TEST REPORT ON

CENTRAL STATES MANUFACTURING, INC.'S
CENTRAL SEAM PLUS PANELS
(24 GA., 3" HIGH, 24" WIDE TRAPEZOIDAL PANEL)
AT 5' 0" – 3' 9" PANEL SPANS
IN ACCORDANCE WITH
ASTM E1646-95(2011) & E1680-11

TESTED FOR:
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TESTING DATE: January 8, 2016
REPORTING DATE: January 12, 2016

ENCON Project C2051-2

ACCREDITED
TL-327

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1.12.2016

SECTION I
TEST SUMMARY

TEST SUMMARY

Table 1. Test Results for Central Seam Plus Panels

Test Method: ASTM E1680-11

Test No.	Static Pressure Difference psf	Total Air Leakage cfm	Air Infiltration Rate	
			cfm/ft^2	cfm/lin.ft
1	1.57	0.022	0.0003	0.0006
2	6.24	0.063	0.0009	0.0019
3	12	0.119	0.0018	0.0035
4	20	0.216	0.0032	0.0064

Test Method: ASTM E1646-95 (2011)

Test No.	Static Pressure Difference (psf)	Rate (gal/hr/ft^2)	Test Duration (min)	Water Infiltration
1	6.24	5.0	15	No leaks
2	12	5.0	15	No leaks
3	20	5.0	15	No leaks

Notes:

1. Panel thickness and coverage width were 24 ga. and 24", respectively.
2. Low sliding clips with factory applied sealant were fastened to support with (2) 1/4"-14 x 1" long self-drilling screws.
3. Panels spanned over unequal spans of 5' 0" and 3' 9".
4. 3/16" Bead of sealant was used in the sidelap.

SECTION II
DESCRIPTION OF TEST

2.1 DESCRIPTION OF TEST

OBJECTIVES

The purpose of the tests was to determine the resistance of metal roof panel systems to water penetration and air infiltration resulting from static air pressure difference between the exterior and interior surfaces. The test method consisted of the following:

1. assembling the test panel in the test chamber to form a typical roof construction;
2. measuring the air leakage through the panel sidelaps and extraneous leakage of the test chambers;
3. spraying the exterior roof surface with water to determine any water penetration through panel sidelaps

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 was installed. One static pressure tap is located at a corner to measure the chamber pressure in such a manner that the reading was not affected by the velocity of the air supply to or from the chamber or other air movement. The air supply opening into the chamber was arranged so that the air does not impinge directly on the test specimen with significant velocity.

AIR SYSTEM

The compressed air supply consists of a compressor unit capable of maintaining a constant positive or negative air pressure difference for the required test period. A digital manometer was used to measure the test pressure difference with accuracy of 1/100."

AIR FLOW METERING SYSTEM

A laminar flow element capable of measuring airflow of 40 SCFM was used to measure the air leakage through the panel sidelaps and extraneous leakage of the test chambers. The flow was measured as a differential pressure using a digital manometer and converted to actual flow using regression equation shown on the flowmeter calibration chart.

WATER SPRAY SYSTEM

The water spray system consists of equally spaced nozzles located at a uniform distance from the test specimen. The system was calibrated to deliver a minimum rate of 5.0 gal/ft^2 per hour.

CALIBRATION

The water spray was calibrated on October 21, 2015 and the air-flow measuring system was calibrated on October 19, 2015.

DESCRIPTION OF TEST

TEST SPECIMEN

The overall dimension of the test construction was in excess of 7' 9" x 8' 9". The panels covered unequal spans of 5' 0" and 3' 9". The construction width contained three full panels and two partial panels. The panels were attached to an intermediate Cee purlin section with panel clips and self-drilling screws per clip. The panels were attached to 16 ga. eave,. rake and ridge sections with self-drilling screws. An overflow device that provided a ½" to ¾" deep water pond was installed on one end of the test specimen. The perimeter of the test construction was sealed to the test chamber wall. The perimeter seals between the panels and the test chamber did not duplicate the actual building perimeter details. The details of the methods of construction are depicted in the enclosed test drawings in Section V.

TEST PROCEDURE

The support beams were moved to 75% of the design thermal movement of the panel clip to the support. This operation was conducted once for a total of two cycles. All supports beam connections to the test chamber were tightened.

The test specimen was preloaded to a positive load greater than or equal to 15 psf or 75% of the building live load or 50 % of the design positive wind pressure difference. The test specimen was also preloaded to a negative load greater than or equal to 50 % of the building design wind uplift pressure difference.

The panel sidelap was temporarily sealed to measure the extraneous air leakage, Q_L, of the test chamber for the specified test pressure difference across the test specimen. The temporary sidelap seal was removed and the airflow through the sidelaps was measured after the test conditions were stabilized for the specified test pressure difference across the test specimen. This measured airflow was designated the total metered airflow, Q_M. The air leakage, Q, through the test specimen was equal to Q_M - Q_L. The ambient room temperature at the test specimen was also measured.

Upon the completion of the air leakage test, the water spray system was installed over the test specimen. The test specimen was subjected to the specified positive (inward) test pressure difference for 15 minutes while the spray system delivered water on the test specimen at a rate of 5.0 gal/ft^2 per hour. The depth and the temperature of the ponded water on the test surface were measured. The test specimen was observed for possible water leakage.

SECTION III
TEST RESULTS

TEST RESULTS

3.1 SPECIMEN IDENTIFICATION

Manufacturer:	Central States Manufacturing
Model Type:	Central Seam Plus Panel
Dimensions:	3" high seam and 24" wide trapezoidal profile
Panel Gauge:	24 Gauge
Clip Type:	Low sliding clip – 3.375" high
Clip tab:	0.035" thick coated, 2" wide, 3" high with factory applied foam melt sealant
Clip base:	0.066" thick coated, 5" wide, 2.375" high
Clip Fasteners:	¼"-14 x 1" long SDS. 2 per clip.
Purlin:	16 ga. (0.060" thick coated)
Sealant Manufacturer:	Edge Adhesives
Panel Sealant:	InstaForm 41 thermally applied gasket foam sealant
Sealant Size:	Nom. 3/16" bead
Thermal Movement:	±1.0"
Purlin:	16 ga. Cee (0.060" thick)

Note: All the test materials were supplied by Central States Manufacturing and were not sampled by ENCON.

3.2 TEST DATA

Date:	1.8.2016
Panel Manufacturer	Central States Manufacturing
Panel Type	Central Seam Plus Roof Panel
Panel Gauge	24 ga.
Panel Width (in)	24
Panel Clip	Low sliding clip
Clip Fasteners	(2) 1/4"-14 x 1" long SDS
Sealant Manufacturer	Edge Adhesives
Panel Sealant	InstaForm 41 thermally applied gasket (3/16" bead)
Panel Span (ft)	5' 0" - 3' 9"
Test Area (ft^2)	67.8
Preload Positive Pressure (psf)	20
Preload Negative Pressure (psf)	20
Ambient Temperature (F)	64.4
Panel Temperature (F)	65
Barometric Pressure (in. Hg)	28.91
Water Depth (in)	0.625

Test Method: ASTM E1680-11

Test No.	Static Pressure Difference psf	Initial Reading DP (in)	Initial Reading [1] cfm	Final Reading DP (in)	Final Reading [1] cfm	Total Air Leakage [2] cfm	Air Infiltration Rate	
							cfm/ft^2	cfm/lin.ft
1	1.57	0.700	3.857	0.704	3.879	0.022	0.0003	0.0006
2	6.24	1.923	10.484	1.935	10.548	0.063	0.0009	0.0019
3	12.0	3.125	16.858	3.148	16.979	0.119	0.0018	0.0035
4	20.0	4.653	24.763	4.696	24.982	0.216	0.0032	0.0064

[1] The actual flow is calculated using the regression equation shown on the flowmeter calibration chart.

[2] Total Air Leakage $Q_{st} = Q \times (1.326 \times B / (0.075 \times (T + 460)))^{0.5}$

Test Method: ASTM E1646-95 (2011)

Test No.	Static Pressure Difference (psf)	Rate ($gal/hr/ft^2$)	Test Duration (min)	Water Infiltration
1	6.24	5	15	No leaks
2	12.0	5	15	No leaks
3	20.0	5	15	No leaks

SECTION IV
PHOTOGRAPHS

PHOTOGRAPHS

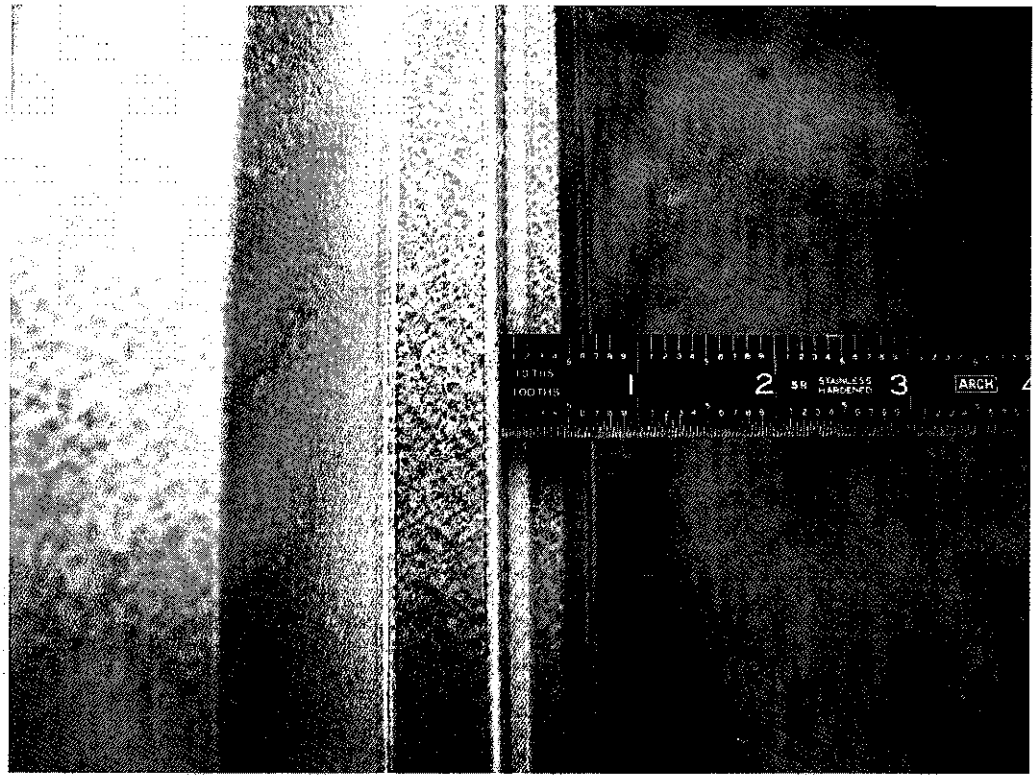


PHOTO 1 View of sealant in in the panel sidelap.
(DSCN4716)

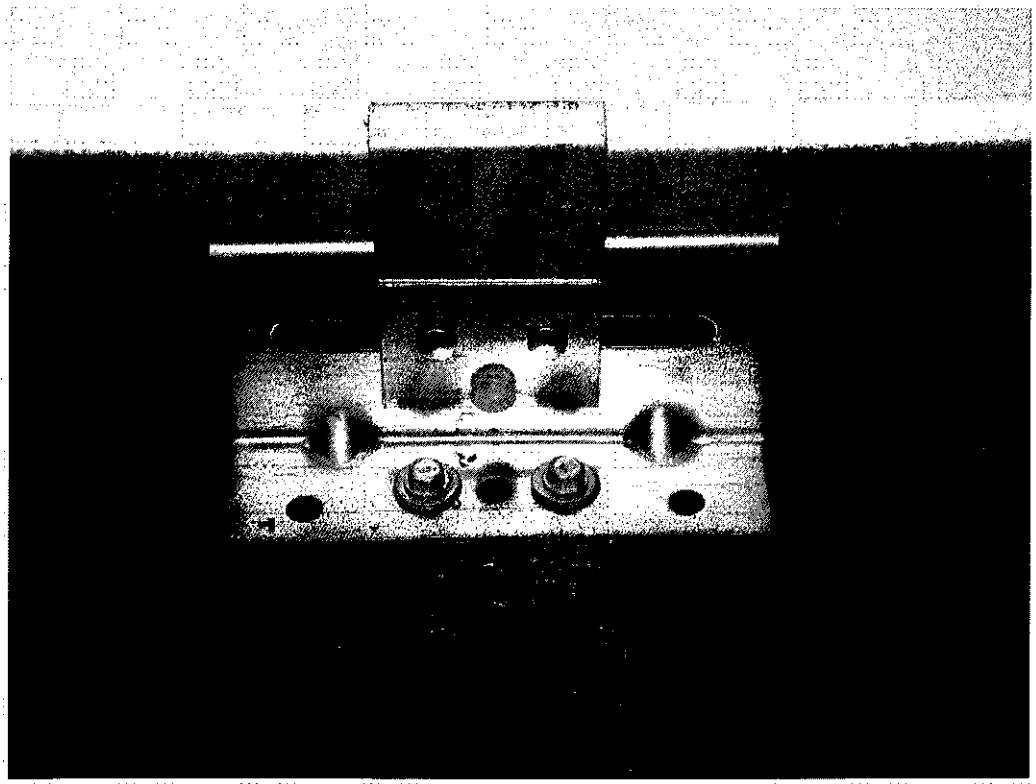


PHOTO 2 View of the panel clip attachment.
(DSCN4690)

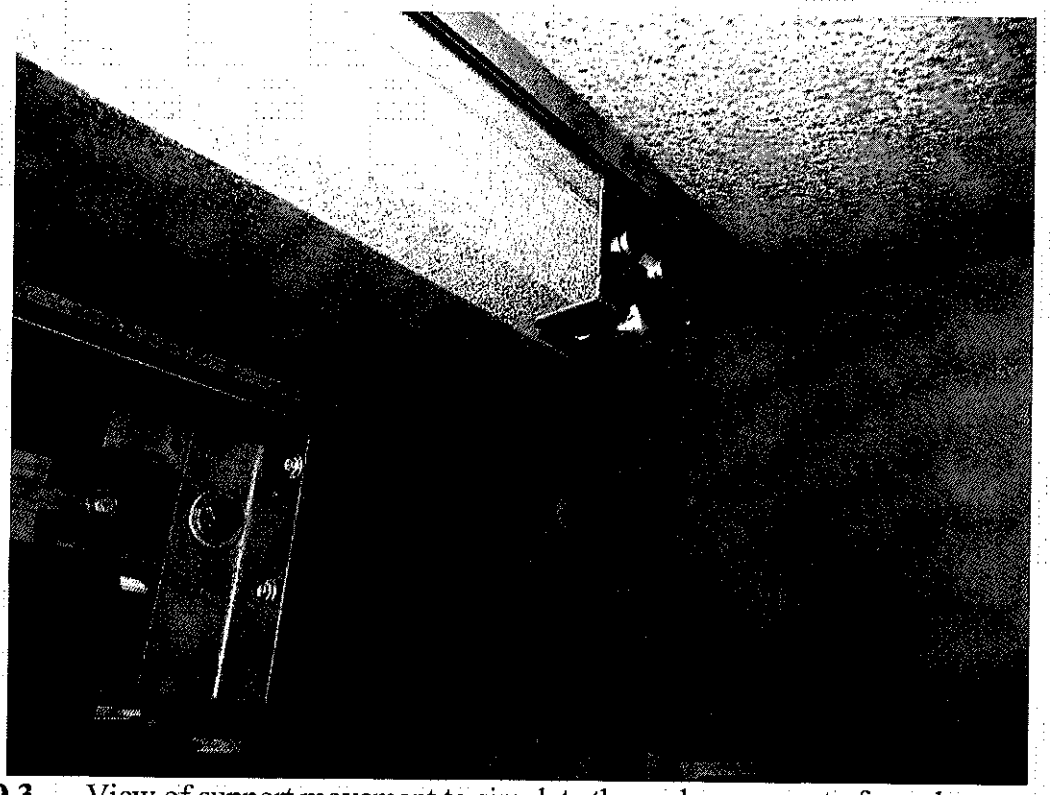


PHOTO 3 View of support movement to simulate thermal movement of panel. (DSCN4696)

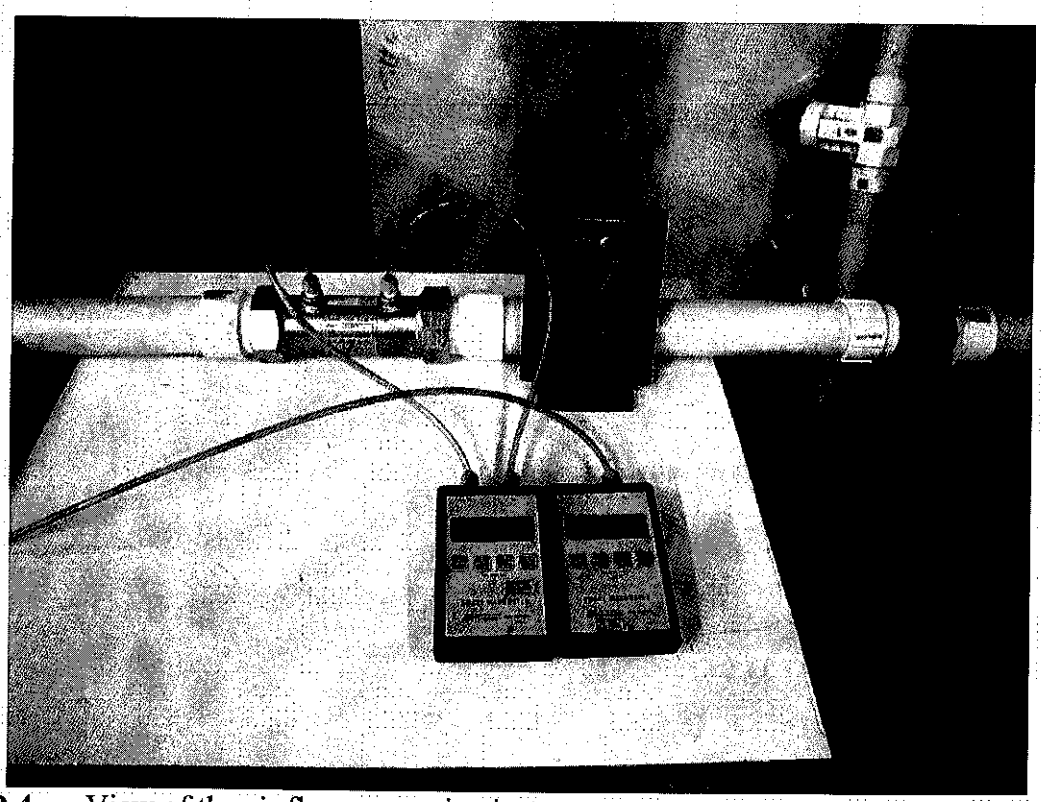


PHOTO 4 View of the air flow measuring instruments. (DSCN4718)

PHOTOGRAPHS

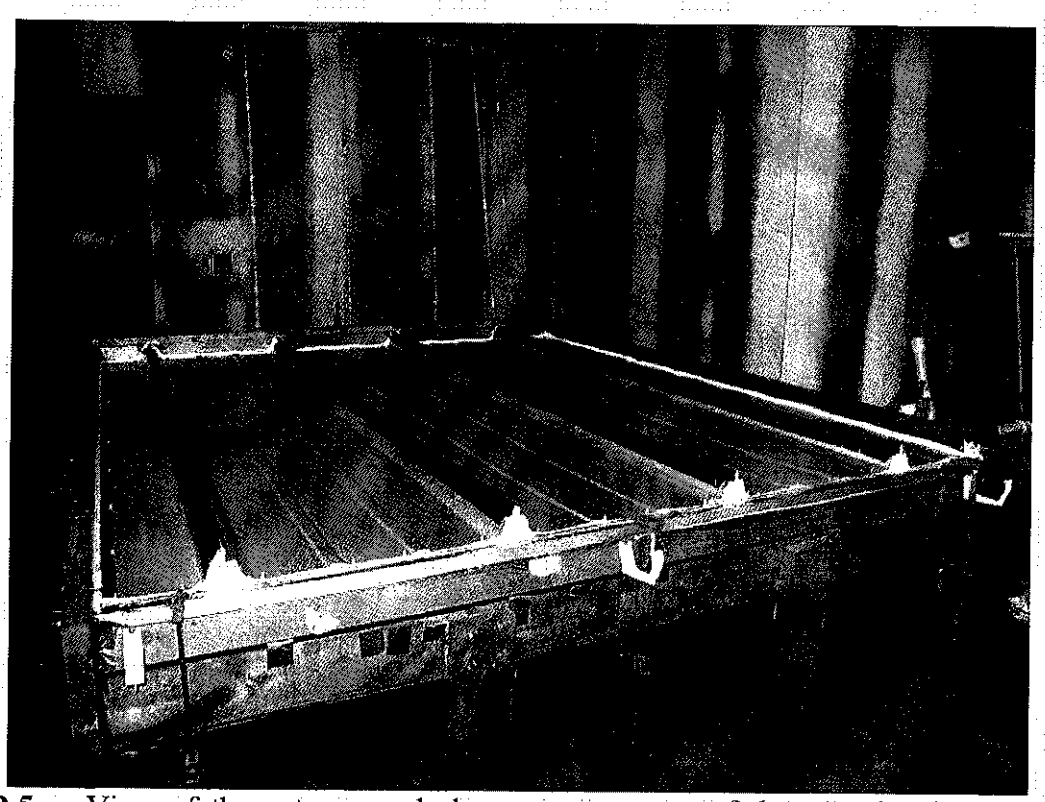


PHOTO 5 View of the extraneous leakage measurement of the test chamber. Note the sidelaps were temporarily sealed for this measurement. (DSCN4719)

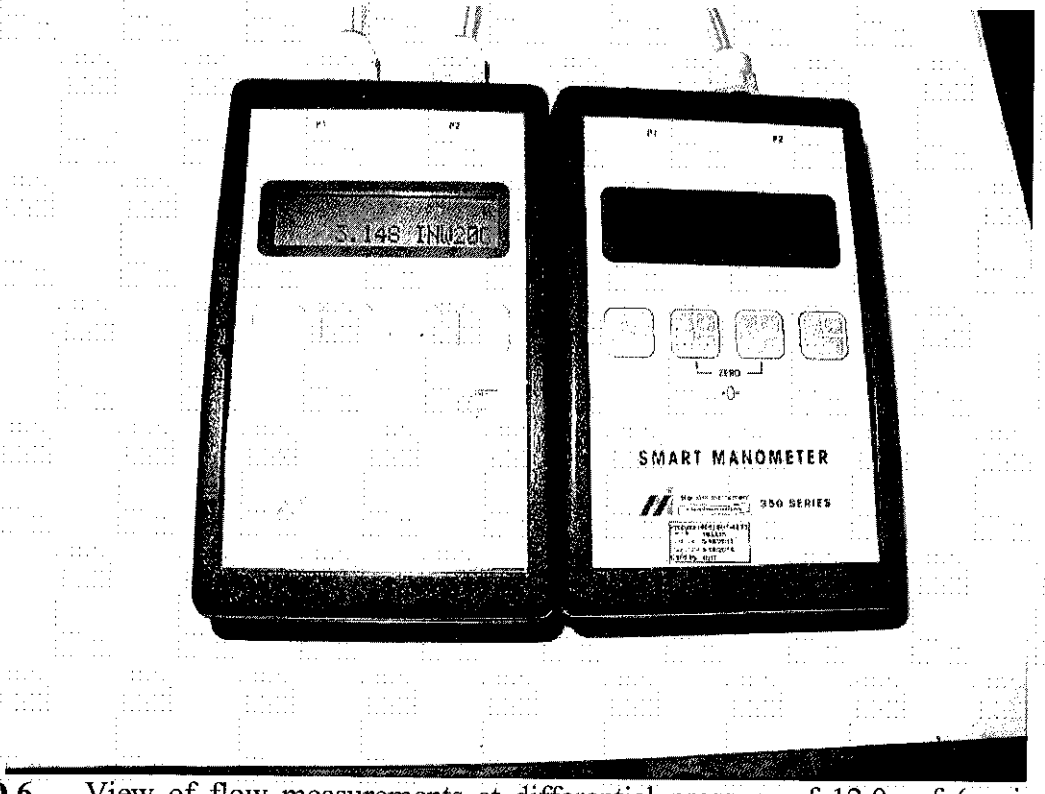


PHOTO 6 View of flow measurements at differential pressure of 12.0 psf (equivalent to 2.306" of water). (DSCN4724)

PHOTOGRAPHS

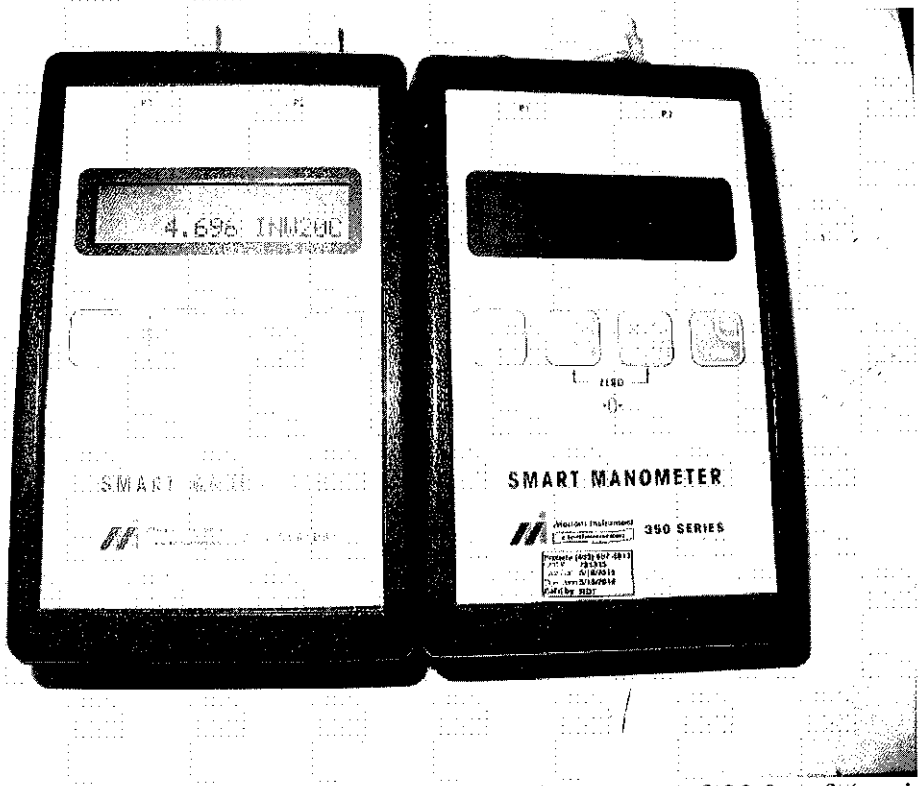


PHOTO 7 View of flow measurements at differential pressure of 20.0 psf (equivalent to 3.843" of water). (DSCN4723)

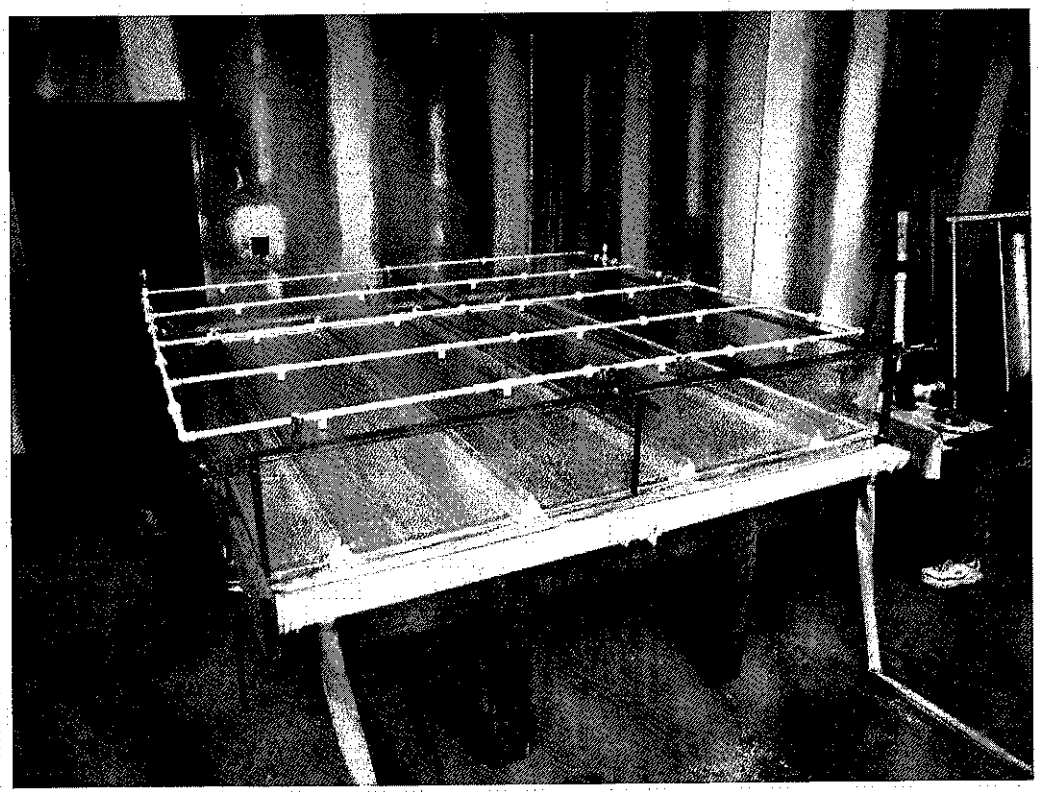


PHOTO 8 View of water spray test. (DSCN4730)

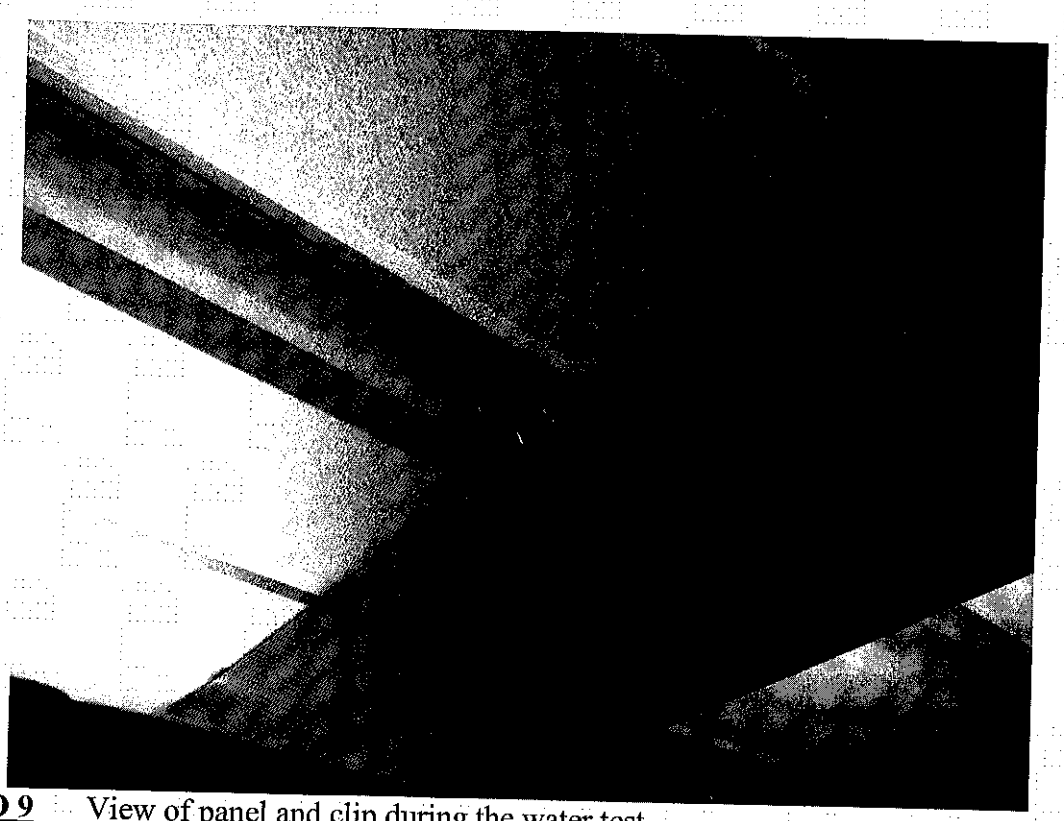


PHOTO 9 View of panel and clip during the water test.
(DSCN4733)

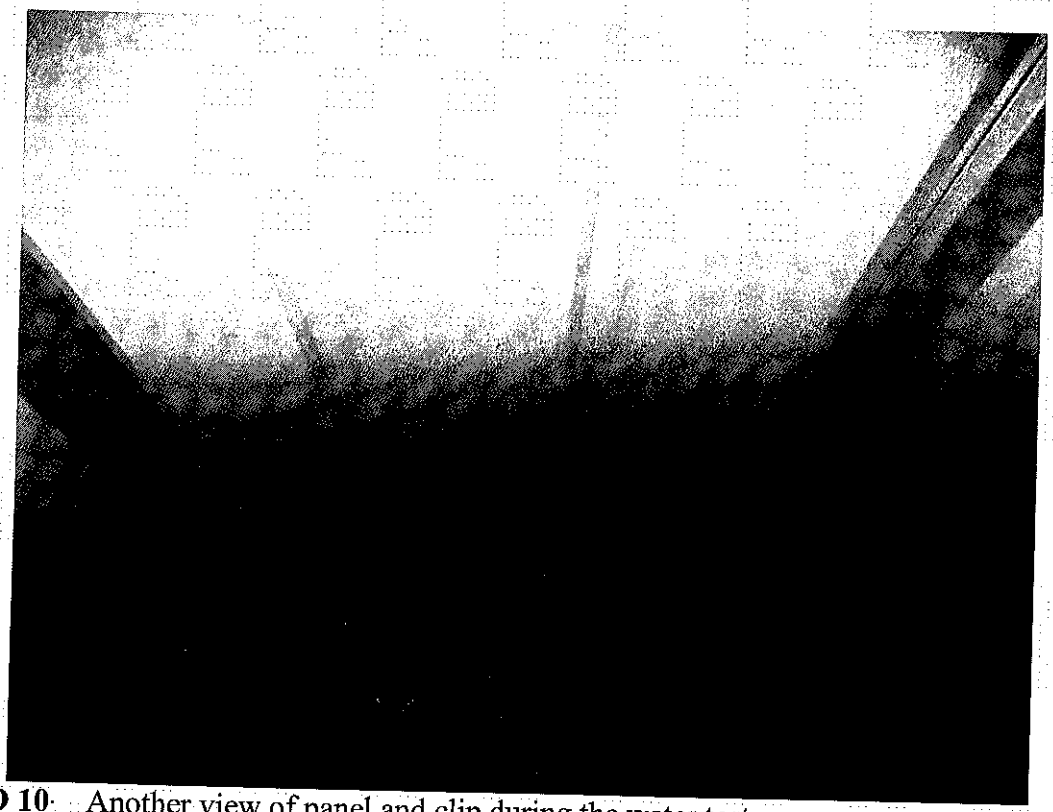
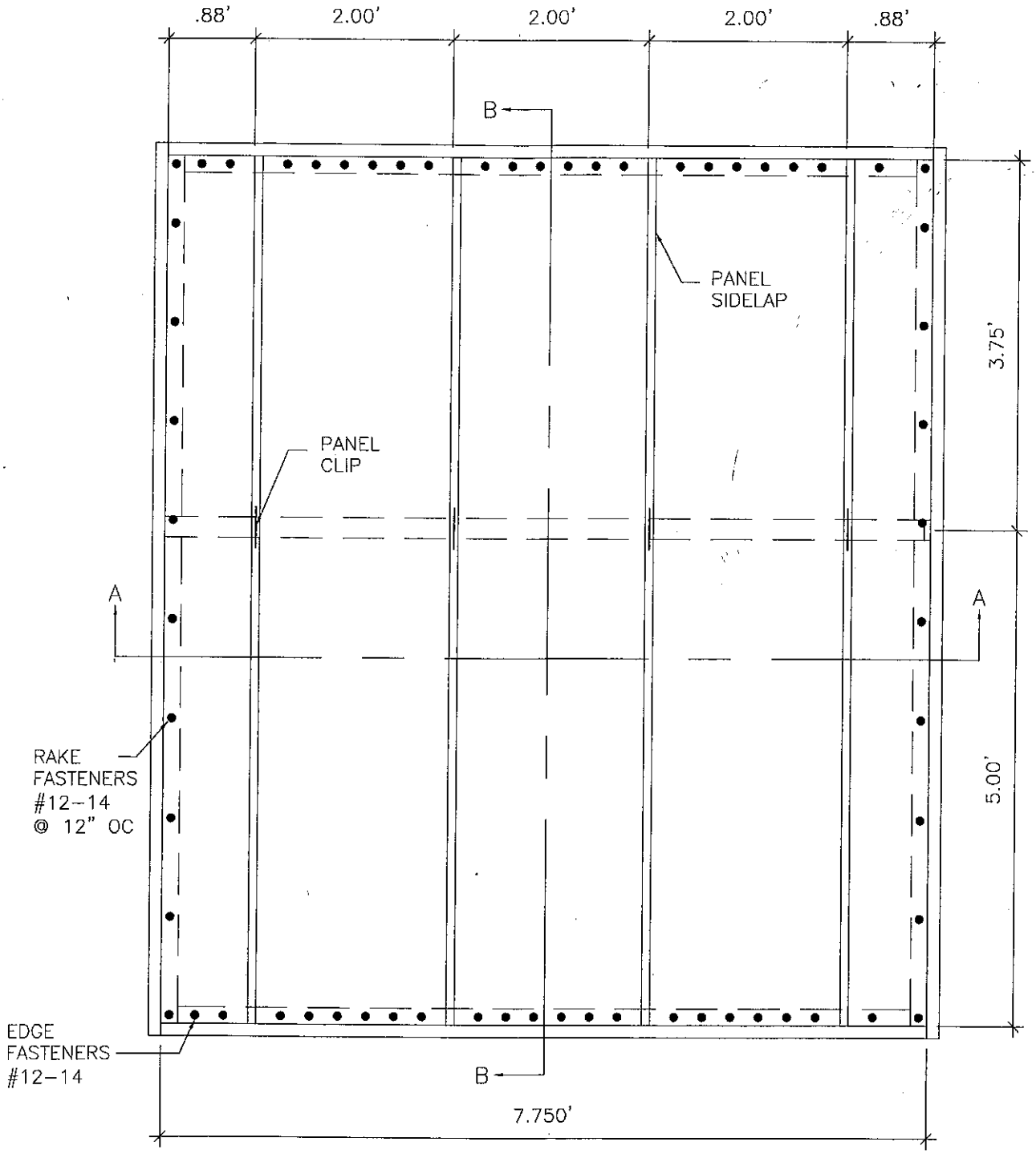
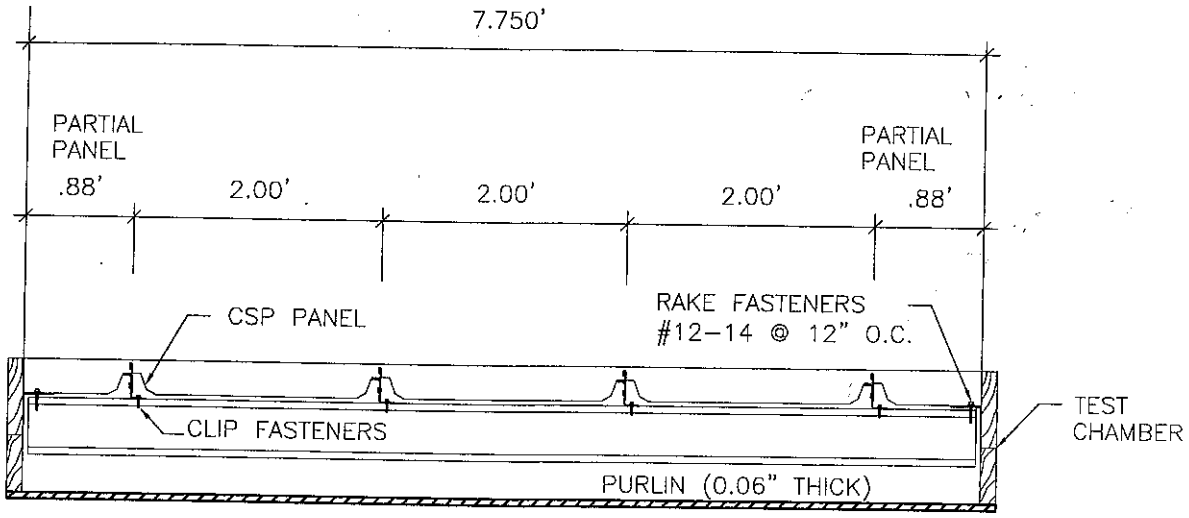


PHOTO 10 Another view of panel and clip during the water test.
(DSCN4739)

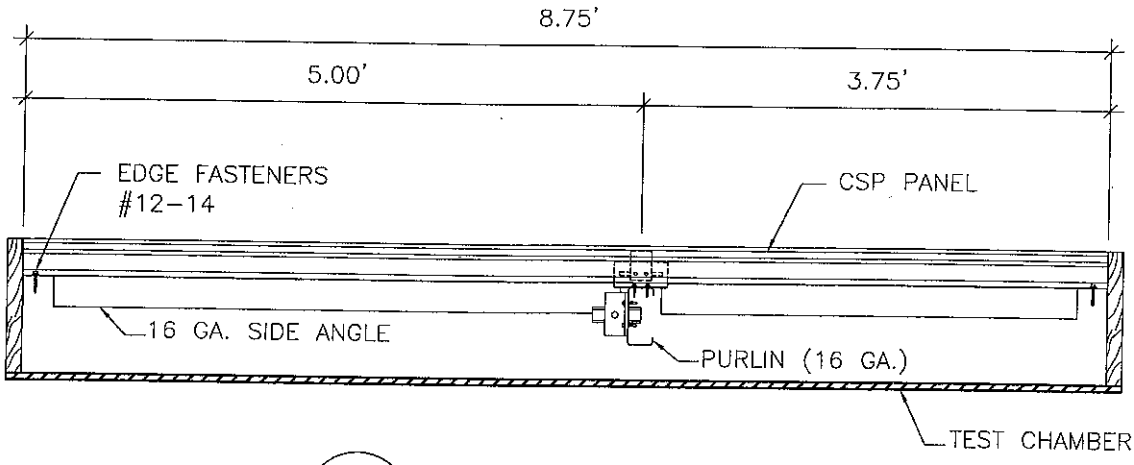
SECTION V
APPENDIX



1/1 PLAN VIEW



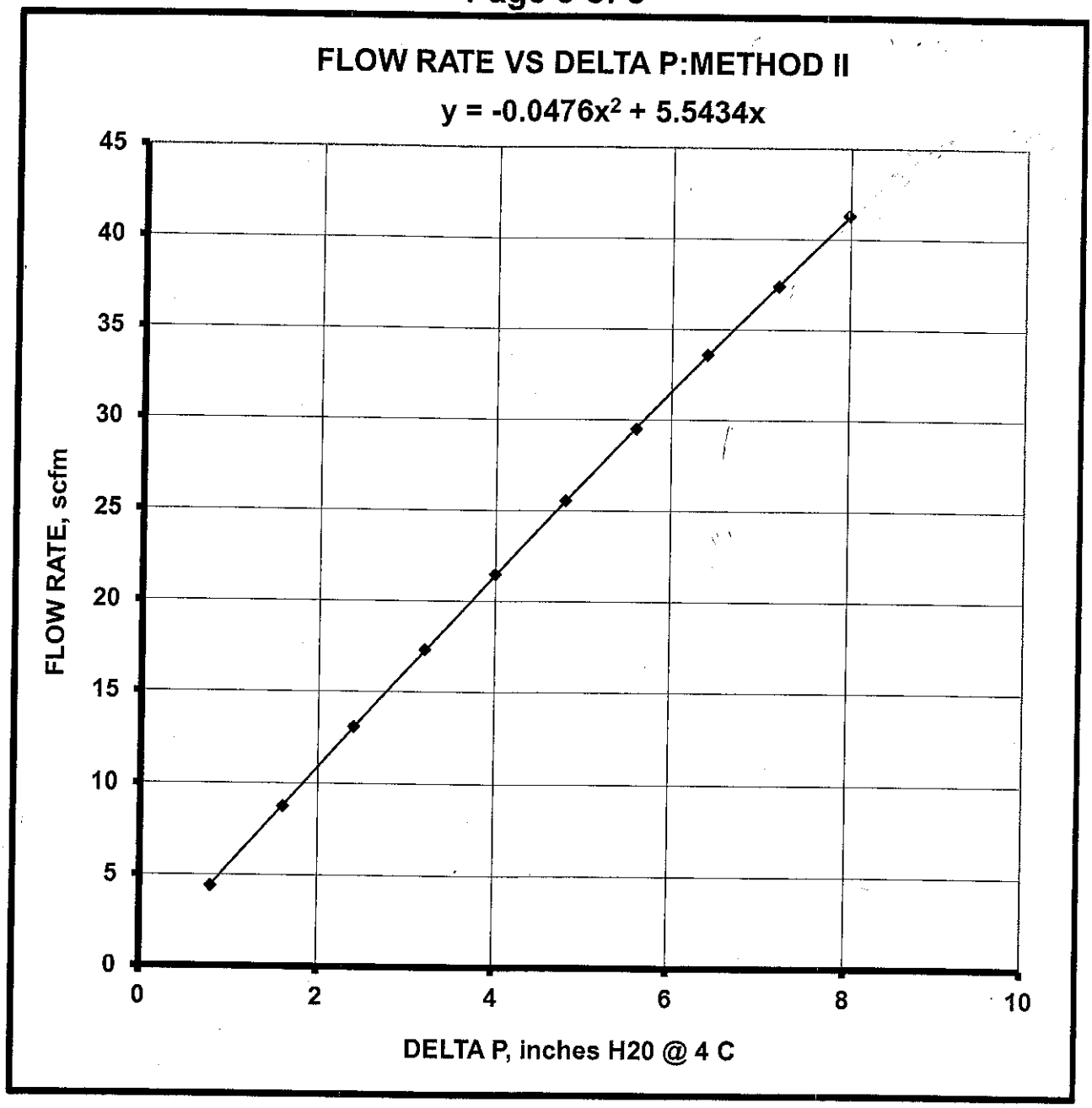
1/2 SECTION VIEW A-A



1/3 SECTION VIEW B-B

ATTACHMENT TO CALIBRATION CERTIFICATE 51630

AS FOUND/AS LEFT CALIBRATION DATA (Gas = Air)



Flow - Humidity - Temperature - Pressure - Design - Consulting - Engineering

NIST Traceable Calibration Data Sheet

Graftel, LLC. 870 Cambridge Drive, Elk Grove Village, IL 60007
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APPENDIX

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.

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.

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