# TEST REPORT ON

## 26 GA. PBR PANELS
## AT 5' 0" PURLIN SPACING
## WITH SEALED 'N' SAFE™ THERMAL BLOCKS
## USING 8" & 10" DEEP, 12 GA. ZEE PURLINS
## IN ACCORDANCE WITH AISI S908-08

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**TEST WITNESSED BY:**
**Bala Sockalingam, Ph.D., P.E.**

**TESTING DATE: January 26 & 27, February 1, 2, 3, 4, 5, 23 & 24, 2010**
**REPORTING DATE: March 3, 2010**
**ENCON® Project C1696-1**

# 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 and (2) bolts. Bracing option 1 was bolted to the purlins at midspan with 2 bolts. The gravity load test was conducted on January 26, 2010.

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 and (2) bolts. Bracing option 2 was bolted to the purlins at midspan with 2 bolts. The gravity load test was conducted on January 27, 2010.

Test #3: 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 and (2) bolts. Bracing option 3 was bolted to the purlins at midspan with 4 bolts. The gravity load test was conducted on January 27, 2010.

Test #4 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 3 was bolted to the purlins at midspan with 4 bolts. The gravity load test was conducted on February 1, 2010. Two more tests (#5 and #6) were conducted for above conditions and tested on February 2, 2010

Test #7: 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. Retrofit bracing option was fastened the bottom flange of the purlins at midspan with 2 screws per purlin. The gravity load test was conducted on February 3, 2010.

Test #8: Nom. 8" x 2.5" x 14 ga., 55 ksi zee purlin supporting PBR panel at 5' 0" purlin spacing and 27' 0" purlin span. The purlins were attached to the support beam with CO Building's anti-roll purlin clips and (2) bolts. No midspan bracing was used in this test. The gravity load test was conducted on February 4, 2010.

## TEST SUMMARY

Test #9: Nom. 8" x 2.5" x 16 ga., 55 ksi zee purlin supporting PBR panel at 5' 0" purlin spacing and 27' 0" purlin span. The purlins were attached to the support beam with CO Building's anti-roll purlin clips and (2) bolts. No midspan bracing was used in this test. The gravity load test was conducted on February 4, 2010.

Test #10: 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 3 was bolted to the purlins at midspan with 4 bolts. The uplift load test was conducted on February 5, 2010.

Test #11: 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 3 was bolted to the purlins at midspan with 4 bolts. The 3" thick blanket insulation was not included between the thermal block and purlin. The gravity load test was conducted on February 23, 2010.

Test #12: 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 (3) bolts. Plate (7" x 5" x 0.25" thick) was inserted between purlin and anti-roll clip. Bracing option 3 was bolted to the purlins at midspan with 4 bolts. The uplift load test was conducted on February 24, 2010.

The zee purlins were manufactured by CO Building Systems. 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, Sealed 'N' Safe™ thermal block and 3" thick blanket insulation with #12 x 2" long hex head self-drilling screws with washers. The sidelap fasteners were 1/4"-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. Several types of midspan bracing were used in these testing.

Sealed 'N' Safe™ thermal blocks consisted of two 24 ga. steel plates with polyurethane foam injected between the plates to form a 1" thick block. The length and width of these thermal blocks were 72" and 5", respectively. The blocks were fastened to the supports through 3" thick

blanket insulation 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 as follows:

| No. | Purlin | Span (ft) | Loading | Bracing | Purlin Attachment At Support | Failure Mode | Reduction Factor $R_t$ |
|---|---|---|---|---|---|---|---|
| 1 | 10Z12 | 30 | Gravity | Bracing 1 | PS1 | Web bending at support | 0.79 |
| 2 | 10Z12 | 30 | Gravity | Bracing 2 | PS1 | Web bending at support | 0.78 |
| 3 | 10Z12 | 30 | Gravity | Bracing 3 | PS1 | Web bending at support | 0.77 |
| 4 | 10Z12 | 30 | Gravity | Bracing 3 | PS2 | Top flange buckled | 0.92 |
| 5 | 10Z12 | 30 | Gravity | Bracing 3 | PS2 | Top flange buckled | 0.98 |
| 6 | 10Z12 | 30 | Gravity | Bracing 3 | PS2 | Top flange buckled | 0.96 |
| 7 | 10Z12 | 30 | Gravity | Retro | PS2 | Top flange buckled | 0.87 |
| 8 | 8Z14 | 27 | Gravity | None | PS1 | Top flange buckled | 0.80 |
| 9 | 8Z16 | 27 | Gravity | None | PS1 | Top flange buckled | 0.83 |
| 10 | 10Z12 | 30 | Uplift | Bracing 3 | PS2 | Bottom flange buckled | 0.61 |
| 11 | 10Z12 | 30 | Gravity | Bracing 3 | PS2 | Top flange buckled | 0.92 |
| 12 | 10Z12 | 30 | Uplift | Bracing 3 | PS3 | Bottom flange buckled | 0.73 |

Notes:

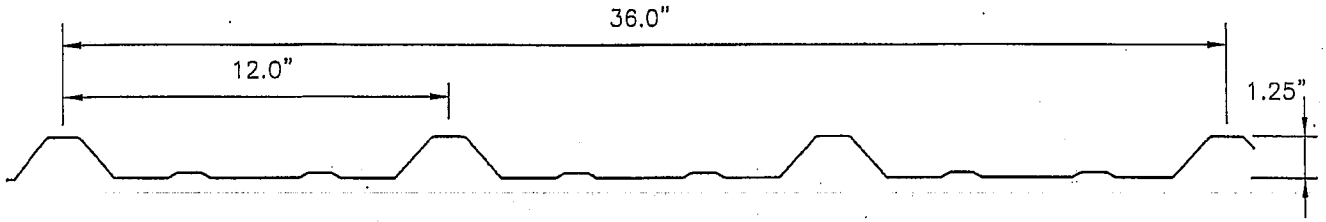
PS1: CO Building anti-roll purlin clip with 2 bolts.

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

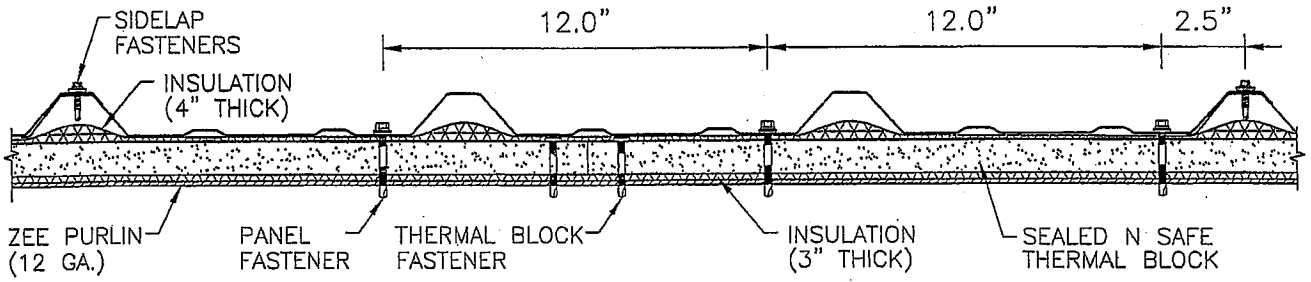
PS3: CO Building anti-roll purlin clip and plate (7" x 5" x 0.25" thick) with 3 bolts.

| ENCON® TECHNOLOGY, INC. | SEALED 'N' SAFE THERMAL BLOCKS TEST PANELS | AISI S908-08 | 4/99 |
|---|---|---|---|

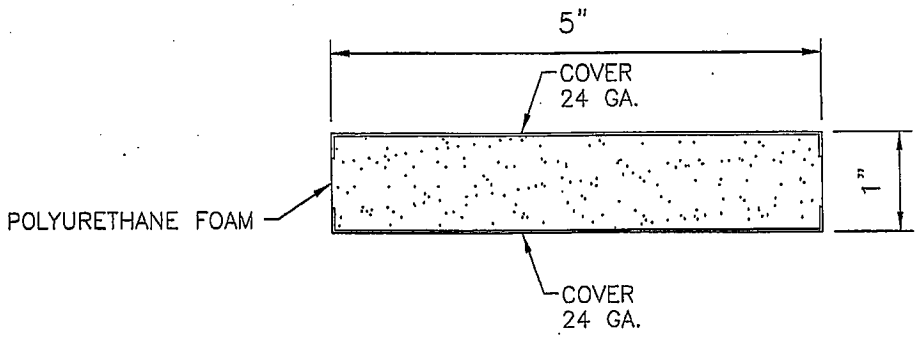





26 GA., PBR PANEL



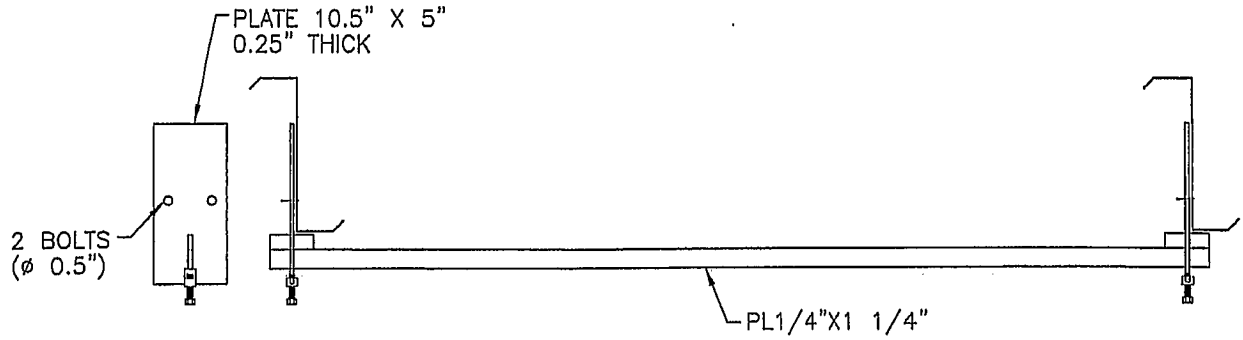

FASTENER PATTERN



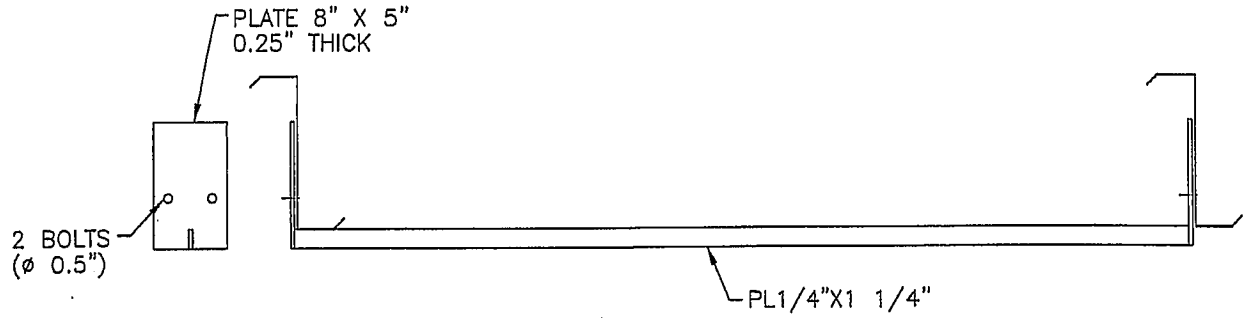

SEALED 'N' SAFE THERMAL BLOCKS

| ENCON TECHNOLOGY, INC. | SEALED 'N' SAFE THERMAL BLOCKS BRACING SYSTEM | AISI S908-08 | 5/99 |
|---|---|---|---|

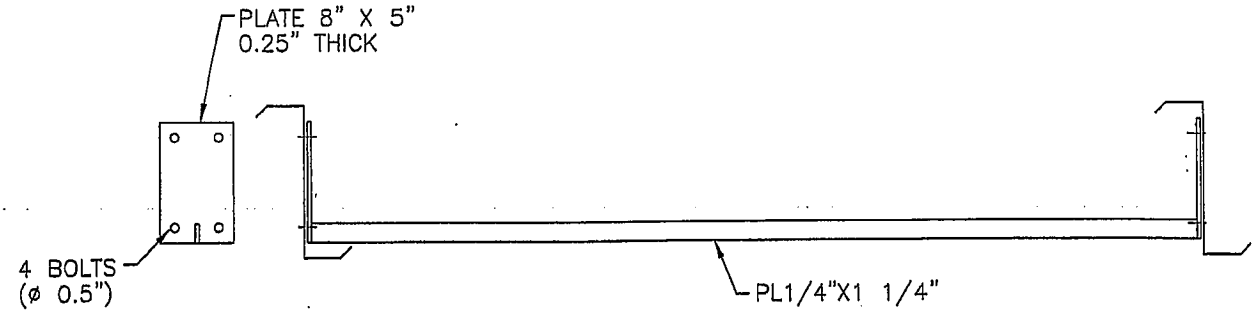




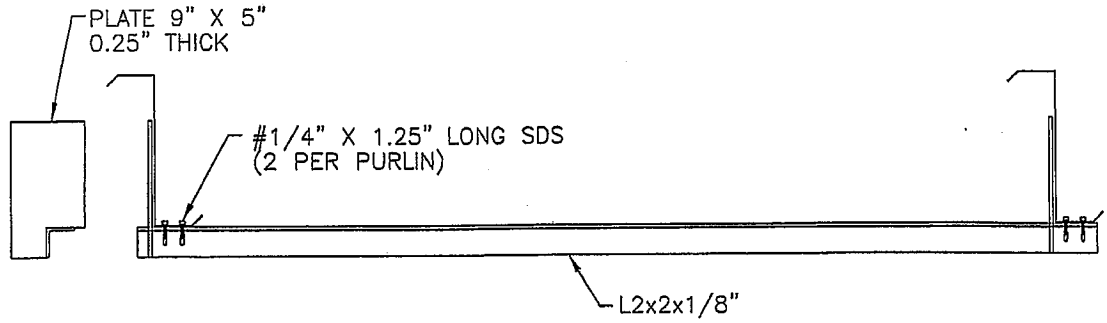

BRACING OPTION 1




BRACING OPTION 2



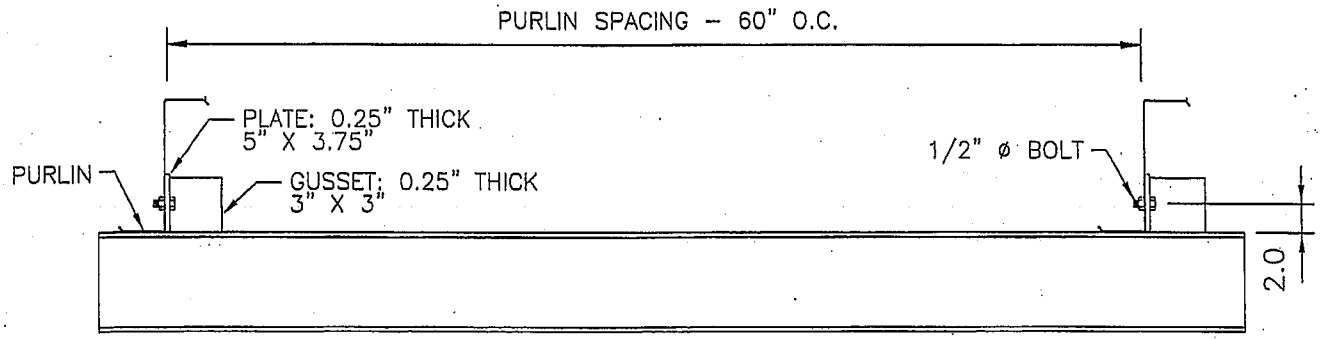

BRACING OPTION 3



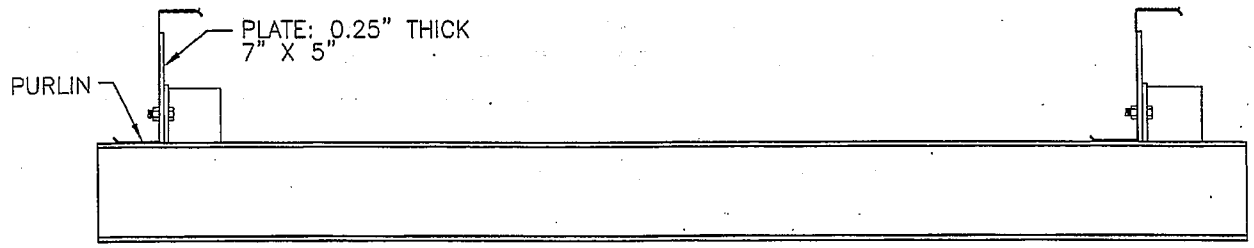

RETRO-FIT

| ENCON® TECHNOLOGY, INC. | SEALED 'N' SAFE THERMAL BLOCKS<br>PURLIN SUPPORT | AISI S908-08 | 6/99 |
|---|---|---|---|

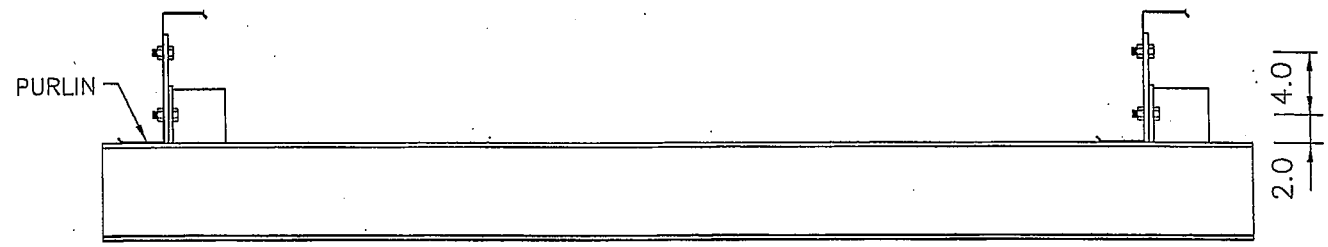





## ANTI–ROLL CLIP
(USED IN TEST #1, 2, 3, 8 & 9)




## ANTI–ROLL CLIP WITH PLATE
(USED IN TEST #4, 5, 6, 7, 10 & 11)




## ANTI–ROLL CLIP WITH PLATE
(USED IN TEST #12)

## 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 1/100."

### 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 28' for 8" deep purlins and 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,

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

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

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

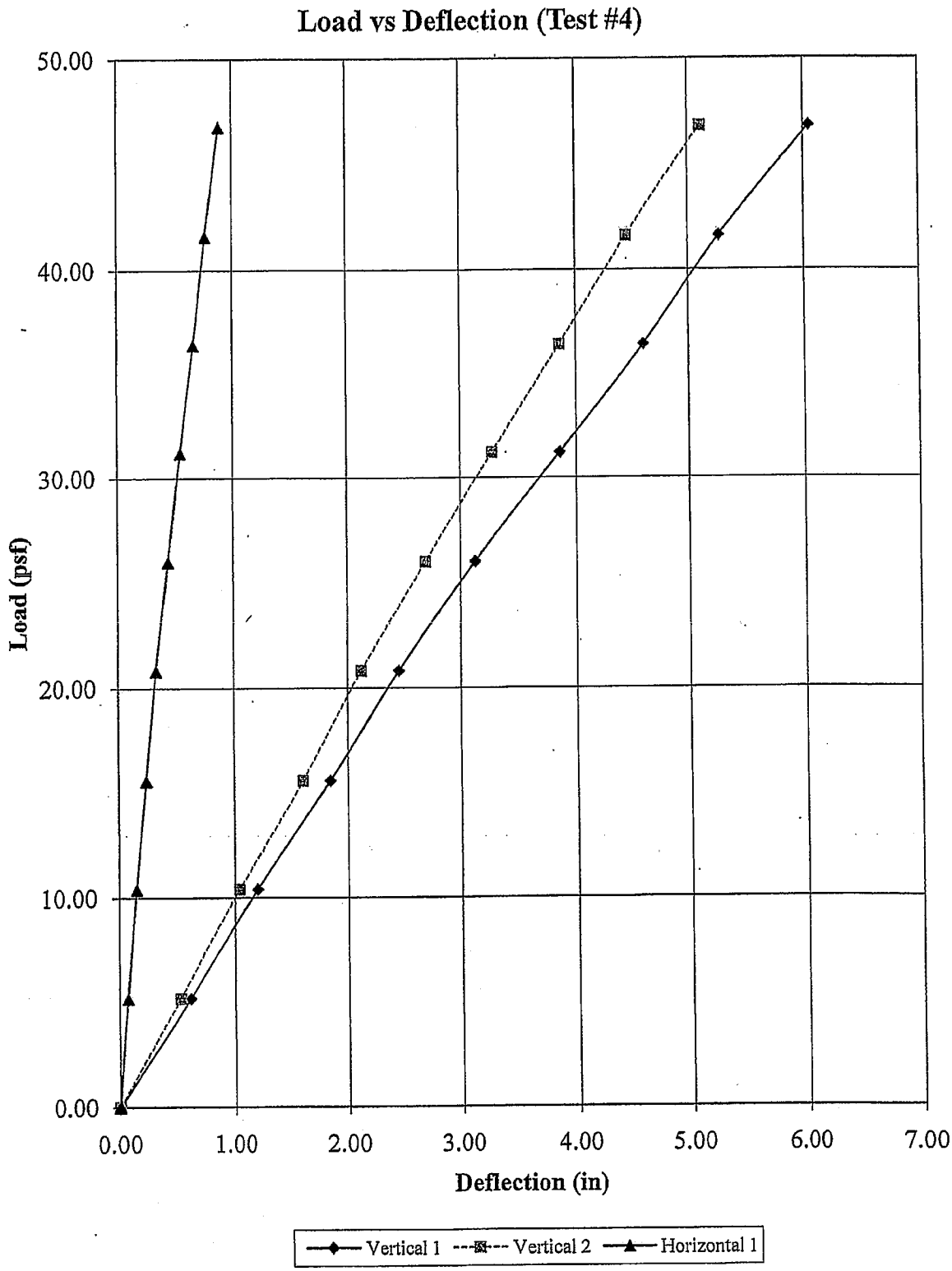
### 3.5 Test #4: 10Z12 with bracing 3 and plate

| | |
|---|---|
| Date: | 2.1.10 |
| Test Number: | 4 |
| Panel Type: | CO Buildings PBR Panel |
| Panel Fasteners: | #12 x 2" long SDS @ 12" o.c. |
| Sidelap Fasteners | 1/4" x 7/8" long SDS @ 12" o.c. |
| Panel Span (ft): | 5' 0" |
| Panel Length (ft): | 7' 0" |
| Insulation: | 4" Insulation, Sealed N Safe, 3" Insulation |
| Purlin Size: | Zee 10" x 2.5" |
| Purlin Thickness: | 12 ga. |
| Yield Stress (ksi): | 68.5 |
| Purlin Span (ft): | 30 |
| Panel Weight (psf): | 0.88 |
| Purlin Weight (lb/ft): | 5.43 |
| Purlin-Frame Attachment: | Welded anti roll clip at eave & ridge |
| Bracing: | Brace option 3 at mid span |

| No | Pressure | Deflection Reading (in) | | | Remarks |
|---|---|---|---|---|---|
| | (psf) | Vertical 1 | Vertical 2 | Horizontal 1 | |
| 1 | 0.00 | 0.00 | 0.00 | 0.000 | |
| 2 | 5.20 | 0.60 | 0.51 | 0.069 | |
| 3 | 10.40 | 1.20 | 1.04 | 0.145 | |
| 4 | 15.60 | 1.85 | 1.61 | 0.231 | |
| 5 | 20.80 | 2.45 | 2.12 | 0.316 | |
| 6 | 26.00 | 3.13 | 2.69 | 0.421 | |
| 7 | 31.20 | 3.86 | 3.28 | 0.528 | |
| 8 | 36.40 | 4.60 | 3.86 | 0.645 | |
| 9 | 41.60 | 5.27 | 4.45 | 0.759 | |
| 10 | 46.80 | 6.05 | 5.11 | 0.882 | |
| 11 | 48.36 | | | | Failure Load |

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

## TEST RESULTS



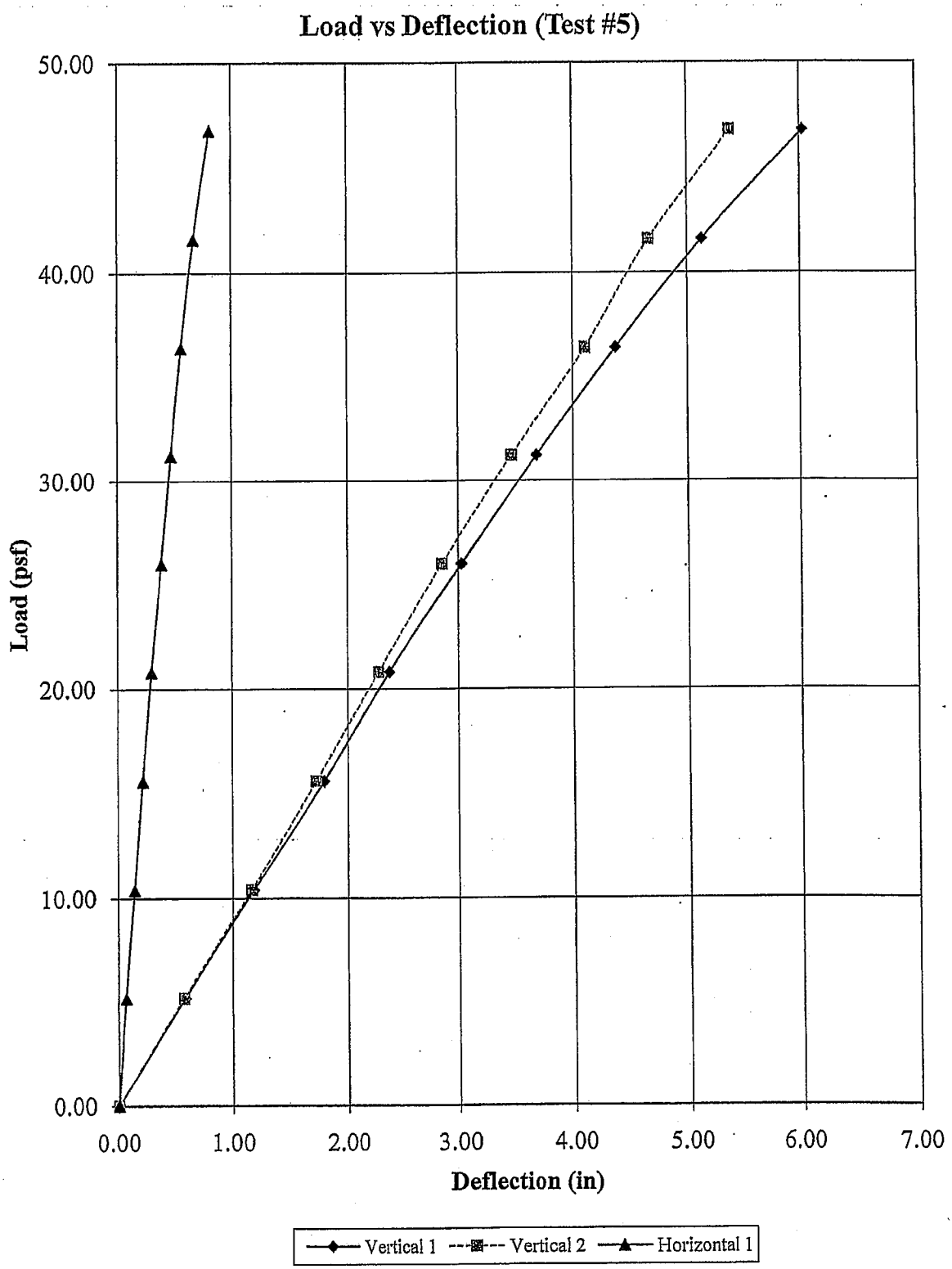
### 3.6 Test #5: 10Z12 with bracing 3 and plate

| | |
|---|---|
| Date: | 2.2.10 |
| Test Number: | 5 |
| Panel Type: | CO Buildings PBR Panel |
| Panel Fasteners: | #12 x 2" long SDS @ 12" o.c. |
| Sidelap Fasteners | 1/4" x 7/8" long SDS @ 12" o.c. |
| Panel Span (ft): | 5' 0" |
| Panel Length (ft): | 7' 0" |
| Insulation: | 4" Insulation, Sealed N Safe, 3" Insulation |
| Purlin Size: | Zee 10" x 2.5" |
| Purlin Thickness: | 12 ga. |
| Yield Stress (ksi): | 65.5 |
| Purlin Span (ft): | 30 |
| Panel Weight (psf): | 0.88 |
| Purlin Weight (lb/ft): | 5.45 |
| Purlin-Frame Attachment: | Welded anti roll clip at eave & ridge |
| Bracing: | Brace option 3 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 | 0.58 | 0.57 | 0.065 | |
| 3 | 10.40 | 1.18 | 1.16 | 0.139 | |
| 4 | 15.60 | 1.79 | 1.72 | 0.215 | |
| 5 | 20.80 | 2.38 | 2.28 | 0.293 | |
| 6 | 26.00 | 3.03 | 2.86 | 0.383 | |
| 7 | 31.20 | 3.68 | 3.46 | 0.467 | |
| 8 | 36.40 | 4.38 | 4.11 | 0.560 | |
| 9 | 41.60 | 5.13 | 4.67 | 0.670 | |
| 10 | 46.80 | 6.03 | 5.38 | 0.810 | |
| 11 | 49.92 | | | | Failure Load |

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

## TEST RESULTS

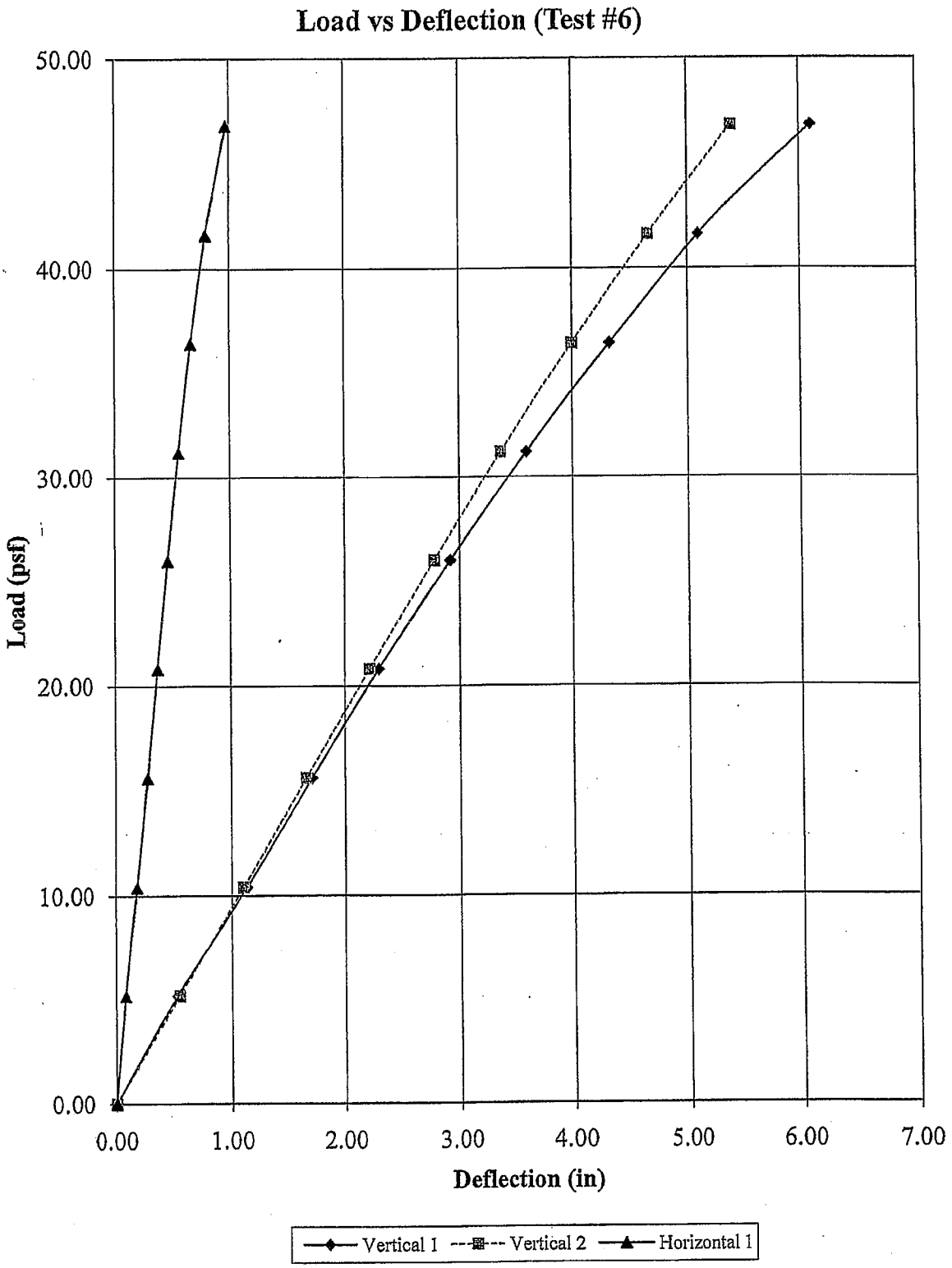


## 3.7 Test #6: 10Z12 with bracing 3 and plate

| | |
|---|---|
| Date: | 2.2.10 |
| Test Number: | 6 |
| Panel Type: | CO Buildings PBR Panel |
| Panel Fasteners: | #12 x 2" long SDS @ 12" o.c. |
| Sidelap Fasteners | 1/4" x 7/8" long SDS @ 12" o.c. |
| Panel Span (ft): | 5' 0" |
| Panel Length (ft): | 7' 0" |
| Insulation: | 4" Insulation, Sealed N Safe, 3" Insulation |
| Purlin Size: | Zee 10" x 2.5" |
| Purlin Thickness: | 12 ga. |
| Yield Stress (ksi): | 65 |
| Purlin Span (ft): | 30 |
| Panel Weight (psf): | 0.88 |
| Purlin Weight (lb/ft): | 5.52 |
| Purlin-Frame Attachment: | Welded anti roll clip at eave & ridge |
| Bracing: | Brace option 3 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 | 0.53 | 0.55 | 0.082 | |
| 3 | 10.40 | 1.13 | 1.10 | 0.183 | |
| 4 | 15.60 | 1.71 | 1.66 | 0.278 | |
| 5 | 20.80 | 2.30 | 2.22 | 0.368 | |
| 6 | 26.00 | 2.92 | 2.78 | 0.458 | |
| 7 | 31.20 | 3.60 | 3.37 | 0.556 | |
| 8 | 36.40 | 4.32 | 4.00 | 0.663 | |
| 9 | 41.60 | 5.10 | 4.65 | 0.793 | |
| 10 | 46.80 | 6.10 | 5.40 | 0.968 | |
| 11 | 49.19 | | | | Failure Load |

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


Load vs Deflection (Test #6)
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

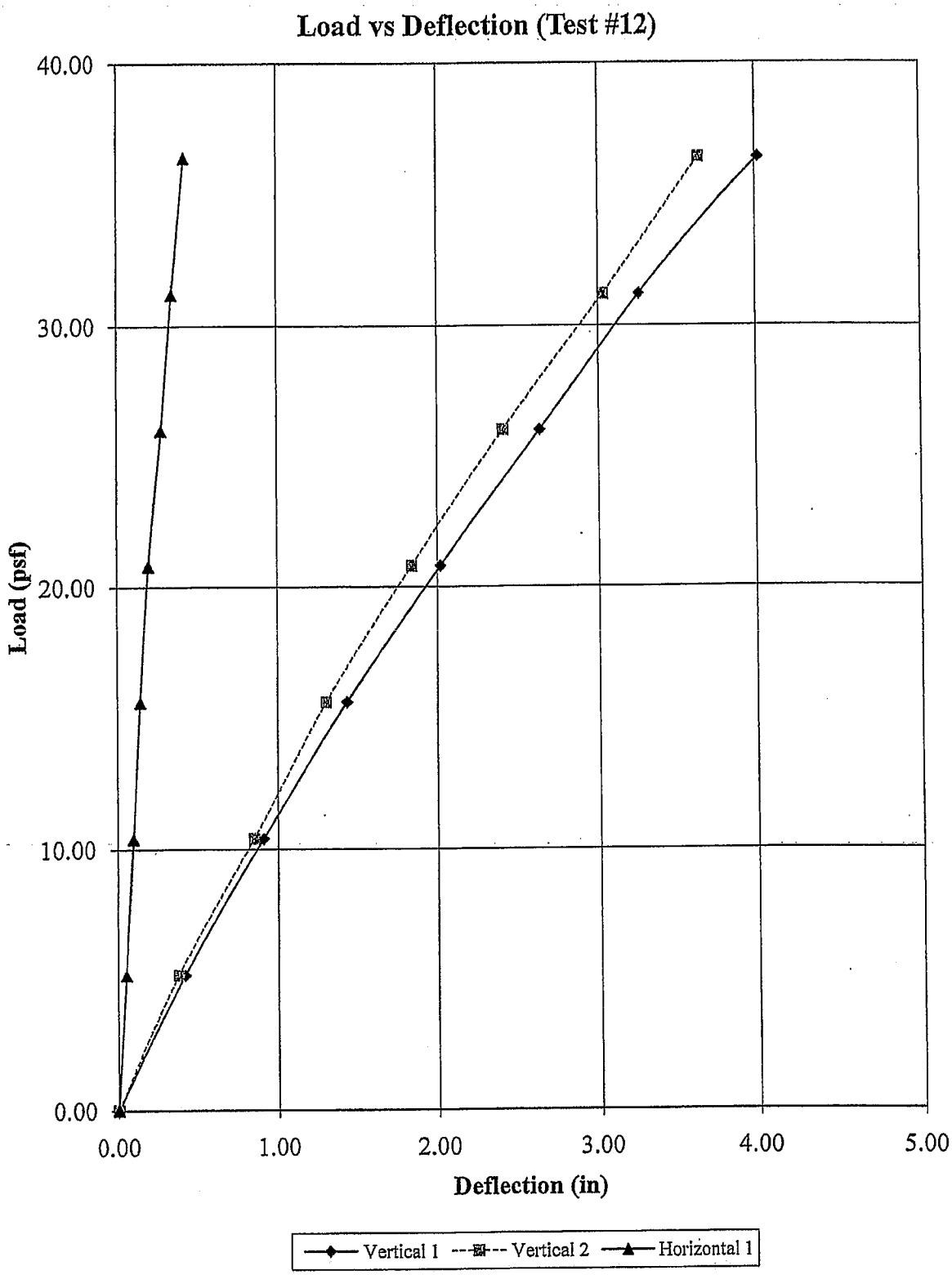
## TEST RESULTS

### 3.13 Test #12: 10Z12 with bracing 3, plate and 3 bolts (Uplift)

| | |
|---|---|
| Date: | 2.24.10 |
| Test Number: | 12 Uplift |
| Panel Type: | CO Buildings PBR Panel |
| Panel Fasteners: | #12 x 2" long SDS @ 12" o.c. |
| Sidelap Fasteners | 1/4" x 7/8" long SDS @ 12" o.c. |
| Panel Span (ft): | 5' 0" |
| Panel Length (ft): | 7' 0" |
| Insulation: | 4" Insulation, Sealed N Safe, 3" Insulation |
| Purlin Size: | Zee 10" x 2.5" |
| Purlin Thickness: | 12 ga. |
| Yield Stress (ksi): | 68 |
| Purlin Span (ft): | 30 |
| Panel Weight (psf): | 0.88 |
| Purlin Weight (lb/ft): | 5.39 |
| Purlin-Frame Attachment: | Welded antiroll clip at eave & ridge with 7" high plate with 2 bolts at bottom and 1 bolt at top |
| Bracing: | Bracing option 3 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 | 0.41 | 0.37 | 0.050 | |
| 3 | 10.40 | 0.91 | 0.85 | 0.097 | |
| 4 | 15.60 | 1.44 | 1.31 | 0.142 | |
| 5 | 20.80 | 2.02 | 1.84 | 0.194 | |
| 6 | 26.00 | 2.64 | 2.41 | 0.272 | |
| 7 | 31.20 | 3.26 | 3.03 | 0.338 | |
| 8 | 36.40 | 4.02 | 3.65 | 0.415 | |
| 9 | 41.39 | | | | Failure Load |

Failure Mode: Bottom flange lip of eave purlin buckled near mid span


Load vs Deflection (Test #12)
40.00
30.00
20.00
10.00
0.00
Load (psf)
0.00
1.00
2.00
3.00
4.00
5.00
Deflection (in)
Vertical 1
Vertical 2
Horizontal 1

## 3.7.4 MODIFICATION FACTOR FOR TEST #4

| | | |
|---|---|---|
| Purlin depth 'd' (in): | | 10.000 |
| Purlin flange width 'b' (in): | | 2.625 |
| Purlin thickness 't' (in): | | 0.101 |
| Measured yield stress '$F_{yt}$' (ksi): | | 68.5 |
| 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): | | 48.360 |
| Specimen weight '$p_d$' (psf): | | 2.431 |
| Effective section modulus '$S_{et}$' ($in^3$): | | 4.137 |
| Moment of inertia of full unreduced section $I_x$ ($in^4$): | | 22.439 |
| Product moment of inertia of full unreduced section $I_{xy}$ ($in^4$): | | 5.004 |
| C2 | from Specification Table D6.3.1-1 | 8.2 |
| C3 | from Specification Table D6.3.1-1 | 33.0 |
| $P_L$ (lb/ft) | $0.5\left(\frac{C2}{1000}\frac{I_{xy}L}{I_x d}+C3\frac{0.25bt}{d^2}\right)(p_{ts}+p_d)s$ | 8.32 |
| $w_{ts}$ (lb/ft) | $(p_{ts}+p_d)s+2P_L(d/B)$ | 192.58 |
| $M_{ts}$ (kip.in) | | 259.98 |
| $M_{nt}$ (kip.in) | | 283.36 |
| Modification Factor '$R_t$': | | 0.918 |

### 3.7.5 MODIFICATION FACTOR FOR TEST #5

| | | |
|---|---|---|
| Purlin depth 'd' (in): | | 10.000 |
| Purlin flange width 'b' (in): | | 2.625 |
| Purlin thickness 't' (in): | | 0.101 |
| Measured yield stress '$F_{yt}$' (ksi): | | 65.5 |
| 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): | | 49.920 |
| Specimen weight '$p_d$' (psf): | | 2.438 |
| Effective section modulus '$S_{et}$' ($in^3$): | | 4.184 |
| Moment of inertia of full unreduced section $I_x$ ($in^4$): | | 22.585 |
| Product moment of inertia of full unreduced section $I_{xy}$ ($in^4$): | | 5.488 |
| C2 | from Specification Table D6.3.1-1 | 8.2 |
| C3 | from Specification Table D6.3.1-1 | 33.0 |
| $P_L$ (lb/ft) | $0.5\left(\frac{C2}{1000}\frac{I_{xy}L}{I_x d}+C3\frac{0.25bt}{d^2}\right)(p_{ts}+p_d)s$ | 9.16 |
| $w_{ts}$ (lb/ft) | $(p_{ts}+p_d)s+2P_L(d/B)$ | 198.71 |
| $M_{ts}$ (kip.in) | | 268.26 |
| $M_{nt}$ (kip.in) | | 274.07 |
| Modification Factor '$R_f$': | | 0.979 |

## 3.7.6 MODIFICATION FACTOR FOR TEST #6

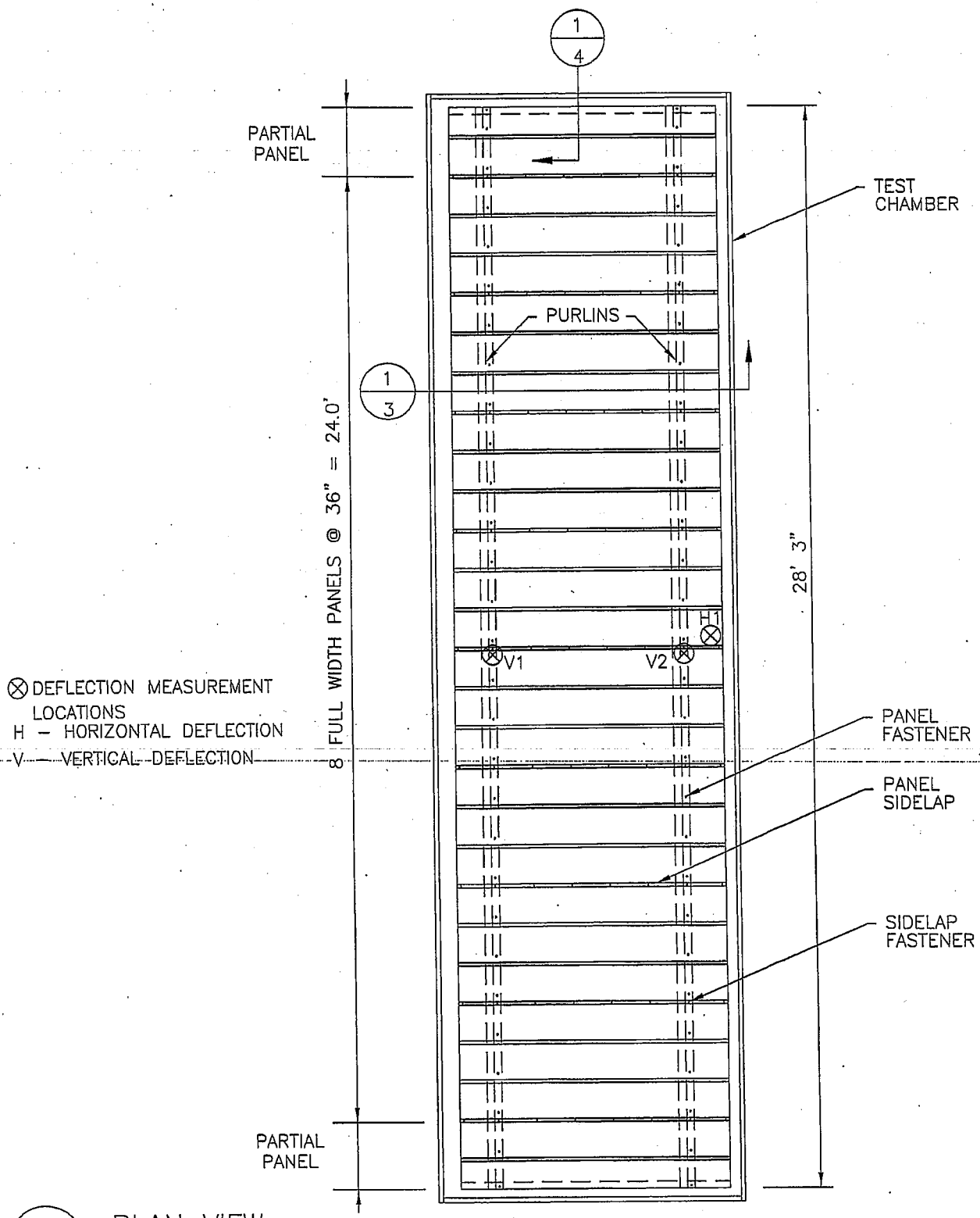
| | | |
|---|---|---|
| Purlin depth 'd' (in): | | 10.000 |
| Purlin flange width 'b' (in): | | 2.625 |
| Purlin thickness 't' (in): | | 0.102 |
| Measured yield stress '$F_{yt}$' (ksi): | | 65.0 |
| Purlin span 'L' (ft): | | 30.000 |
| Maximum anticipated purlin spacing 'B' (ft): | | 5.000 |
| Tributary width of purlin tested 's' (ft): | | 3.737 |
| Failure load of single span system tested '$p_{ts}$' (psf): | | 49.192 |
| Specimen weight '$p_d$' (psf): | | 2.458 |
| Effective section modulus '$S_{et}$' ($in^3$): | | 4.256 |
| Moment of inertia of full unreduced section $I_x$ ($in^4$): | | 22.939 |
| Product moment of inertia of full unreduced section $I_{xy}$ ($in^4$): | | 5.239 |
| C2 | from Specification Table D6.3.1-1 | 8.2 |
| C3 | from Specification Table D6.3.1-1 | 33.0 |
| $P_L$ (lb/ft) | $0.5\left(\frac{C2}{1000}\frac{I_{xy}L}{I_x d}+C3\frac{0.25bt}{d^2}\right)(p_{ts}+p_d)s$ | 8.64 |
| $w_{ts}$ (lb/ft) | $(p_{ts}+p_d)s+2P_L(d/B)$ | 195.90 |
| $M_{ts}$ (kip.in) | | 264.46 |
| $M_{nt}$ (kip.in) | | 276.62 |
| Modification Factor '$R_t$': | | 0.956 |

## 3.7.12 MODIFICATION FACTOR FOR TEST #12

| | | |
|---|---|---|
| Purlin depth 'd' (in): | | 10.030 |
| Purlin flange width 'b' (in): | | 2.625 |
| Purlin thickness 't' (in): | | 0.100 |
| Measured yield stress '$F_{yt}$' (ksi): | | 68.0 |
| Purlin span 'L' (ft): | | 30.000 |
| Maximum anticipated purlin spacing 'B' (ft): | | 5.000 |
| Tributary width of purlin tested 's' (ft): | | 3.789 |
| Failure load of single span system tested '$p_{ts}$' (psf): | | 41.392 |
| Specimen weight '$p_d$' (psf): | | 2.419 |
| Effective section modulus '$S_{et}$' ($in^3$): | | 4.058 |
| Moment of inertia of full unreduced section $I_x$ ($in^4$): | | 22.498 |
| Product moment of inertia of full unreduced section $I_{xy}$ ($in^4$): | | 5.003 |
| C2 | from Specification Table D6.3.1-1 | 8.2 |
| C3 | from Specification Table D6.3.1-1 | 33.0 |
| $P_L$ (lb/ft) | $0.5\left(\frac{C2}{1000}\frac{I_{xy}L}{I_x d}+C3\frac{0.25bt}{d^2}\right)(p_{ts}-p_d)s$ | 6.42 |
| $w_{ts}$ (lb/ft) | $(p_{ts}+p_d)s+2P_L(d/B)$ | 149.81 |
| $M_{ts}$ (kip.in) | | 202.25 |
| $M_{nt}$ (kip.in) | | 275.94 |
| Modification Factor '$R_t$': | | 0.733 |

| ENCON TECHNOLOGY, INC. | SEALED 'N' SAFE THERMAL BLOCKS<br>PURLIN BASE TEST DETAILS | AISI S908-08 | 58/99 |
|---|---|---|---|

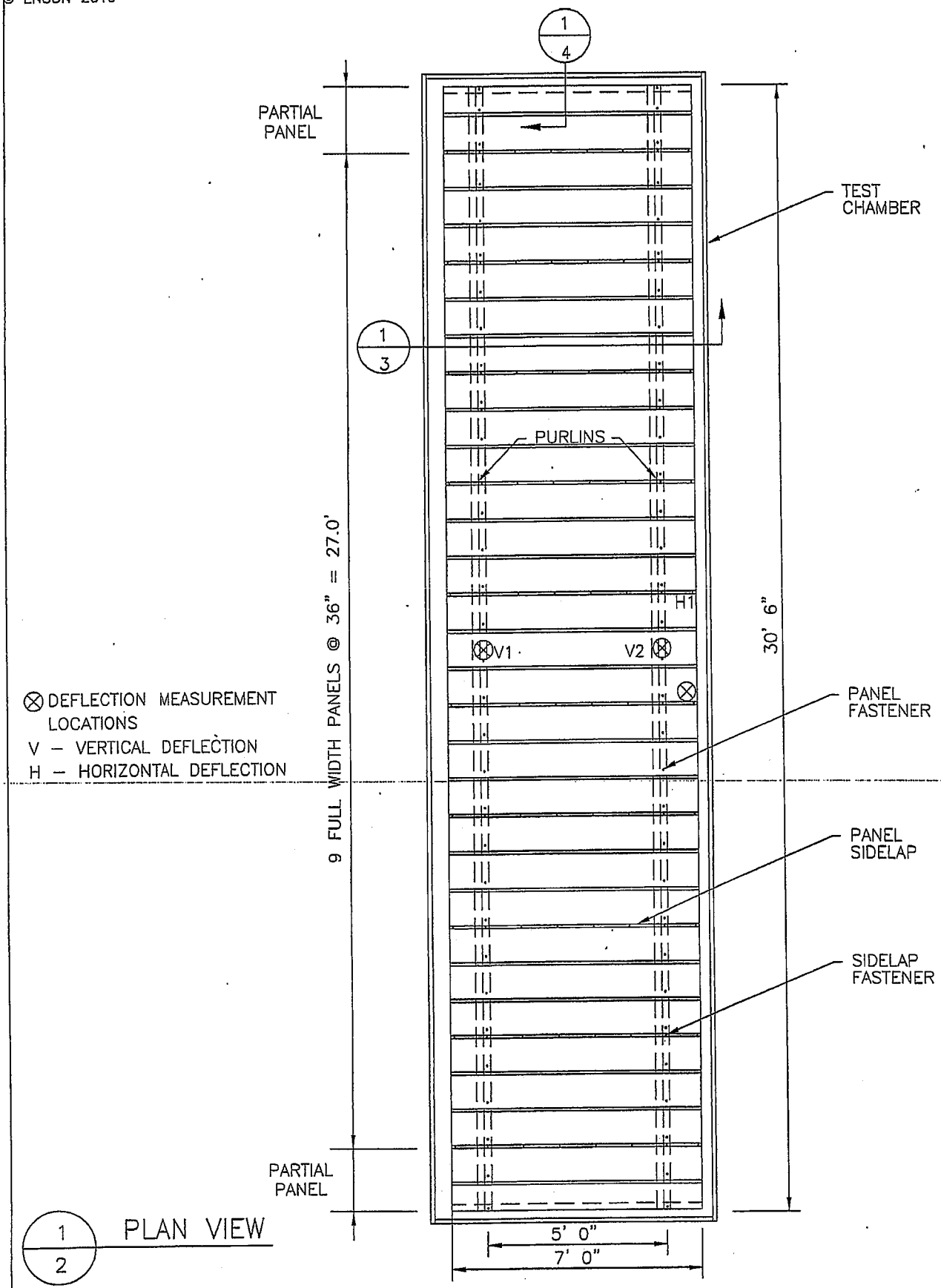





1/1 PLAN VIEW

| ENCON TECHNOLOGY, INC. | SEALED 'N' SAFE THERMAL BLOCKS<br>PURLIN BASE TEST DETAILS | AISI S908-08 | 59/99 |
|---|---|---|---|

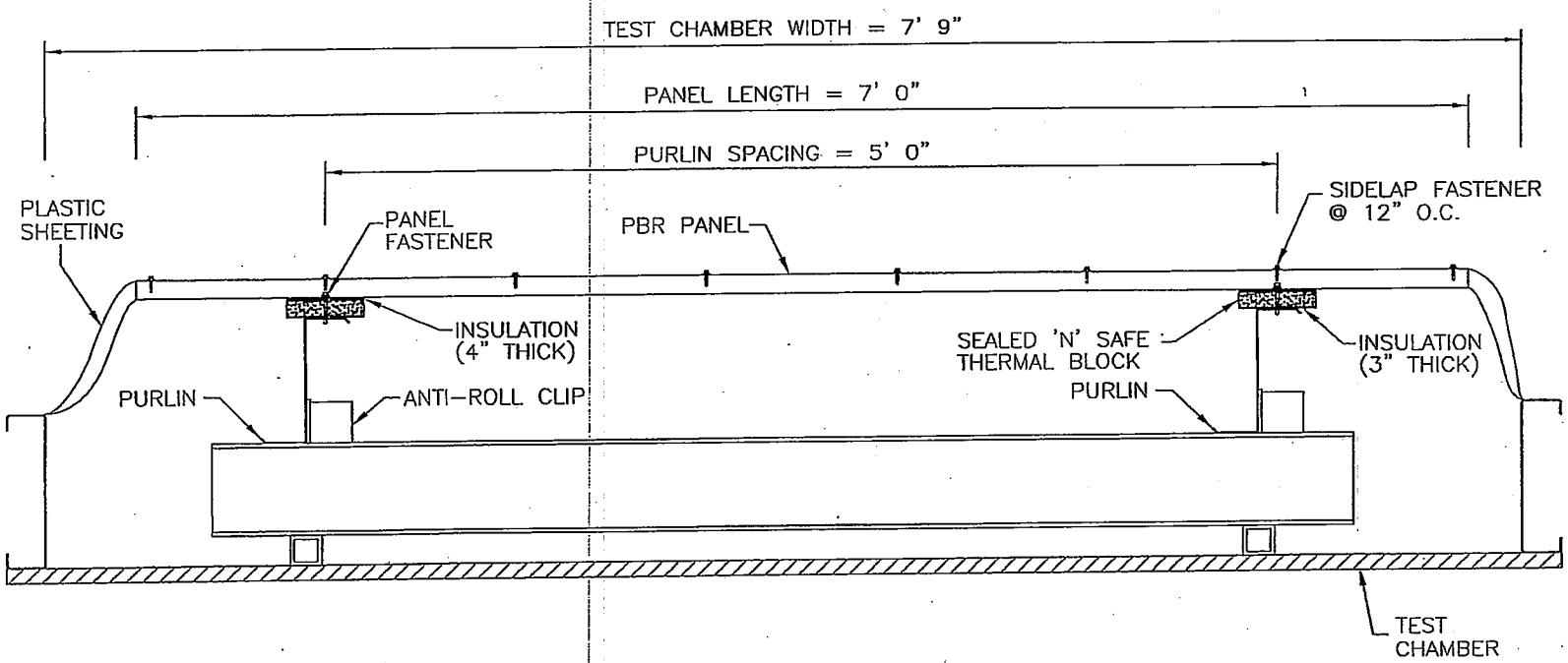





1/2 PLAN VIEW

| ENCON® TECHNOLOGY, INC. | SEALED 'N' SAFE THERMAL BLOCKS<br>PURLIN BASE TEST DETAILS | AISI S908-08 | 60/99 |
|---|---|---|---|





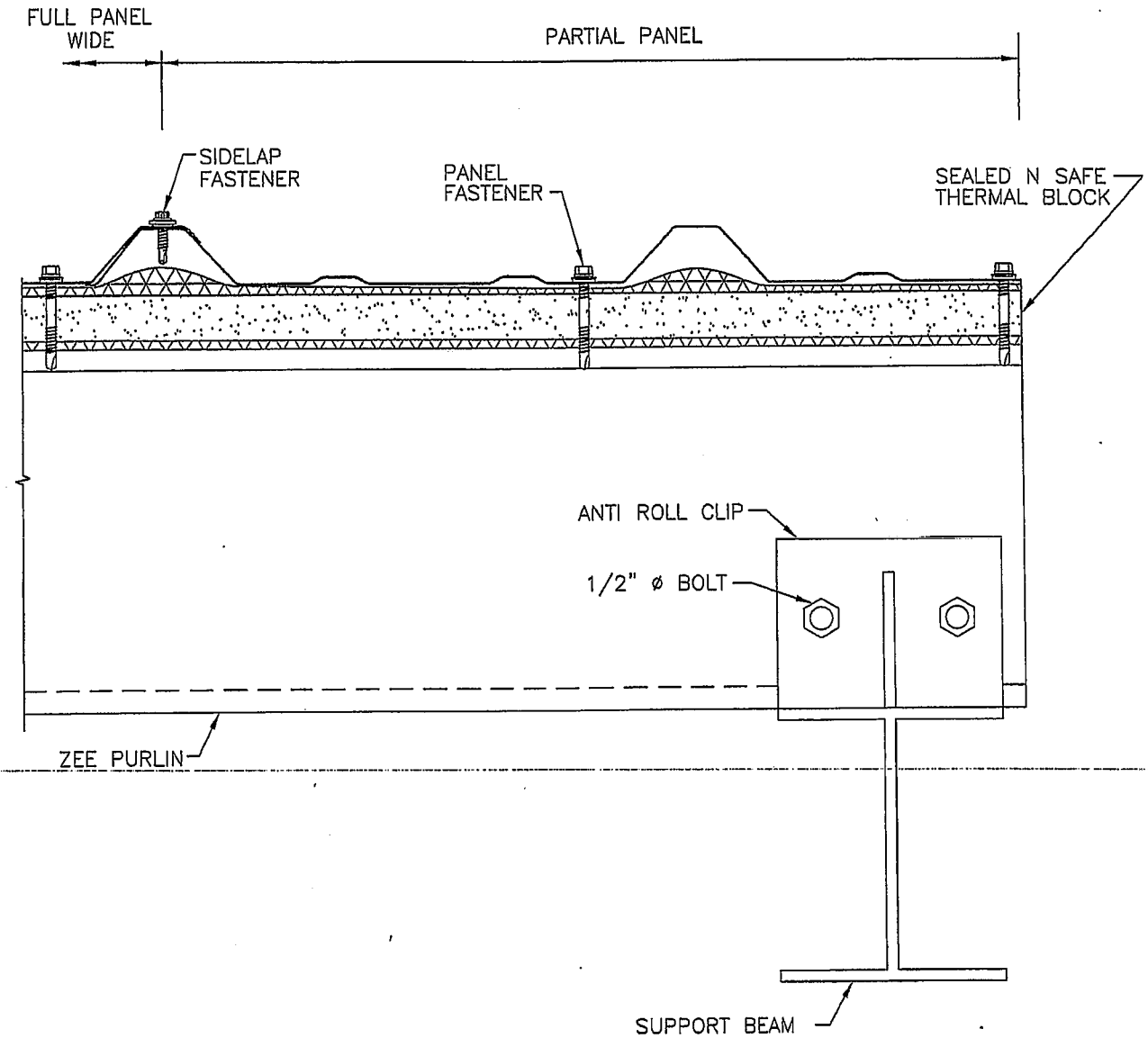

1/3 SECTION VIEW



C1696006E
MAR 3, 2010

| ENCON TECHNOLOGY, INC. | SEALED 'N' SAFE THERMAL BLOCKS<br>PURLIN BASE TEST DETAILS | AISI S908-08 | 61/99 |
|---|---|---|---|






1/4 DETAIL OF "PURLIN SUPPORTS"

SHERRY LABORATORIES

TESTING TODAY, PROTECTING TOMORROW

WWW.SHERRYLABS.COM

Sherry Laboratories
3100 North Hemlock Circle
Broken Arrow, OK 74012-1115

Tel: 918-258-6066
800-982-8378
Fax: 918-258-1154

# LABORATORY REPORT

**Attn: Bala Sockalingam**
**ENCON Technology, Inc.**
**1216 N. Lansing Ave., Suite C**
**Tulsa, OK 74106**

**Report No.:** 10020090-004-v1
**Date Received:** 2/2/2010
**Date Reported:** 2/5/2010
**P.O. No.:** Credit Card

**Sample Description: (1) Test Sample No.: 4A, CO Building 10Z - Test #4**

**Tensile Test (Rectangular) per ASTM E8-08**

| Parameter | Result |
|---|---|
| Orientation | Parallel to Length of the Specimen |
| Thickness, inch | 0.101 |
| Width, inch | 0.504 |
| Tensile Strength, psi | 88,000 |
| Yield Strength, psi at 0.2% offset | 68,500 |
| Elongation in 2 inches, % | 22 |

Approved by: Maurice Cochran

Maurice Cochran, Supervisor of Mechanical Testing
Sherry Laboratories

SHERRY LABORATORIES

TESTING TODAY, PROTECTING TOMORROW

WWW.SHERRYLABS.COM

Sherry Laboratories
3100 North Hemlock Circle
Broken Arrow, OK 74012-1115

Tel: 918-258-6066
800-982-8378
Fax: 918-258-1154

# LABORATORY REPORT

**Attn: Bala Sockalingam**
**ENCON Technology, Inc.**
**1216 N. Lansing Ave., Suite C**
**Tulsa, OK 74106**

**Report No.:** 10020323-001-v1
**Date Received:** 2/5/2010
**Date Reported:** 2/10/2010
**P.O. No.:** Verbal

**Sample Description: (1) Test Sample No.: 5A, CO Building 10Z - Test #5**

## Tensile Test (Rectangular) per ASTM E8-08

| Parameter | Result |
|---|---|
| Orientation | Parallel to Length of the Specimen |
| Thickness, inch | 0.101 |
| Width, inch | 0.502 |
| Tensile Strength, psi | 86,000 |
| Yield Strength, psi at 0.2% offset | 65,500 |
| Elongation in 2 inches, % | 22 |

Approved by: Maurice Cochran

Maurice Cochran, Supervisor of Mechanical Testing
Sherry Laboratories

SHERRY LABORATORIES

TESTING TODAY, PROTECTING TOMORROW

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# LABORATORY REPORT

**Attn: Bala Sockalingam**
**ENCON Technology, Inc.**
**1216 N. Lansing Ave., Suite C**
**Tulsa, OK 74106**

**Report No.:** 10020323-002-v1
**Date Received:** 2/5/2010
**Date Reported:** 2/10/2010
**P.O. No.:** Verbal

**Sample Description: (1) Test Sample No.: 6A, CO Building 10Z - Test #6**

## Tensile Test (Rectangular) per ASTM E8-08

| Parameter | Result |
|---|---|
| Orientation | Parallel to Length of the Specimen |
| Thickness, inch | 0.102 |
| Width, inch | 0.503 |
| Tensile Strength, psi | 85,500 |
| Yield Strength, psi at 0.2% offset | 65,000 |
| Elongation in 2 inches, % | 22 |

Approved by: Maurice Cochran

Maurice Cochran, Supervisor of Mechanical Testing
Sherry Laboratories

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# LABORATORY REPORT

**Attn: Bala Sockalingam**
**ENCON Technology, Inc.**
**1216 N. Lansing Ave., Suite C**
**Tulsa, OK 74106**

**Report No.:** 10021136-006-v1
**Date Received:** 2/25/2010
**Date Reported:** 3/2/2010
**P.O. No.:** Verbal

**Sample Description: (1) Test Sample, CO Building 10Z - Test #12, Sample No.: 12A**

## Tensile Test (Rectangular) per ASTM E8-08

| Parameter | Result |
|---|---|
| Orientation | Parallel to Length of the Specimen |
| Thickness, inch | 0.100 |
| Width, inch | 0.500 |
| Tensile Strength, psi | 89,000 |
| Yield Strength, psi at 0.2% offset | 68,000 |
| Elongation in 2 inches, % | 20 |

Approved by: Maurice Cochran

Maurice Cochran, Supervisor of Mechanical Testing
Sherry Laboratories

CFS Version 6.0.0
Section: Test#4.sct
Zee 12 ga Test #4
PBR 10Z Gravity
Rev. Date: 2/6/2010 6:03:28 PM
By: Bala Sockalingam, Ph.D., P.E

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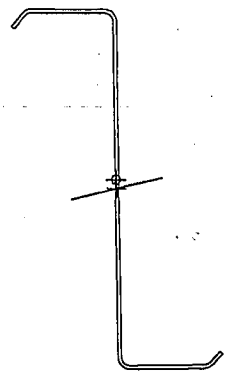

## Section Inputs

Material: [N/A]
No strength increase from cold work of forming.
Modulus of Elasticity, E 29500000 psi
Yield Strength, Fy 68500 psi
Tensile Strength, Fu 88000 psi
Warping Constant Override, Cw 0 in^6
Torsion Constant Override, J 0 in^4

Stiffened Zee, Thickness 0.101 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 (in) | Angle (deg) | Radius (in) | Web | k Coef. | Hole Size (in) | Distance (in) |
|---|---|---|---|---|---|---|---|
| 1 | 0.6250 | 50.000 | 0.25000 | None | 0.000 | 0.0000 | 0.3125 |
| 2 | 2.6250 | 0.000 | 0.25000 | Single | 0.000 | 0.0000 | 1.3125 |
| 3 | 10.0000 | -89.000 | 0.25000 | Single | 0.000 | 0.0000 | 5.0000 |
| 4 | 2.5630 | 1.000 | 0.25000 | Single | 0.000 | 0.0000 | 1.2815 |
| 5 | 0.5630 | 46.000 | 0.25000 | None | 0.000 | 0.0000 | 0.2815 |

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## Full Section Properties

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | 1.5961 | in^2 | Wt. | 5.4268 | lb/ft | Width | 15.803 in |
| Ix | 22.439 | in^4 | rx | 3.7495 | in | Ixy | -5.004 in^4 |
| Sx(t) | 4.5246 | in^3 | y(t) | 4.9594 | in | α | 13.091 deg |
| Sx(b) | 4.4569 | in^3 | y(b) | 5.0347 | in | | |
| | | | Height | 9.9942 | in | | |
| Iy | 2.083 | in^4 | ry | 1.1423 | in | Xo | -0.0097 in |
| Sy(l) | 0.6848 | in^3 | x(l) | 3.0415 | in | Yo | 0.2436 in |
| Sy(r) | 0.6914 | in^3 | x(r) | 3.0125 | in | jx | -0.0385 in |
| | | | Width | 6.0540 | in | jy | -0.2590 in |
| I1 | 23.603 | in^4 | r1 | 3.8455 | in | | |
| I2 | 0.919 | in^4 | r2 | 0.7589 | in | | |
| Ic | 24.522 | in^4 | rc | 3.9197 | in | Cw | 34.127 in^6 |
| Io | 24.617 | in^4 | ro | 3.9272 | in | J | 0.005427 in^4 |

## Fully Braced Strength - 2007 North American Specification - US (ASD)

Material Type: [N/A], Fy=68500 psi

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Compression | | | Positive Moment | | | Positive Moment | |
| Pao | 34664 | lb | Maxo | 169677 | lb-in | Mayo | 23786 lb-in |
| Ae | 0.91087 | in^2 | Ixe | 21.201 | in^4 | Iye | 1.785 in^4 |
| | | | Sxe(t) | 4.1366 | in^3 | Sye(l) | 0.5997 in^3 |
| Tension | | | Sxe(b) | 4.3541 | in^3 | Sye(r) | 0.5799 in^3 |
| Ta | 65469 | lb | | | | | |
| | | | Negative Moment | | | Negative Moment | |
| | | | Maxo | 167106 | lb-in | Mayo | 23337 lb-in |
| Shear | | | Ixe | 21.184 | in^4 | Iye | 1.769 in^4 |
| Vay | 9853 | lb | Sxe(t) | 4.4183 | in^3 | Sye(l) | 0.5689 in^3 |
| Vax | 10858 | lb | Sxe(b) | 4.0740 | in^3 | Sye(r) | 0.6009 in^3 |

CFS Version 6.0.0
Section: Test#5.sct
Zee 12 ga Test #5
PBR 10Z Gravity
Rev. Date: 2/10/2010 3:18:50 PM
By: Bala Sockalingam, Ph.D., P.E

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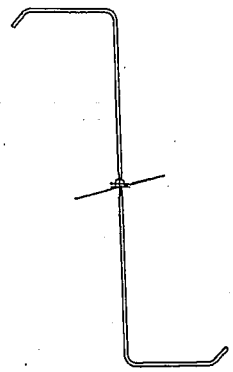

## Section Inputs

Material: [N/A]
No strength increase from cold work of forming.
Modulus of Elasticity, E 29500000 psi
Yield Strength, Fy 65500 psi
Tensile Strength, Fu 86000 psi
Warping Constant Override, Cw 0 in^6
Torsion Constant Override, J 0 in^4

Stiffened Zee, Thickness 0.101 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 (in) | Angle (deg) | Radius (in) | Web | k Coef. | Hole Size (in) | Distance (in) |
|---|---|---|---|---|---|---|---|
| 1 | 0.6250 | 50.000 | 0.25000 | None | 0.000 | 0.0000 | 0.3125 |
| 2 | 2.6250 | 0.000 | 0.25000 | Single | 0.000 | 0.0000 | 1.3125 |
| 3 | 10.0000 | -88.000 | 0.25000 | Single | 0.000 | 0.0000 | 5.0000 |
| 4 | 2.5630 | 1.000 | 0.25000 | Single | 0.000 | 0.0000 | 1.2815 |
| 5 | 0.6250 | 46.000 | 0.25000 | None | 0.000 | 0.0000 | 0.3125 |

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## Full Section Properties

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | 1.6037 | in^2 | Wt. | 5.4527 | lb/ft | Width | 15.879 in |
| Ix | 22.585 | in^4 | rx | 3.7527 | in | Ixy | -5.488 in^4 |
| Sx(t) | 4.5390 | in^3 | y(t) | 4.9758 | in | α | 14.226 deg |
| Sx(b) | 4.5030 | in^3 | y(b) | 5.0156 | in | | |
| | | | Height | 9.9915 | in | | |
| Iy | 2.329 | in^4 | ry | 1.2050 | in | Xo | -0.0026 in |
| Sy(l) | 0.7416 | in^3 | x(l) | 3.1402 | in | Yo | 0.0972 in |
| Sy(r) | 0.7437 | in^3 | x(r) | 3.1314 | in | jx | -0.0329 in |
| | | | Width | 6.2716 | in | jy | -0.1010 in |
| I1 | 23.977 | in^4 | r1 | 3.8666 | in | | |
| I2 | 0.938 | in^4 | r2 | 0.7646 | in | | |
| Ic | 24.914 | in^4 | rc | 3.9415 | in | Cw | 35.249 in^6 |
| Io | 24.929 | in^4 | ro | 3.9427 | in | J | 0.005453 in^4 |

## Fully Braced Strength - 2007 North American Specification - US (ASD)

Material Type: [N/A], Fy=65500 psi

| Compression | | | Positive Moment | | | Positive Moment | |
|---|---|---|---|---|---|---|---|
| Pao | 34023 | lb | Maxo | 164109 | lb-in | Mayo | 24577 lb-in |
| Ae | 0.93498 | in^2 | Ixe | 21.451 | in^4 | Iye | 2.005 in^4 |
| | | | Sxe(t) | 4.1842 | in^3 | Sye(l) | 0.6525 in^3 |
| Tension | | | Sxe(b) | 4.4097 | in^3 | Sye(r) | 0.6266 in^3 |
| Ta | 62901 | lb | | | | | |
| | | | Negative Moment | | | Negative Moment | |
| | | | Maxo | 163597 | lb-in | Mayo | 24465 lb-in |
| Shear | | | Ixe | 21.515 | in^4 | Iye | 2.001 in^4 |
| Vay | 9836 | lb | Sxe(t) | 4.4515 | in^3 | Sye(l) | 0.6238 in^3 |
| Vax | 10434 | lb | Sxe(b) | 4.1711 | in^3 | Sye(r) | 0.6534 in^3 |

CFS Version 6.0.0
Section: Test#6.sct
Zee 12 ga Test #6
PBR 10Z Gravity
Rev. Date: 2/10/2010 3:21:06 PM
By: Bala Sockalingam, Ph.D., P.E



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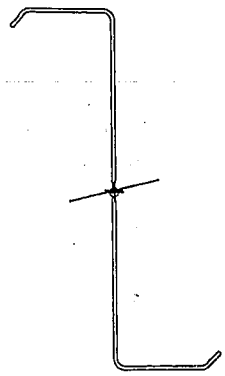

## Section Inputs

Material: [N/A]
No strength increase from cold work of forming.

| | |
|---|---|
| Modulus of Elasticity, E | 29500000 psi |
| Yield Strength, Fy | 65000 psi |
| Tensile Strength, Fu | 85500 psi |
| Warping Constant Override, Cw | 0 in^6 |
| Torsion Constant Override, J | 0 in^4 |

Stiffened Zee, Thickness 0.102 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 (in) | Angle (deg) | Radius (in) | Web | k Coef. | Hole Size (in) | Distance (in) |
|---|---|---|---|---|---|---|---|
| 1 | 0.6250 | 50.000 | 0.25000 | None | 0.000 | 0.0000 | 0.3125 |
| 2 | 2.6250 | 0.000 | 0.25000 | Single | 0.000 | 0.0000 | 1.3125 |
| 3 | 10.0000 | -89.000 | 0.25000 | Single | 0.000 | 0.0000 | 5.0000 |
| 4 | 2.6250 | 1.000 | 0.25000 | Single | 0.000 | 0.0000 | 1.3125 |
| 5 | 0.6250 | 45.000 | 0.25000 | None | 0.000 | 0.0000 | 0.3125 |

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## Full Section Properties

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | 1.6244 | in^2 | Wt. | 5.5230 | lb/ft | Width | 15.926 in |
| Ix | 22.939 | in^4 | rx | 3.7578 | in | Ixy | -5.239 in^4 |
| Sx(t) | 4.5905 | in^3 | y(t) | 4.9970 | in | α | 13.416 deg |
| Sx(b) | 4.5904 | in^3 | y(b) | 4.9971 | in | | |
| | | | Height | 9.9942 | in | | |
| Iy | 2.225 | in^4 | ry | 1.1705 | in | Xo | 0.0071 in |
| Sy(l) | 0.7259 | in^3 | x(l) | 3.0657 | in | Yo | -0.0522 in |
| Sy(r) | 0.7179 | in^3 | x(r) | 3.1001 | in | jx | -0.0156 in |
| | | | Width | 6.1658 | in | jy | 0.0578 in |
| I1 | 24.189 | in^4 | r1 | 3.8588 | in | | |
| I2 | 0.976 | in^4 | r2 | 0.7750 | in | | |
| Ic | 25.164 | in^4 | rc | 3.9359 | in | Cw | 36.507 in^6 |
| Io | 25.169 | in^4 | ro | 3.9363 | in | J | 0.005633 in^4 |

## Fully Braced Strength - 2007 North American Specification - US (ASD)

Material Type: [N/A], Fy=65000 psi

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Compression | | | Positive Moment | | | Positive Moment | |
| Pao | 34448 | lb | Maxo | 165639 | lb-in | Mayo | 23236 lb-in |
| Ae | 0.95396 | in^2 | Ixe | 21.865 | in^4 | Iye | 1.892 in^4 |
| | | | Sxe(t) | 4.2557 | in^3 | Sye(l) | 0.6317 in^3 |
| Tension | | | Sxe(b) | 4.5026 | in^3 | Sye(r) | 0.5970 in^3 |
| Ta | 63226 | lb | | | | | |
| | | | Negative Moment | | | Negative Moment | |
| | | | Maxo | 164383 | lb-in | Mayo | 23860 lb-in |
| Shear | | | Ixe | 21.760 | in^4 | Iye | 1.919 in^4 |
| Vay | 10151 | lb | Sxe(t) | 4.4939 | in^3 | Sye(l) | 0.6130 in^3 |
| Vax | 10561 | lb | Sxe(b) | 4.2234 | in^3 | Sye(r) | 0.6322 in^3 |

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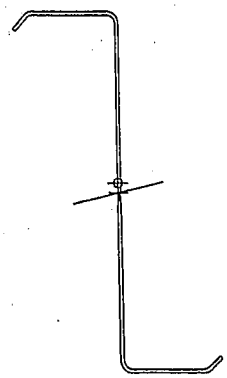

## Section Inputs

Material: [N/A]
No strength increase from cold work of forming.

| | | |
|---|---|---|
| Modulus of Elasticity, E | 29500000 | psi |
| Yield Strength, Fy | 68000 | psi |
| Tensile Strength, Fu | 89500 | psi |
| Warping Constant Override, Cw | 0 | in^6 |
| Torsion Constant Override, J | 0 | in^4 |

Stiffened Zee, Thickness 0.1 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 (in) | Angle (deg) | Radius (in) | Web | k Coef. | Hole Size (in) | Distance (in) |
|---|---|---|---|---|---|---|---|
| 1 | 0.625 | 48.000 | 0.25000 | None | 0.000 | 0.000 | 0.313 |
| 2 | 2.625 | 0.000 | 0.25000 | Single | 0.000 | 0.000 | 1.313 |
| 3 | 10.030 | -89.000 | 0.25000 | Single | 0.000 | 0.000 | 5.015 |
| 4 | 2.563 | 0.000 | 0.25000 | Single | 0.000 | 0.000 | 1.281 |
| 5 | 0.563 | 45.000 | 0.25000 | None | 0.000 | 0.000 | 0.281 |

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## Full Section Properties

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | 1.5847 | in^2 | Wt. | 5.3878 | lb/ft | Width | 15.847 in |
| Ix | 22.498 | in^4 | rx | 3.7679 | in | Ixy | -5.003 in^4 |
| Sx(t) | 4.5178 | in^3 | y(t) | 4.9798 | in | α | 13.049 deg |
| Sx(b) | 4.4546 | in^3 | y(b) | 5.0504 | in | | |
| | | | Height | 10.0302 | in | | |
| Iy | 2.072 | in^4 | ry | 1.1435 | in | Xo | -0.0150 in |
| Sy(l) | 0.6777 | in^3 | x(l) | 3.0579 | in | Yo | 0.2729 in |
| Sy(r) | 0.6860 | in^3 | x(r) | 3.0206 | in | jx | -0.0146 in |
| | | | Width | 6.0785 | in | jy | -0.2935 in |
| I1 | 23.657 | in^4 | r1 | 3.8638 | in | | |
| I2 | 0.913 | in^4 | r2 | 0.7589 | in | | |
| Ic | 24.570 | in^4 | rc | 3.9376 | in | Cw | 34.158 in^6 |
| Io | 24.688 | in^4 | ro | 3.9471 | in | J | 0.005282 in^4 |

## Fully Braced Strength - 2007 North American Specification - US (ASD)

Material Type: [N/A], Fy=68000 psi

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Compression | | | Positive Moment | | | Positive Moment | |
| Pao | 33877 | lb | Maxo | 167450 | lb-in | Mayo | 23415 lb-in |
| Ae | 0.89675 | in^2 | Ixe | 21.195 | in^4 | Iye | 1.775 in^4 |
| | | | Sxe(t) | 4.1124 | in^3 | Sye(l) | 0.5931 in^3 |
| Tension | | | Sxe(b) | 4.3466 | in^3 | Sye(r) | 0.5750 in^3 |
| Ta | 64525 | lb | | | | | |
| | | | Negative Moment | | | Negative Moment | |
| | | | Maxo | 165234 | lb-in | Mayo | 22802 lb-in |
| Shear | | | Ixe | 21.188 | in^4 | Iye | 1.752 in^4 |
| Vay | 9524 | lb | Sxe(t) | 4.4062 | in^3 | Sye(l) | 0.5600 in^3 |
| Vax | 10714 | lb | Sxe(b) | 4.0579 | in^3 | Sye(r) | 0.5936 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.