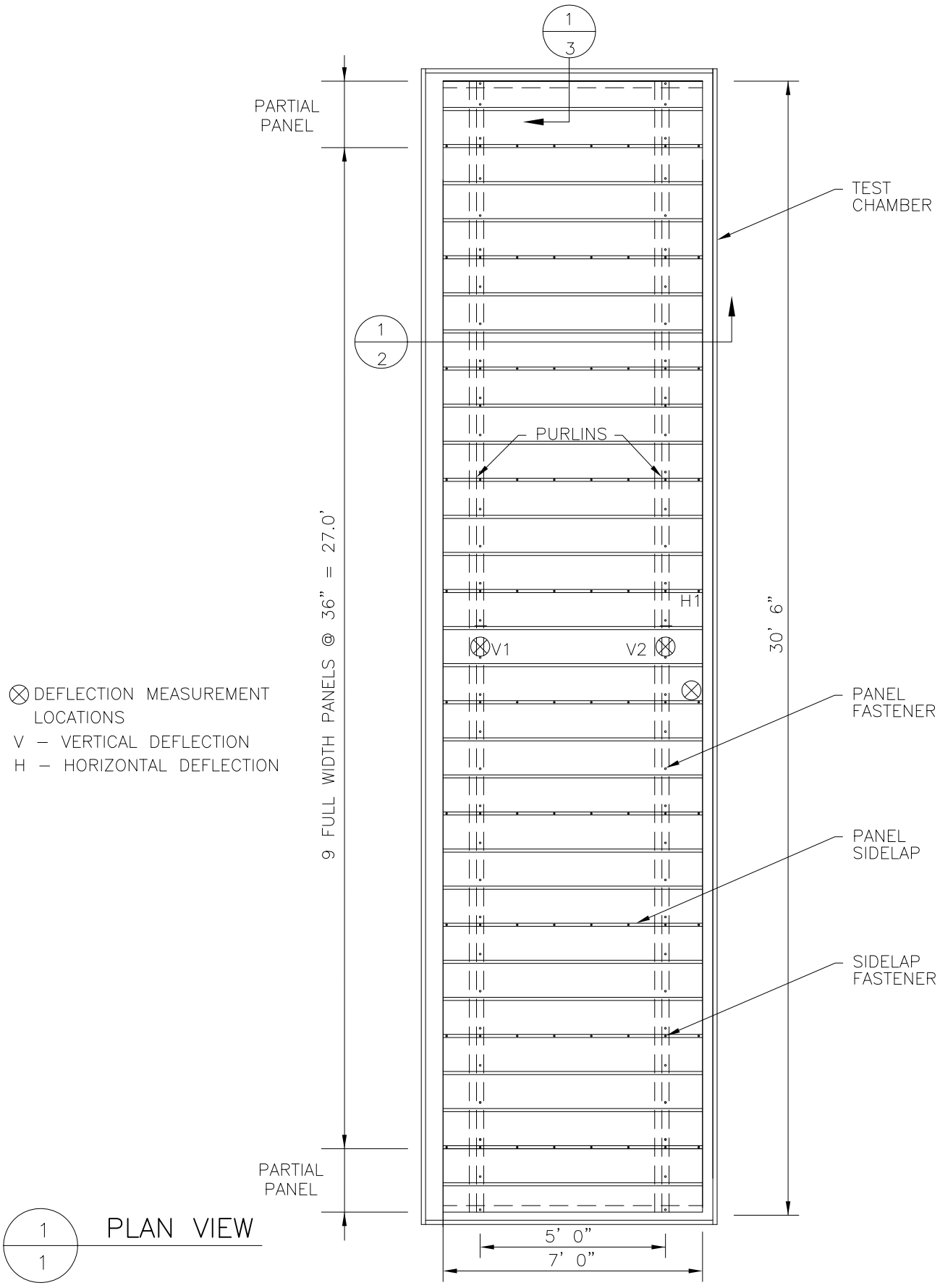
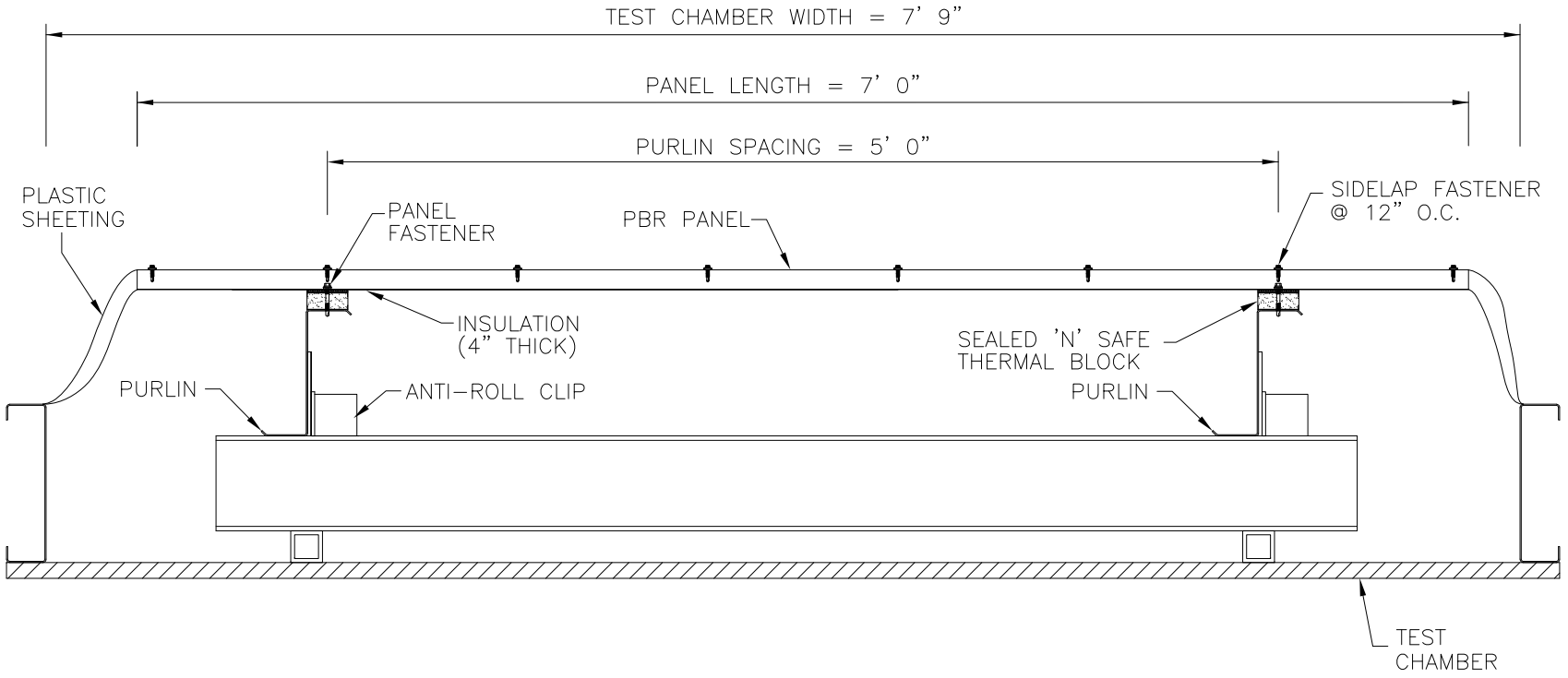


PHOTO 8 View of the flange buckling failure of 12 ga. 10" deep Zee purlin (Test #2). (DSCN1398)

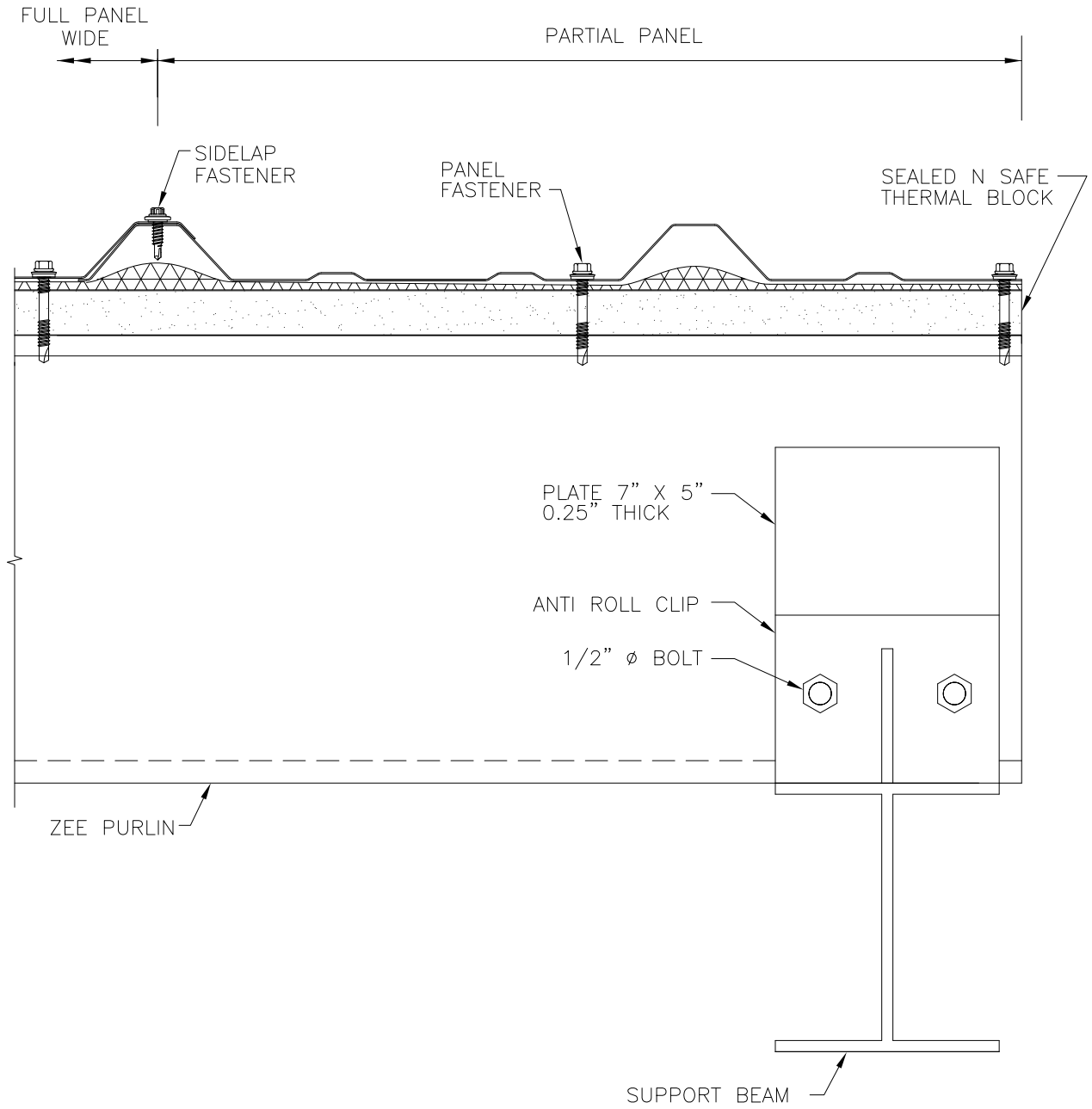


⊗ DEFLECTION MEASUREMENT LOCATIONS
V – VERTICAL DEFLECTION
H – HORIZONTAL DEFLECTION

1/1 PLAN VIEW



1/2 SECTION VIEW



1/3 DETAIL OF "PURLIN SUPPORTS"

SHERRY LABORATORIES
An Element Materials Technology Company

Western Materials, SEG, & Nonmetallics
3100 North Hemlock Circle
Broken Arrow, OK 74012-1115

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800-982-8378
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LABORATORY REPORT

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Report No: **B13110167**
Date Reported: **11/7/2013**
P.O. No: **Verbal**

Material: **Steel**

Description: **(2) Test Samples**

Room Temperature Tensile Testing - ASTM E8/E8M-11, Parallel to Length of the Specimen, As Received

Sample ID	Width, Initial, in	Thickness, Initial, in	Tensile Strength, psi	Yield (0.2% Offset), psi	Elongation (4W), %	Location of Fracture
Sample: 10Zee, Test #1	0.500	0.103	80800	69800	22	Inside Middle Half of Gage

Room Temperature Tensile Testing - ASTM E8/E8M-11, Parallel to Length of the Specimen, As Received

Sample ID	Width, Initial, in	Thickness, Initial, in	Tensile Strength, psi	Yield (0.2% Offset), psi	Elongation (4W), %	Location of Fracture
Sample: 10Zee, Test #2	0.500	0.103	79800	68200	23	Inside Middle Half of Gage

Approved by:

Jason Pierce
Materials Testing Supervisor

Section: Test#1.sct
Zee 12 ga Test #1
PBR 10Z Gravity
Rev. Date: 11/7/2013 4:34:25 PM
By: Bala Sockalingam, Ph.D., P.E.
Printed: 11/15/2013 8:24:37 AM

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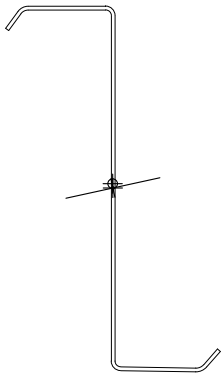

Section Inputs

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Material: [N/A]
No strength increase from cold work of forming.
Modulus of Elasticity, E        29500000 psi
Yield Strength, Fy                 69800 psi
Tensile Strength, Fu               80800 psi
Warping Constant Override, Cw          0 in^6
Torsion Constant Override, J           0 in^4

Stiffened Zee, Thickness 0.103 in
Placement of Part from Origin:
X to center of gravity           0 in
Y to center of gravity           0 in
Outside dimensions, Open shape
        Length      Angle     Radius  Web      k    Hole Size   Distance
          (in)      (deg)       (in)         Coef.       (in)       (in)
  1     0.7500     54.000    0.25000 None    0.000     0.0000     0.3750
  2     2.5625      0.000    0.25000 Single  0.000     0.0000     1.2813
  3    10.0000    -90.000    0.15625 Single  0.000     0.0000     5.0000
  4     2.5000     -1.000    0.15625 Single  0.000     0.0000     1.2500
  5     0.7500     49.000    0.28125 None    0.000     0.0000     0.3750
```

Section: Test#1.sct
Zee 12 ga Test #1
PBR 10Z Gravity
Rev. Date: 11/7/2013 4:34:25 PM
By: Bala Sockalingam, Ph.D., P.E.
Printed: 11/15/2013 8:24:37 AM

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Full Section Properties

Area	1.6521	in^2	Wt.	5.6172	lb/ft	Width	16.040 in
Ix	23.488	in^4	rx	3.7706	in	Ixy	-4.900 in^4
Sx(t)	4.7064	in^3	y(t)	4.9908	in	α	12.290 deg
Sx(b)	4.6513	in^3	y(b)	5.0498	in		
			Height	10.0406	in		
Iy	2.065	in^4	ry	1.1180	in	Xo	-0.0070 in
Sy(l)	0.7018	in^3	x(l)	2.9421	in	Yo	0.1220 in
Sy(r)	0.7000	in^3	x(r)	2.9499	in	jx	0.0212 in
			Width	5.8920	in	jy	-0.1363 in
I1	24.556	in^4	r1	3.8553	in		
I2	0.997	in^4	r2	0.7770	in		
Ic	25.553	in^4	rc	3.9328	in	Cw	37.585 in^6
Io	25.578	in^4	ro	3.9347	in	J	0.005842 in^4

Fully Braced Strength - 2010 North American Specification - US (ASD)

Material Type: [N/A], Fy=69800 psi

Compression			Positive Moment			Positive Moment	
Pao	37019	lb	Maxo	15.241	k-ft	Mayo	2.136 k-ft
Ae	0.95465	in^2	Ixe	22.444	in^4	Iye	1.839 in^4
			Sxe(t)	4.3759	in^3	Sye(l)	0.6355 in^3
Tension			Sxe(b)	4.5696	in^3	Sye(r)	0.6133 in^3
Ta	66746	lb					
			Negative Moment			Negative Moment	
			Maxo	15.128	k-ft	Mayo	2.107 k-ft
Shear			Ixe	22.496	in^4	Iye	1.813 in^4
Vay	10251	lb	Sxe(t)	4.6278	in^3	Sye(l)	0.6050 in^3
Vax	11293	lb	Sxe(b)	4.3434	in^3	Sye(r)	0.6260 in^3

Section: Test#2.sct
Zee 12 ga Test #2
PBR 10Z Gravity
Rev. Date: 11/7/2013 4:38:30 PM
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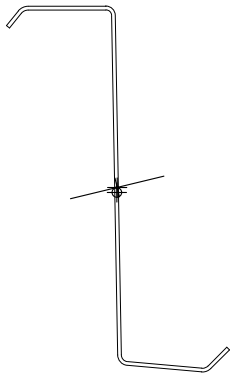

Section Inputs

```
Material: [N/A]
No strength increase from cold work of forming.
Modulus of Elasticity, E        29500000 psi
Yield Strength, Fy                 68200 psi
Tensile Strength, Fu               79800 psi
Warping Constant Override, Cw          0 in^6
Torsion Constant Override, J           0 in^4

Stiffened Zee, Thickness 0.103 in
Placement of Part from Origin:
X to center of gravity           0 in
Y to center of gravity           0 in
Outside dimensions, Open shape
        Length      Angle     Radius  Web      k    Hole Size   Distance
          (in)      (deg)       (in)         Coef.       (in)       (in)
  1     0.6875     51.000    0.25000 None    0.000     0.0000     0.3438
  2     2.5625      0.000    0.25000 Single  0.000     0.0000     1.2813
  3     9.8750    -89.000    0.15625 Single  0.000     0.0000     4.9375
  4     2.4688     -5.000    0.18750 Single  0.000     0.0000     1.2344
  5     0.8750     45.000    0.21875 None    0.000     0.0000     0.4375
```

Section: Test#2.sct
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PBR 10Z Gravity
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Full Section Properties

Area	1.6456	in^2	Wt.	5.5950	lb/ft	Width	15.977 in
Ix	23.277	in^4	rx	3.7610	in	Ixy	-5.382 in^4
Sx(t)	4.6610	in^3	y(t)	4.9940	in	α	13.578 deg
Sx(b)	4.5780	in^3	y(b)	5.0846	in		
			Height	10.0786	in		
Iy	2.293	in^4	ry	1.1804	in	Xo	-0.0102 in
Sy(l)	0.7521	in^3	x(l)	3.0482	in	Yo	-0.1376 in
Sy(r)	0.7409	in^3	x(r)	3.0944	in	jx	0.1224 in
			Width	6.1426	in	jy	0.1313 in
I1	24.577	in^4	r1	3.8646	in		
I2	0.993	in^4	r2	0.7767	in		
Ic	25.570	in^4	rc	3.9419	in	Cw	37.476 in^6
Io	25.601	in^4	ro	3.9443	in	J	0.005819 in^4

Fully Braced Strength - 2010 North American Specification - US (ASD)

Material Type: [N/A], Fy=68200 psi

Compression			Positive Moment			Positive Moment	
Pao	36988	lb	Maxo	14.632	k-ft	Mayo	2.522 k-ft
Ae	0.97623	in^2	Ixe	22.121	in^4	Iye	2.293 in^4
			Sxe(t)	4.2994	in^3	Sye(l)	0.7521 in^3
Tension			Sxe(b)	4.4837	in^3	Sye(r)	0.7409 in^3
Ta	65659	lb					
			Negative Moment			Negative Moment	
			Maxo	14.898	k-ft	Mayo	2.164 k-ft
Shear			Ixe	22.635	in^4	Iye	1.980 in^4
Vay	10406	lb	Sxe(t)	4.6117	in^3	Sye(l)	0.6360 in^3
Vax	11021	lb	Sxe(b)	4.3778	in^3	Sye(r)	0.6538 in^3

APPENDIX

5.4 TEST CONDITIONS

A. OWNERSHIP OF ENCON WORK PRODUCT

All test results developed as a part of this work shall be CUSTOMER's property. All samples submitted to ENCON for testing shall become the property of ENCON. CUSTOMER understands that any test program including procedures and test machines incorporated as a part of this work is a result of continuing long-term research and development by ENCON and because of this all ENCON test procedures, test drawings and other intellectual property relating to this work is and shall remain the property of ENCON. Test samples were disposed of shortly after completion of the tests unless other arrangements were agreed to in writing prior to the test.

ENCON will use its normal procedures to retain copies of the information developed as a part of this test for a period of three years from the date the work was done. This material may be routinely destroyed thereafter.

B. ENCON GUARANTEE

ENCON guarantees it used its best effort to accomplish this test work. Work done by ENCON was carefully completed by personnel believed to be competent. ENCON tests were based on what was currently believed to be good engineering practices in use at the time of the test.

The safety factors used are generally accepted as suitable to produce safe results. However, good engineering practices and applicable codes and insurance requirements must be taken into consideration in determining if a test procedure is satisfactory for a specific end use. Applicable specifications, good engineering practices and applicable safety factors may change in the future. CUSTOMER should be alert to these changes.

The information and test results presented by ENCON in this test report are offered in good faith based on information ENCON believes to be reliable. This information is offered as a guide to assist CUSTOMER in CUSTOMER's endeavors and does not contain any warranties as to fitness by ENCON. No REPRESENTATION OF WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THOSE OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE are made by ENCON, and more specifically, ENCON hereby expressly disclaim such. In no event shall ENCON be liable for ANY CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES, including, without limitation, labor, transportation, loss of use, loss of profits, harm, personnel injury and damage to property.

If any doubt exists as to the proper means of interpreting or using the test results contained herein, contact ENCON for clarification. CUSTOMER should assure themselves through careful evaluations that test results are suitable for those end uses to which CUSTOMER intends to put them.

APPENDIX

Information and material provided by CUSTOMER to ENCON was reviewed by an ENCON executive. However, ENCON does not accept the responsibility for accuracy or verification of CUSTOMER's information or the suitability of CUSTOMER materials. Materials supplied by CUSTOMER were tested as received and were not evaluated for code or insurance compliance. CUSTOMER is expected to review the ENCON drawings, tables, test results and other information provided by ENCON to CUSTOMER critically so as to assure CUSTOMER that these presentations, formulas, drawings and other information are accurate and meaningful for the purpose intended.

No other warranties or guarantees shall be issued, implied, delivered or otherwise construed to be issued, implied or delivered.