TEST REPORT ON

26 GA. PBR PANELS
AT 5' 0" PURLIN SPACING
WITH SEALED 'N' SAFE™ THERMAL BLOCKS
IN ACCORDANCE WITH ASTM E1592-05

TESTED FOR:
Sealed 'N' Safe, LLC
320 West 100 North
Ephraim, Utah 84627
Telephone: (435) 283-6550
Fax: (435) 283-8326

TESTED BY:
ENCON® Technology, Inc.
1216 North Lansing Avenue, Suite C
Tulsa, OK 74106
Telephone: (918) 492-5992
FAX: (866) 366-1543

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

TESTING DATES: December 15, 2009
REPORTING DATE: December 18, 2009
ENCON® Project C1677-1

ACCREDITED
TL-327

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SECTION I
TEST SUMMARY

TEST SUMMARY

1.1 SUMMARY

Test was conducted on PBR metal roof panels at ENCON® Technology, Inc.'s Test Facility, Tulsa, Oklahoma. The purpose of this test was uplift resistance of panel fastener fastened to the supports through blanket insulation and Sealed 'N' Safe™ thermal block. This test meets the provisions of ASTM E 1592-05.

The test was conducted on December 15, 2009 and witnessed by Bala Sockalingam, Ph.D., P.E., of ENCON® Technology.

1.2 ROOF SYSTEM DESCRIPTION

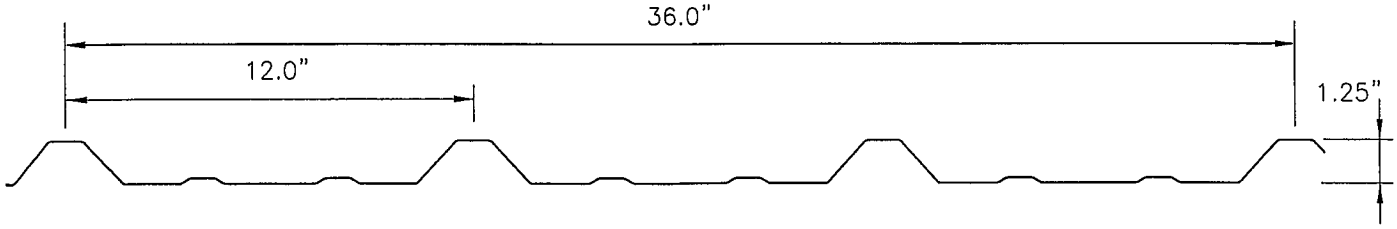
PBR panels are 26 ga., 1-1/4" high and 36" wide through fastened panels. Each panel consists of four major ribs spaced at 12" o.c. as shown on Page 3.

The panels were attached to nominal 16 ga. (0.060") Cee supports 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. Each panel spanned over three continuous spans of 5' 0". The sidelap fasteners were 1/4"-14 x 7/8" long hex head self-drilling screws with washers and were spaced at 15" o.c.

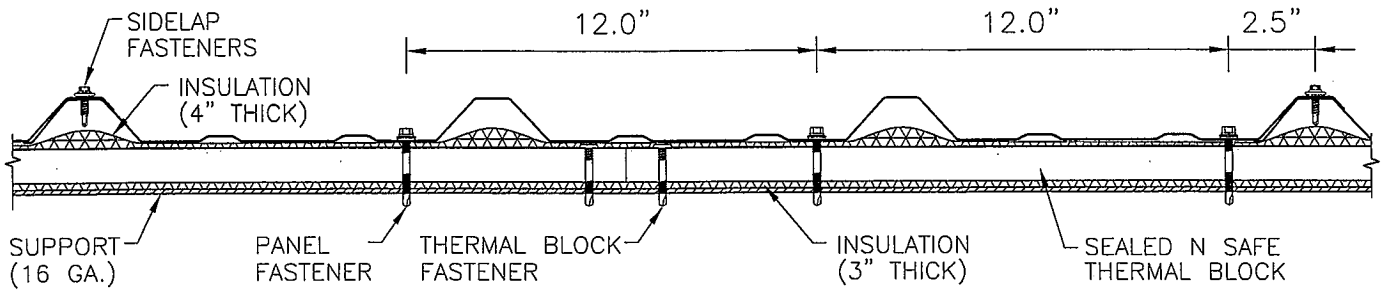
Sealed 'N' Safe™ thermal blocks consisted of two 24 ga. steel plates with polyurethane foam injected between the plates to form a 1" thick block. The length and width of these thermal blocks were 72" and 5", respectively. The blocks were fastened to the supports through 3" thick blanket insulation with #12 x 1-5/8" long pancake head self-drilling screws located at each end of the blocks.

1.3 TEST RESULTS

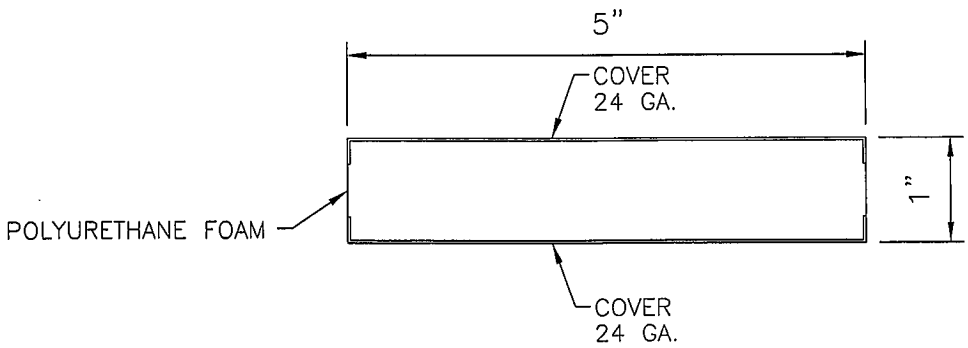
The panels were loaded to a failure condition and observations made. The failure mode was the panel fastener pullover. The ultimate and allowable loads were 87.2 and 43.6 psf, respectively. A diagrammatic representation of this test setup is illustrated on Page 2.



26 GA., PBR PANEL



FASTENER PATTERN AT END & INTERMEDIATE SUPPORTS



SEALED 'N' SAFE THERMAL BLOCKS

SECTION II
DESCRIPTION OF TEST

2.1 DESCRIPTION OF TEST

Test was conducted to determine the structural performance of the metal panel at 5' 0" span under configurations under uniform static pressure difference. The test method consisted of the following: (1) sealing the test specimen against one face of a test chamber; (2) supplying air to and exhausting air from the chamber at the rate required to maintain the test pressure difference across the specimen; and (3) observing, measuring, and recording the deflections, deformations, and nature of any failures of principal or critical elements of the panel profile or members of the anchor system. 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. End and edge restraint was representative of field conditions, and the unit contained sufficient individual components to minimize the effect of variations in material and workmanship.

2.1.1 TEST CHAMBER

The test chamber consisted of a box as shown in the applicable drawings in Section V. It contains one open surface against 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.

2.1.2 AIR SYSTEM

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

2.1.3 DEFLECTION AND DISTORTION MEASUREMENT

Deflection and distortion measurements were taken by means of a level and staffs calibrated to 1/100 of an inch, which were attached to the topside of the specimen. The deflection staffs were placed so that movement of the support members did not influence their readings. Reading locations are as shown on the drawings in Section V.

2.1.4 TEST PROCEDURE

A nominal air pressure of 5.2 psf, which was equivalent to four times the dead weight of the specimen, was applied to the test panel for at least a minimum of 60 seconds and until the panel had stabilized and readings were taken. These readings were considered as bench mark readings and the load corresponding to these readings were considered as "Reference Zero Load."

The air pressure was then increased by load increments as shown on recorded data and held for 60 seconds and until the panel had stabilized and the first set of readings were measured for the test panel. The air pressure was then reduced to zero or no load and then once again to the Reference Zero Load and the bench mark readings were taken.

This procedure was repeated several times each time increasing the air pressure by a load increment over the previous load. It was ensured that benchmark readings were taken between each incremental increase in order to keep track of permanent deflections. This load sequence was continued until the panel was subjected to maximum air pressure resulting in its failure.

2.1.5 TEST SPECIMEN

The test specimen was of sufficient size to determine the performance of all typical parts of the panel system excluding support elements such as supports, eave struts, rake angles and similar structural parts supporting the panel system. Conditions of structural support of the panel system were simulated as accurately as possible. The test specimen included the panels and fasteners attachment of the panels to its structural supports. All of the parts of the test specimen were actual size and material. The overall dimension of the specimen was in excess of 10' x 15'. The panels were supported by secondary structures (supports). The details of methods of construction and anchorage are depicted in the enclosed test drawings

Endwall edges "cut end" (Details 1/2 and 1/3) were attached to rake angles or other structural elements by clamps and show the locations of the fasteners relative to the various edge conditions. Detail 1/4 shows the locations of the fasteners at the end supports

Plastic sheeting (max 6 mil thick) was used to keep the air pressure chamber airtight. The sheeting was placed between the supports and panels. The sheeting was pleated to allow the sheeting to flow into the panel ribs when air pressure was applied to the panels.

2.1.6 SPECIMEN WIDTH & LENGTH

The specimen width was more than ten feet and contained no less than three full panels and five structural elements. Edge seals did not constrain the specimen any more than normal gable attachment. The panels spanned 3 equal spans of 5' 0".

2.1.7 SPECIMEN ORIENTATION AND SEALING

The test specimen was installed in its "as used" orientation, i.e., the interior side of the specimen faced the applied air pressure. The panel was secured to the test jig by the same number and type of fasteners as are normally used for installation of the test specimen on a building. The use of tape or film did not restrict differential movement between adjoining members.

2.1.8 FAILURE

Failure was considered to have occurred when components separated or permanent distortion interfered with the function of the system or the system was unable to carry additional load.

2.2 FACTOR OF SAFETY

The design load was calculated with factor of safety of 2 as per *AISI-NAS 2007 Specifications.*

SECTION III
TEST RESULTS

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.
Base Metal Thickness:	0.016"
Panel Yield Stress:	94.5 ksi (tested)
Panel Fasteners:	#12 x 2" long hex head self-drilling screws with washers (DB Building Fasteners, Inc.)
Sidelap Fasteners:	1/4"-14 x 7/8" long hex head self-drilling screws with washers
Sidelap Fasteners Spacing:	15" o.c.
Thermal Blocks:	Sealed 'N' Safe™ - 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 the thermal block were 72" and 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 and 3" thick blanket insulation
Support Thickness:	16 ga. (0.059")

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

3.2 TEST RESULTS FOR 26 GA., 36" WIDE PANELS AT 5' 0" PURLIN SPACING

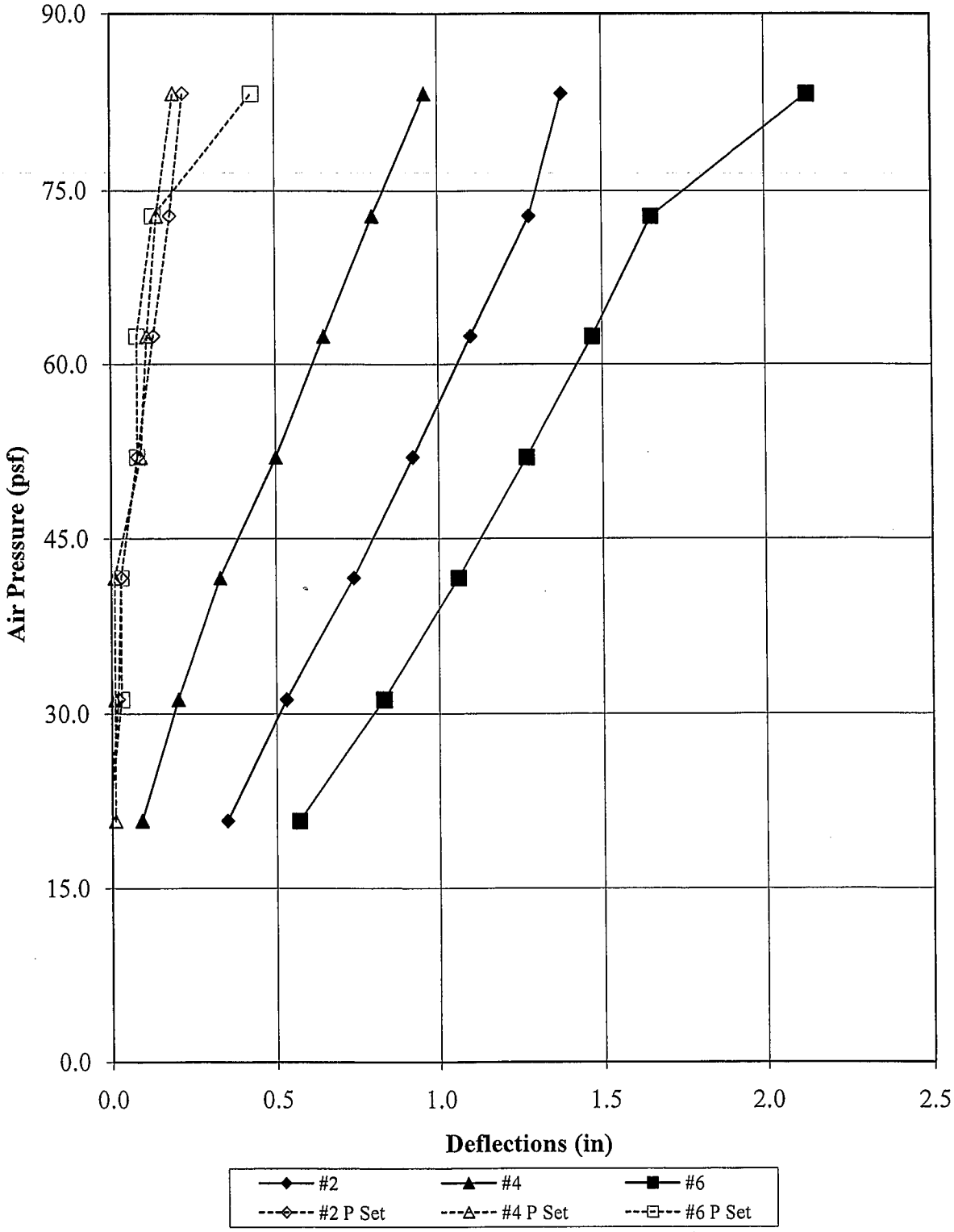
Uplift Load Testing of 26 Ga., PBR Panel
@ 5' 0" Steel Support Spacing with
Blanket Insulation and Sealed 'N' Safe™ Thermal Blocks
Test conducted on December 15, 2009

No.	Pressure	Time	Deflection (in)						
	psf	Sec	1	2	3	4	5	6	Remarks
1	20.8	60	0.17	0.35	0.15	0.09	0.25	0.57	
2	5.2		0.00	-0.01	-0.02	0.01	0.00	-0.01	
3	31.2	60	0.32	0.53	0.29	0.20	0.44	0.83	
4	5.2		-0.01	0.02	0.00	0.01	0.01	0.03	
5	41.6	60	0.43	0.74	0.42	0.33	0.60	1.06	
6	5.2		0.03	0.03	0.03	0.01	0.02	0.03	
7	52.0	60	0.62	0.92	0.57	0.50	0.79	1.27	
8	5.2		0.11	0.08	0.09	0.09	0.06	0.08	
9	62.4	60	0.72	1.10	0.68	0.65	0.95	1.47	
10	5.2		0.14	0.13	0.13	0.11	0.07	0.08	
11	72.8	60	0.83	1.28	0.83	0.80	1.14	1.65	
12	5.2		0.20	0.18	0.16	0.14	0.11	0.13	
13	83.2	60	0.92	1.38	0.94	0.96	1.45	2.13	*
14	5.2		0.22	0.22	0.22	0.19	0.17	0.43	
15	87.2								

Failure Mode: Fastener pullover

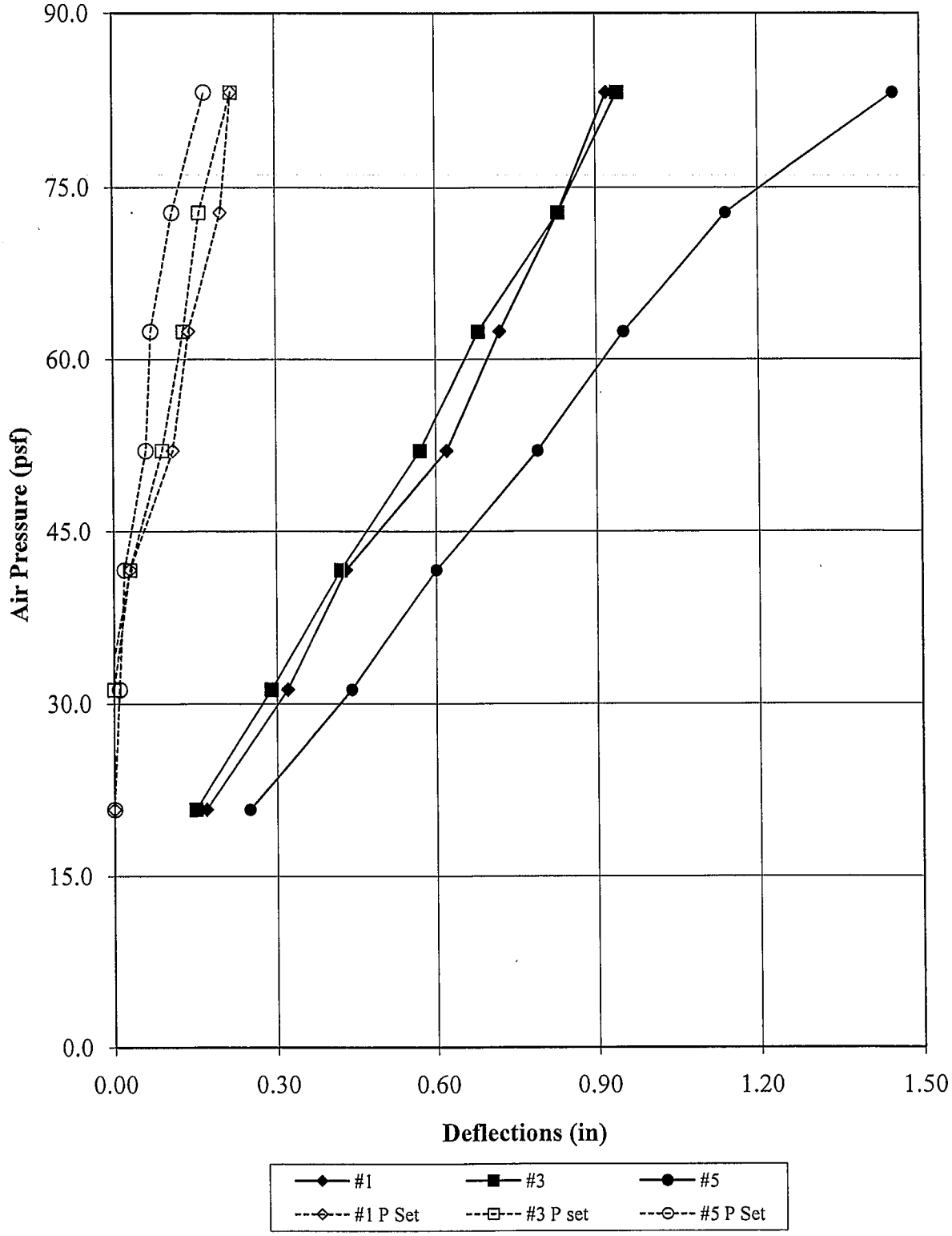
* The panel flat buckled at the end span.

Uplift Load vs Panel Flat Deflections
26 ga. PBR Panel at 5' 0" Span



Note: P Set denotes permanent deflection after each load cycle.

Uplift Load vs Panel Rib Deflections
26 ga. PBR Panel at 5' 0" Span



Note: P Set denotes permanent deflection after each load cycle.

SECTION IV
PHOTOGRAPHS

PHOTOGRAPHS

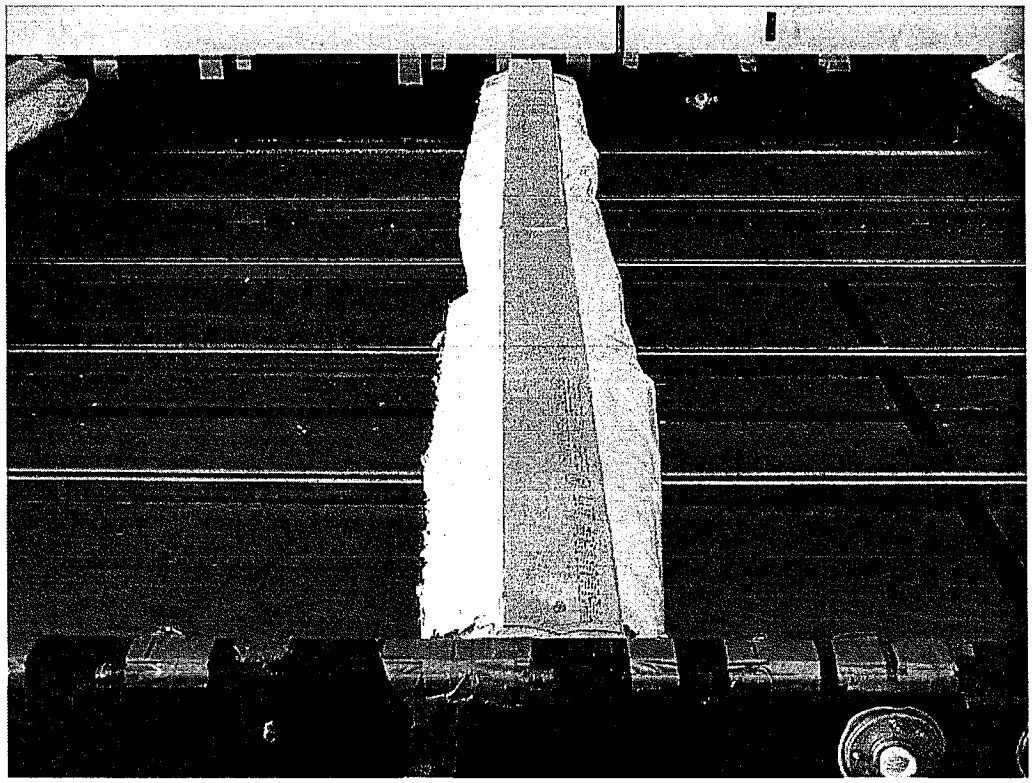


PHOTO 1 View of the Sealed 'N' Safe™ thermal blocks fastened through 3" thick blanket insulation to the supports. (DSC00061)

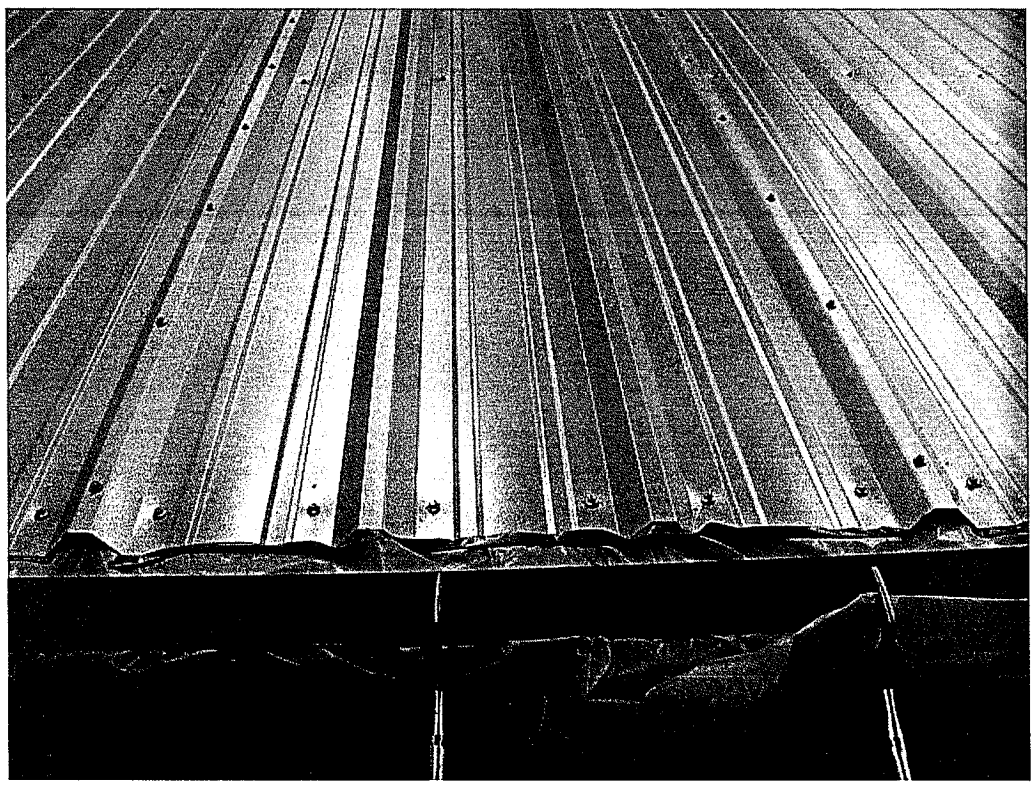


PHOTO 2 View of the 26 ga. PBR panel attachment at end and interior supports. (DSC00062)

PHOTOGRAPHS

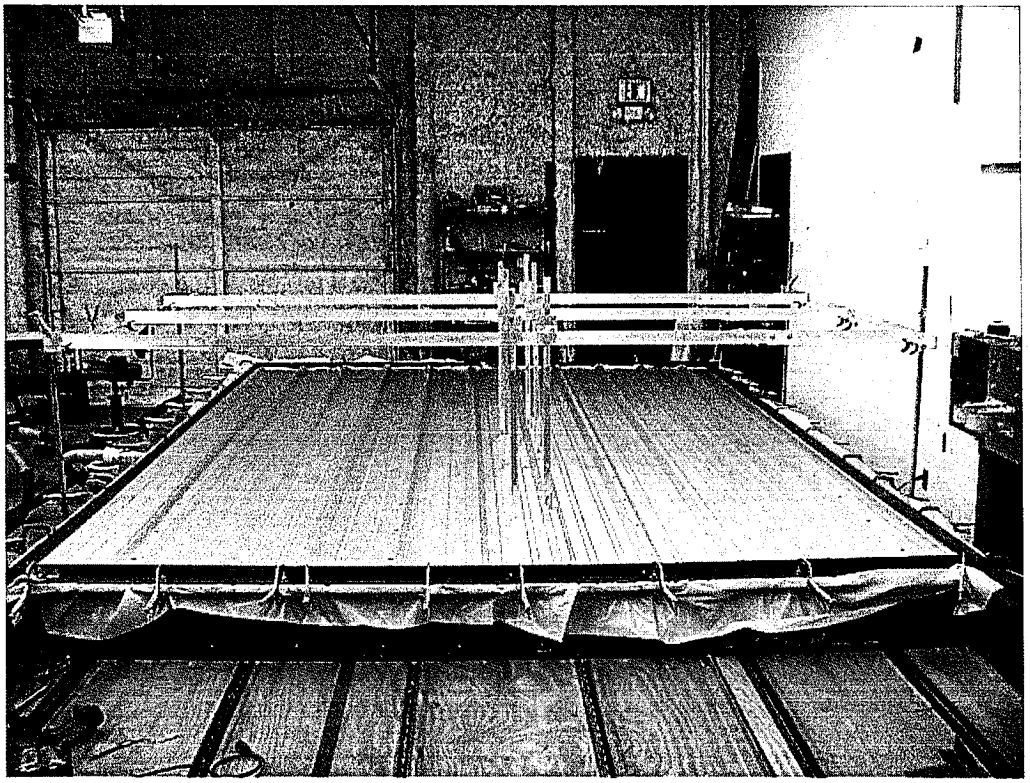


PHOTO 3 Overview of the 5' 0" span test.
(DSC00064)

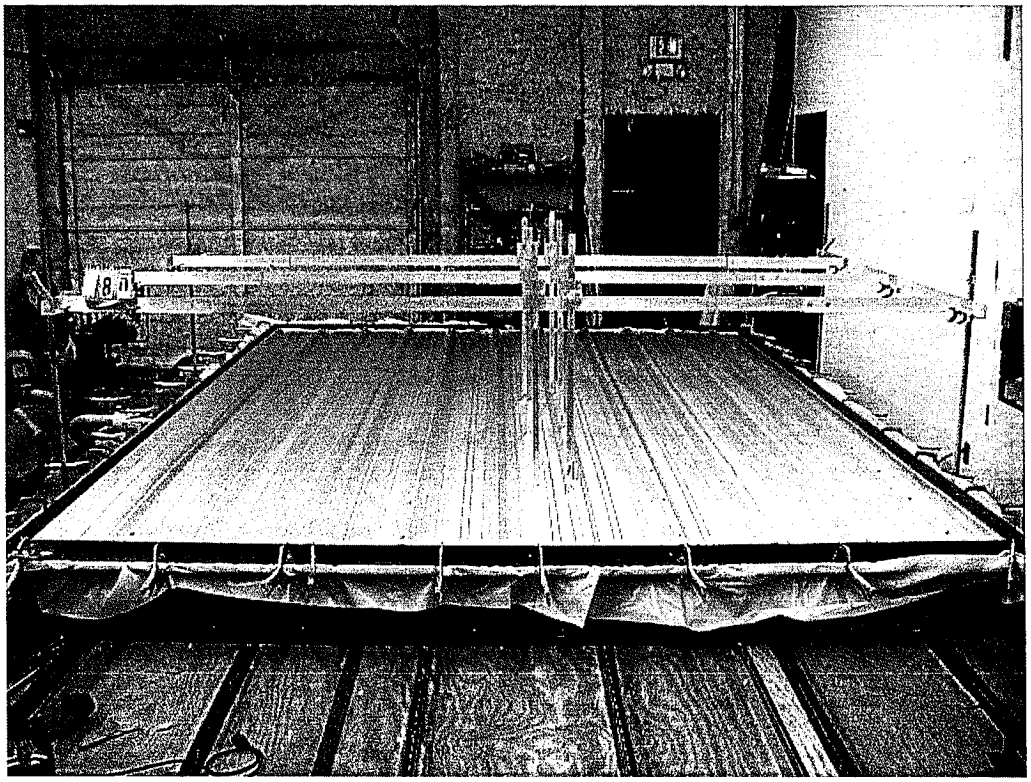


PHOTO 4 View of the test at a pressure of 41.6 psf (equivalent to 8" of water).
(DSC00067)

PHOTOGRAPHS

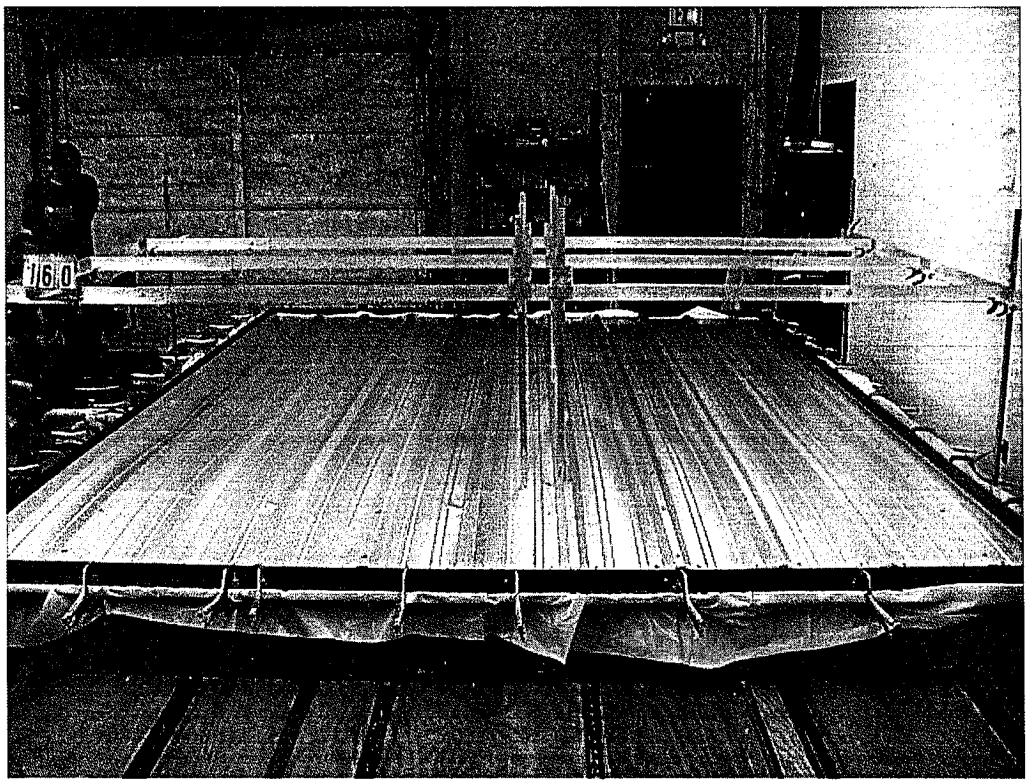


PHOTO 5 View of the test at a pressure of 83.2 psf (equivalent to 16" of water). (DSC00071)

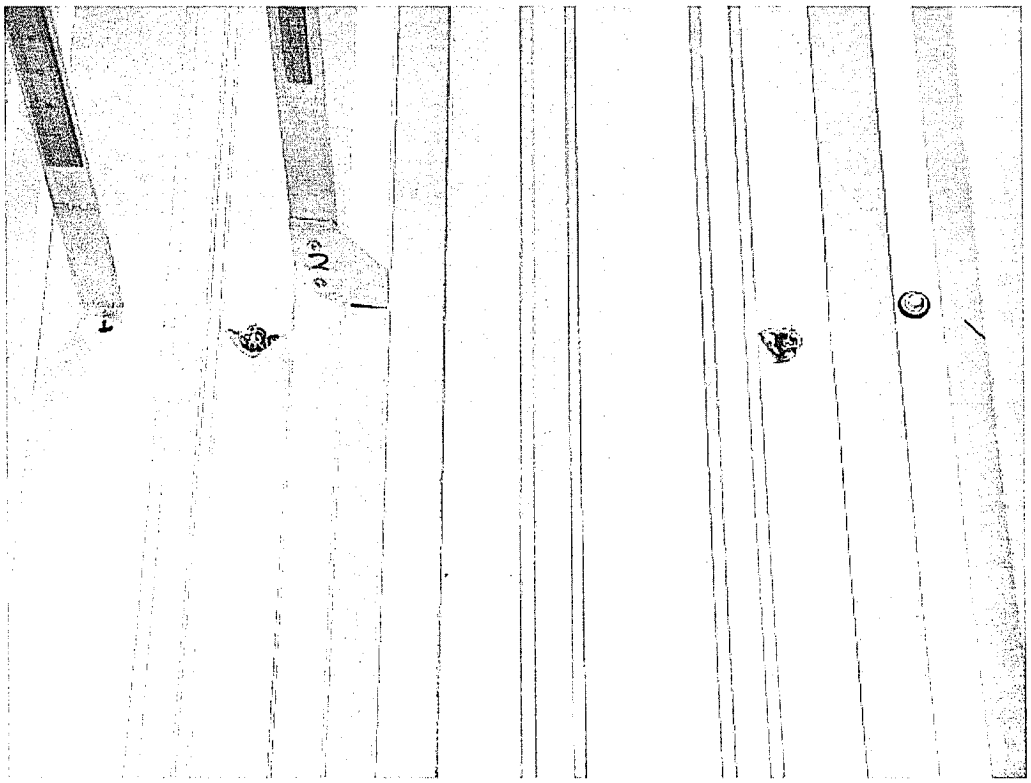
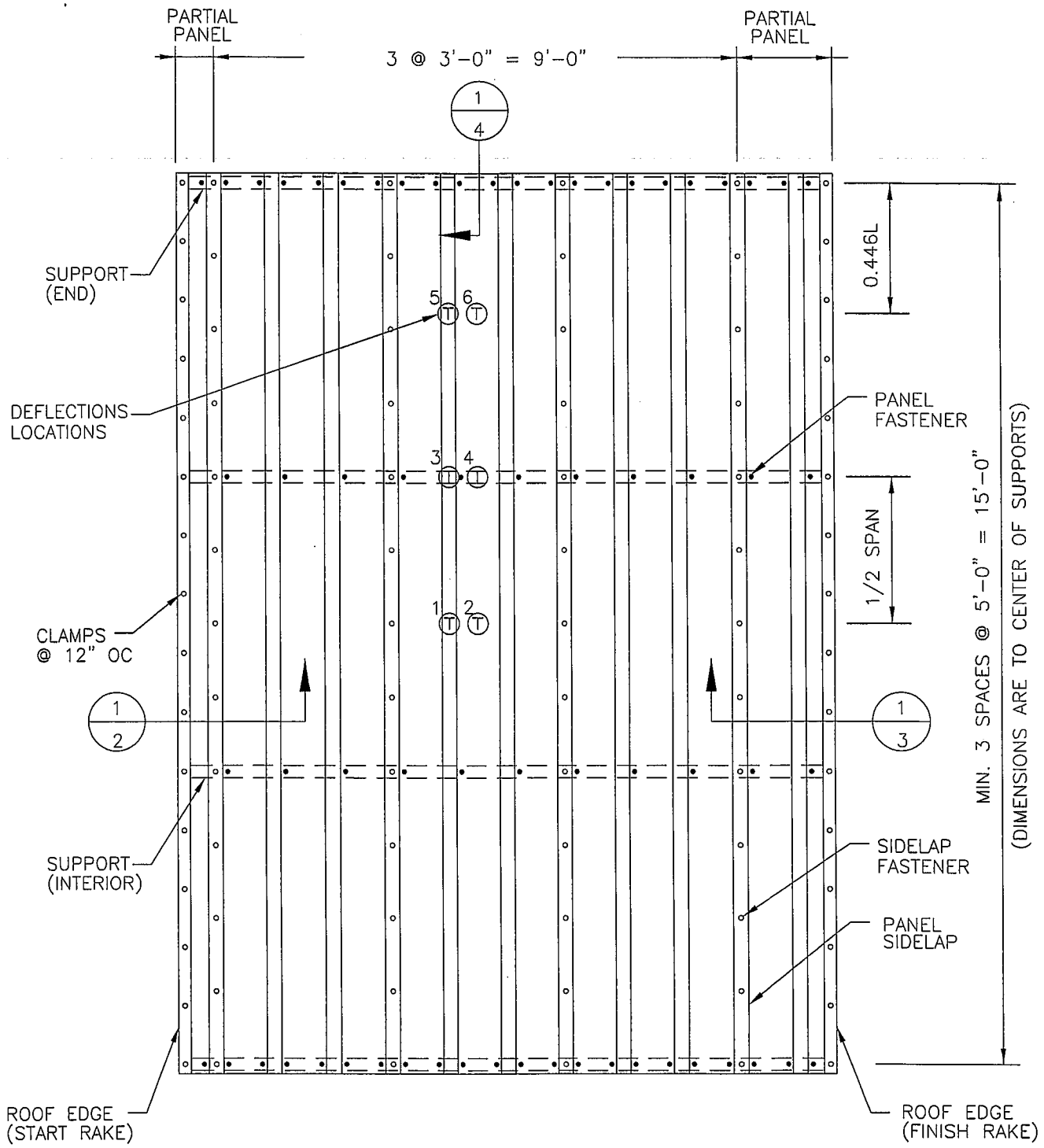
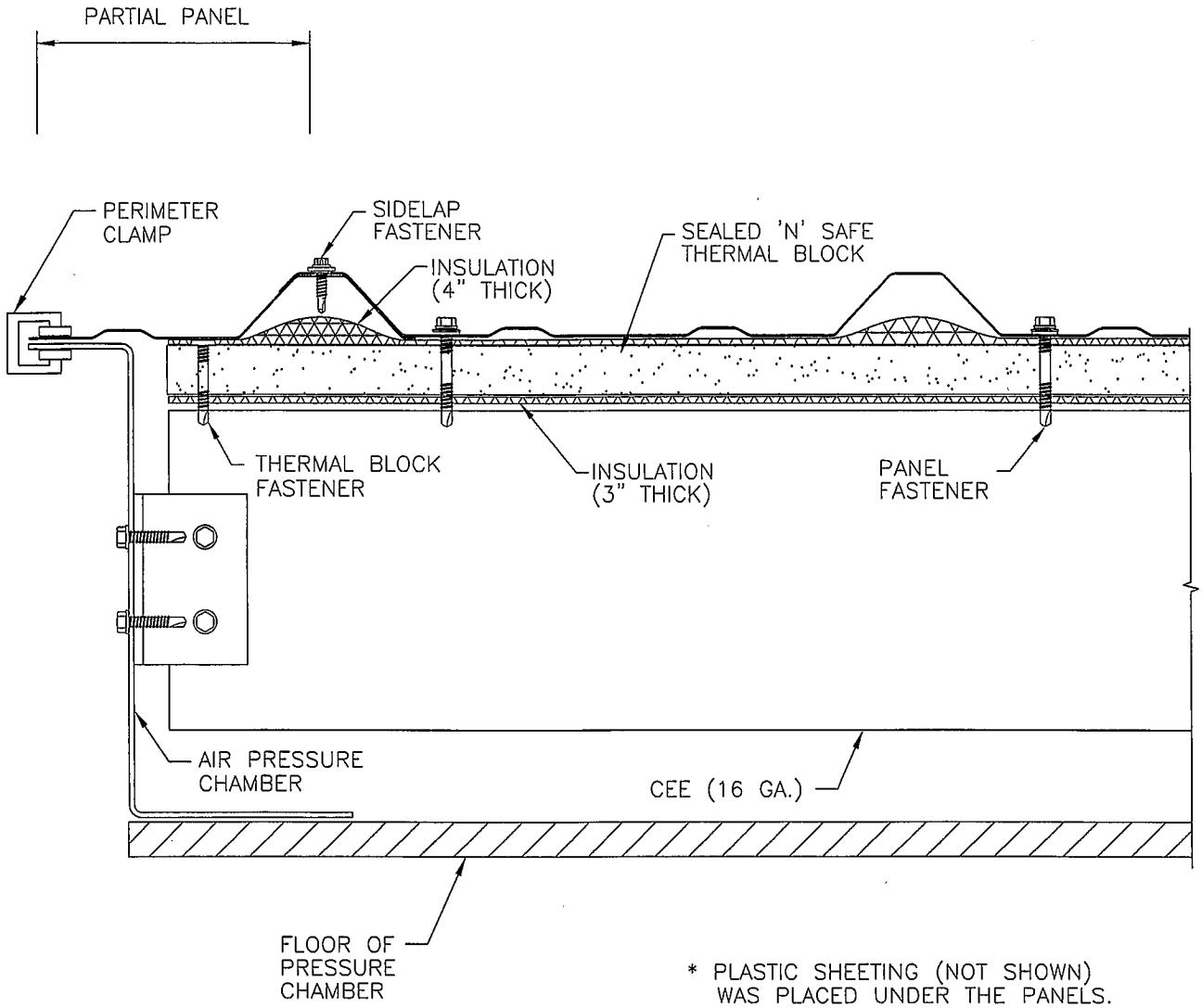


PHOTO 6 View of the test at failure. The failure mode was the panel fastener pullover. (DSC00076)

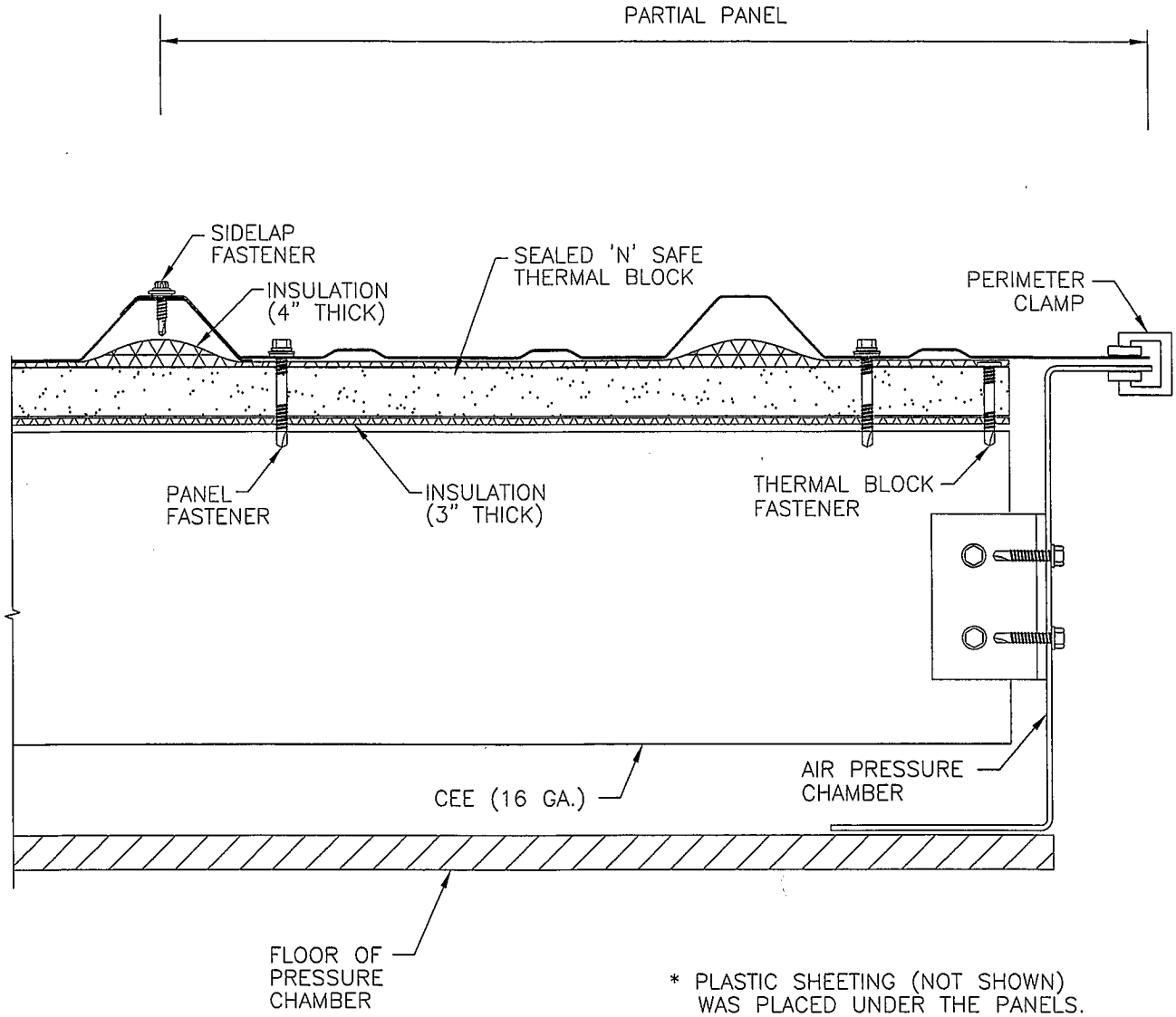
SECTION V
APPENDIX



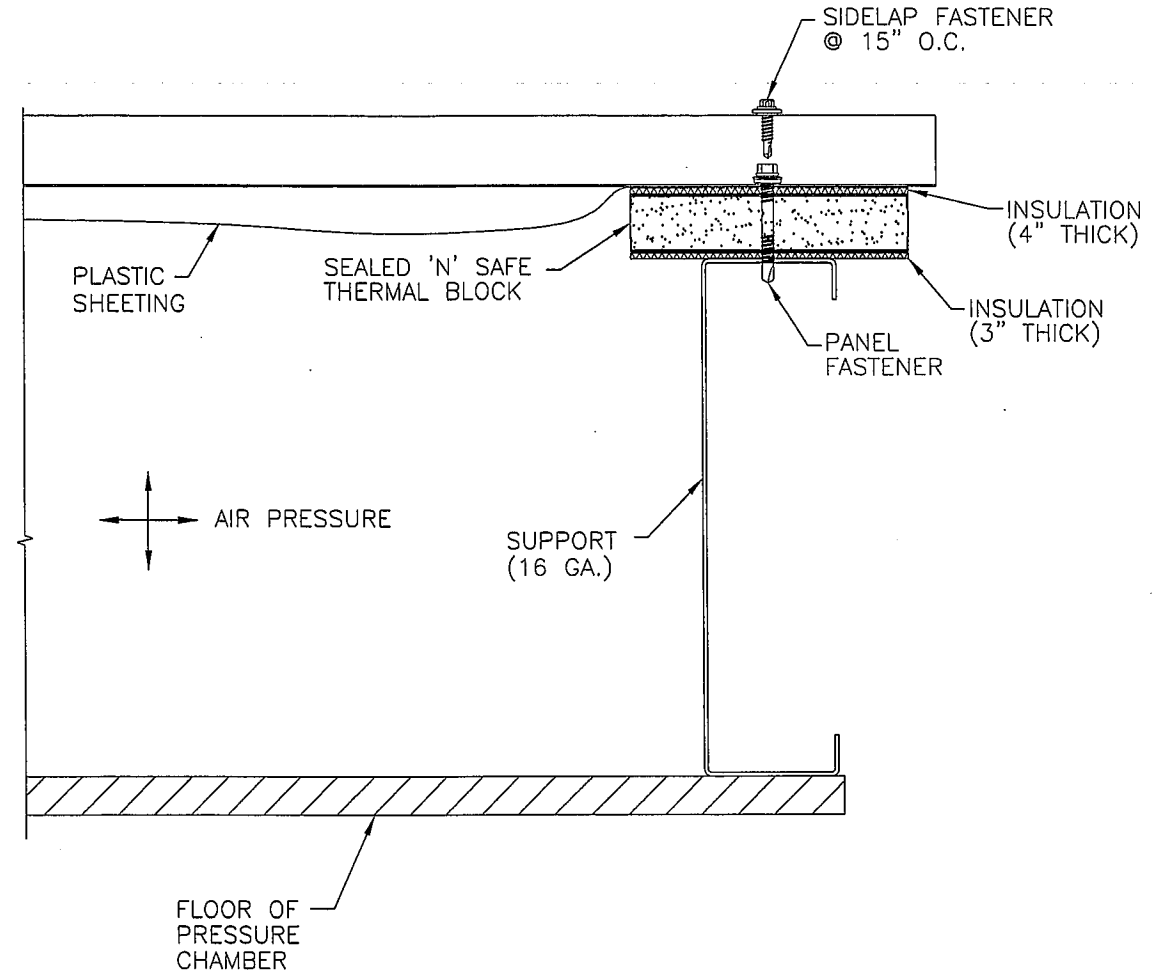
1/1 PLAN VIEW OF TEST ROOF
5' 0" SUPPORT SPACING



1/2 DETAIL OF "START RAKE" OF TEST ROOF



1/3 DETAIL OF "FINISH RAKE" OF TEST ROOF



1/4 DETAIL OF "EAVE END" OF TEST ROOF

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.: 09120600-004-v1
Date Received: 12/11/2009
Date Reported: 12/16/2009
P.O. No.: Verbal

Sample Description: (1) Test Sample No.: 7, Co Buildings R Panel

Tensile Test (Rectangular) per ASTM E8-08

Parameter	Result
Orientation	Parallel to Length of the Specimen
Thickness, inch	0.016
Width, inch	0.499
Tensile Strength, psi	98,000
Yield Strength, psi at 0.2% offset	94,500
Elongation in 2 inches, %	2.8

Approved by: Maurice Cochran

Maurice Cochran, Supervisor of Mechanical Testing
Sherry Laboratories

5.3 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.

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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.

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