



# SMITH-EMERY LABORATORIES

An Independent Commercial Testing Laboratory, Established 1904

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File No: 32562-1 January 13, 2003

Laboratory No: L-02-125

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CLIENT: Composite Systems Inc.  
199 South Hudson Ave  
Pasadena, CA 91101

ATTN. Paul Clark

PROJECT Indiana University Medical Building ICBO ER #5446

## REPORT OF TESTS

Date of Tests: 1-10,11,13,14-03

Tests Performed by: Dana Nelson

### Mockup Descriptions.

Mockup: Overall size 12' 1" in height x 8' 1" in width the system tested was a precast architectural concrete & steel stud wall furnished by Earl Composite systems. This assembly was attached to 6" galvanized studs spaced on 16" centers using Metal Stud Crete Composite connector strips screwed at approximately 5" centers, this assembly was attached to the test chamber using A36 Plate 1/4" x 4" x 7-1/2" with two (2) A 307 Grade bolts that attach the plate to the web of the galvanized studs. The test assembly attachment locations are at the top and the bottom of the first galvanized stud in from each end of the panel. At 6" below the top and 6" above the bottom of the panel.

### **PRELOAD (50% of design load)**

Develop a positive pressure on the mockup of 15.0 PSF. Maintain pressure for a period of 10 seconds, then release. (No deflection readings required.)

ACCEPTANCE CRITERIA: NONE

Completed.

### **AIR INFILTRATION TEST**

(Ref: ASTM E 283)

### TEST PROCEDURE

Cover and seal the mockup completely with polyethylene sheeting while leaving the chamber uncovered. Develop a positive differential pressure of 6.24 PSF on the chamber. Record the airflow required to maintain this pressure. This number represents the airflow through the chamber. Remove the sheeting and reestablish the positive pressure of 6.24 PSF. Record the airflow required to maintain this pressure. This number is the airflow through the mockup and chamber. The difference between the two-recorded airflows is the airflow through the mockup.

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**ACCEPTANCE CRITERIA:**

*0.06 CFM per square foot of exterior surface, exclusive of any operating window and door areas. Mockup area = (+) X = SF.*

*Maximum allowable airflow through mockup = 5.8 CFM.*

Panel Covered 27.2 CFM

Panel Uncovered 27.2 CFM

Total air loss 0.0 CFM

**Results Pass.**

**WATER PENETRATION UNDER STATIC PRESSURE**

(Ref. ASTM E 331)

**TEST PROCEDURE**

Establish a positive test pressure of 10.0 PSF on the mockup. Apply water to the exterior of the mockup at a rate of 5 gallons per hour per square foot for a period of fifteen minutes while maintaining the differential pressure of 10.0 PSF. During this period, visually inspect the interior of the mockup for water penetration.

**ACCEPTANCE CRITERIA:**

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

**Results Pass.**

**WATER PENETRATION UNDER DYNAMIC PRESSURE**

(Ref.: AAMA 501.1)

**TEST PROCEDURE**

Apply an air stream equivalent to a static differential air pressure of 10.0 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period, visually inspect the interior of the mockup for water penetration.

**ACCEPTANCE CRITERIA.**

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water*

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*leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces...*

**Results Pass.**

**STRUCTURAL TEST AT 50% & 100% OF INWARD DESIGN PRESSURE  
(Ref. ASTM E 330)**

**TEST PROCEDURE**

Apply positive pressure to the mockup of 15.0 PSF and hold for 10 seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record initial readings. Increase positive pressure to 30.0 PSF and hold for 10 seconds. Record deflection readings. Reduce pressure to zero.

**ACCEPTANCE CRITERIA:**

*Net deflection of framing members shall not exceed  $1/360$  time's span or  $3/4$ " , Span is defined as the distance between anchor centerlines*

**Results Pass.**

Positive Deflections @ design load of 30 PSF	Allowable deflection 0.375
Transducer #2	0.025
Transducer #3	0.141
Transducer #4	0.053
Transducer #5	0.141
Transducer #7	0.145
Transducer #8	0.133
Net deflection of transducers 2,3,4	<b>0.102</b>
Net deflection of transducers 5,7,8	<b>0.008</b>

**STRUCTURAL TEST AT 50% & 100% OF OUTWARD DESIGN PRESSURE (Ref. ASTM E 330)**

**TEST PROCEDURE**

Apply negative pressure to the mockup of 15.0 PSF and hold for 10 seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record initial readings. Increase negative pressure to 30.0 PSF and hold for 10 seconds. Record deflection readings. Reduce pressure to zero.

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**ACCEPTANCE CRITERIA:**  
*Same as procedure (above)*

Negative Deflections @ design load of 30 PSF      Allowable deflection 0.375

Transducer #2	0.030
Transducer #3	0.142
Transducer #4	0.052
Transducer #5	0.141
Transducer #7	0.134
Transducer #8	0.125
Net deflection of transducers 2,3,4	<b>0.102</b>
Net deflection of transducers 5,7,8	<b>0.019</b>

**Results Pass.**

**AIR INFILTRATION TEST**  
**(Ref: ASTM E 283)**

**TEST PROCEDURE**

Cover and seal the mockup completely with polyethylene sheeting while leaving the chamber uncovered. Develop a positive differential pressure of 6.24 PSF on the chamber. Record the airflow required to maintain this pressure. This number represents the airflow through the chamber. Remove the sheeting and reestablish the positive pressure of 6.24 PSF. Record the airflow required to maintain this pressure. This number is the airflow through the mockup and chamber. The difference between the two-recorded airflows is the airflow through the mockup.

**ACCEPTANCE CRITERIA:**

*0.06 CFM per square foot of exterior surface. Mockup area = (+) X = SF.*

*Maximum allowable airflow through mockup = 5.8 CFM.*

Panel Covered 27.2 CFM

Panel Uncovered 27.2 CFM

Total air loss 0.0 CFM

**Results Pass.**

**WATER PENETRATION UNDER STATIC PRESSURE**  
**(Ref. ASTM E 331)**

**TEST PROCEDURE**

Apply an air stream equivalent to a static differential air pressure of 10.0 PSF to the mockup.

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Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. while maintaining the differential pressure of 10.0 PSF. During this period, visually inspect the interior of the mockup for water penetration.

**ACCEPTANCE CRITERIA:**

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

**Results Pass.**

**WATER PENETRATION UNDER DYNAMIC PRESSURE  
(Ref.: AAMA 501.1)**

**TEST PROCEDURE**

Apply an air stream equivalent to a static differential air pressure of 10.0 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period, visually inspect the interior of the mockup for water penetration.

**ACCEPTANCE CRITERIA:**

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces...*

**Results Pass.**

**THERMAL CYCLE TEST.**

**TEST PROCEDURE**

Perform a thermal cycle test by enclosing the main elevation of the test specification with an additional insulated test chamber equipped with cooling and heating. The chamber size measures 9'6" wide x 24' tall. Temperatures and Thermal movement will be measured by use of Thermal couples and transducers set on the metal framing and concrete on the interior and exterior of the mockup. The internal design conditions are 70 degrees F; Testing shall consist of three complete thermal cycles using the ranges specified. The temperatures will be maintained

for a period of two hours once stabilized.

Temperatures

Exterior +160 degrees F and 0 degrees F +- 5 degrees F

Interior 70 degrees F.

**ACCEPTANCE CRITERIA:**

*At the conclusion of the thermal cycling the wall shall be visually inspected for detrimental effects.*

**Observation:** no visible degradation was observed.

**Results Pass.**

1<sup>st</sup> Cold Cycle 1-10-03

	Outside	Inside	Inside	#2	#3	#4	net	#5	#7	#8	net
	Panel	Panel	Air								
830 am	49	22.6	69.9	.004	.031	.006	.026	.028	.028	.027	.001
900 am	3.7	21.2	69.4	.004	.032	.006	.027	.028	.028	.027	.001
930 am	1.9	20.8	69.9	.005	.037	.007	.032	.034	.035	.030	.001
1000am	1.5	19.7	69.1	.005	.039	.007	.033	.036	.035	.030	.002
1030am	0.8	19.2	69.8	.006	.044	.008	.037	.040	.038	.036	.005

1<sup>st</sup> Hot Cycle 1-11-03

	Outside	Inside	Inside	#2	#3	#4	net	#5	#7	#8	net
	Panel	Panel	Air								
928 am	157.7	128.9	70.7	.021	.103	.010	.088	.110	.110	.109	.001
958 am	160.0	132.8	70.1	.026	.108	.010	.090	.114	.114	.112	.001
1028am	162.9	144.9	70.0	.024	.116	.011	.099	.113	.113	.116	.001
1058am	162.7	146.2	70.3	.023	.115	.012	.088	.105	.099	.110	.008
1128am	162.7	147.6	73.9	.022	.108	.005	.094	.094	.089	.098	.007

2nd Cold Cycle 1-11-03

	Outside	Inside	Inside	#2	#3	#4	net	#5	#7	#8	net
	Panel	Panel	Air								
442pm	4.7	22.4	70.1	.010	.039	.004	.032	.025	.018	.024	.007
512pm	2.1	18.9	68.9	.010	.039	.004	.032	.025	.018	.025	.007
542pm	0.9	16.5	68.7	.009	.038	.002	.032	.023	.015	.022	.008
612pm	0.1	15.1	67.9	.009	.029	.001	.024	.015	.009	.013	.005
642pm	1.1	13.8	67.2	.009	.029	.000	.024	.015	.008	.012	.005

2nd hot Cycle 12-13-03

	Outside	Inside	Inside	#2	#3	#4	net	#5	#7	#8	net
	Panel	Panel	Air								
847 am	162.0	148.0	70.0	.021	.089	.008	.074	.095	.094	.093	.001
917 am	160.2	147.6	69.7	.020	.088	.006	.075	.080	.076	.082	.006
947 am	158.9	146.3	70.1	.019	.074	.002	.063	.060	.053	.061	.008
1017am	158.9	145.1	71.0	.018	.018	.001	.058	.052	.045	.053	.007
1047am	158.4	144.2	71.7	.017	.017	.001	.057	.048	.041	.041	.007

3rd Cold Cycle 12-13-03

	Outside	Inside	Inside	#2	#3	#4	net	#5	#7	#8	net
	Panel	Panel	Air								
437pm	5.0	21.0	68.8	.017	.088	.025	.067	.107	.110	.108	.003
507pm	2.9	18.8	67.9	.014	.083	.021	.066	.100	.102	.102	.001
537pm	1.1	16.7	68.7	.015	.078	.019	.061	.094	.098	.095	.003
607pm	0.7	14.9	68.8	.017	.080	.021	.061	.098	.100	.098	.002
637pm	0.5	13.7	67.9	.017	.080	.021	.061	.096	.098	.096	.002

3rd Hot Cycle 12-13-03

	Outside	Inside	Inside	#2	#3	#4	net	#5	#7	#8	net
	Panel	Panel	Air								
905pm	158.1	144.2	69.1	.019	.072	.004	.060	.078	.074	.078	.00
935pm	159.8	145.1	69.7	.020	.078	.004	.066	.074	.083	.081	.00
1005pm	160.3	146.1	70.1	.022	.080	.005	.067	.080	.0894	.083	.003
1035pm	161.2	146.9	70.3	.023	.083	.006	.068	.084	.088	.084	.004
1105	159.6	145.6	69.8	.021	.081	.005	.068	.088	.089	.086	.002

**AIR INFILTRATION TEST**  
 (Ref: ASTM E 283)

TEST PROCEDURE

Cover and seal the mockup completely with polyethylene sheeting while leaving the chamber

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uncovered. Develop a positive differential pressure of 6.24 PSF on the chamber. Record the airflow required to maintain this pressure. This number represents the airflow through the chamber. Remove the sheeting and reestablish the positive pressure of 6.24 PSF. Record the airflow required to maintain this pressure. This number is the airflow through the mockup and chamber. The difference between the two-recorded airflows is the airflow through the mockup.

**ACCEPTANCE CRITERIA:**

*0.06 CFM per square foot of exterior surface. Mockup area = (+) X = SF.*

*Maximum allowable airflow through mockup = 5.8 CFM.  
Panel Covered 27.2 CFM*

**WATER PENETRATION UNDER STATIC PRESSURE  
(Ref. ASTM E 331)**

**TEST PROCEDURE**

Apply an air stream equivalent to a static differential air pressure of 10.0 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes, while maintaining the differential pressure of 10.0 PSF. During this period, visually inspect the interior of the mockup for water penetration.

**ACCEPTANCE CRITERIA:**

*There shall be no unacceptable water leakage, defined as follows:  
The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

**Results Pass.**

**WATER PENETRATION UNDER DYNAMIC PRESSURE  
(Ref.: AAMA 501.1)**

**TEST PROCEDURE**

Apply an air stream equivalent to a static differential air pressure of 10.0 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period, visually inspect the interior of the mockup for water penetration.

**ACCEPTANCE CRITERIA:**



*There shall be no unacceptable water leakage, defined as follows:  
The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces...*

**Results Pass.**

**STRUCTURAL TEST AT 75% & 150% OF INWARD DESIGN PRESSURE  
(Ref. ASTM E 330)**

**TEST PROCEDURE**

Apply positive pressure to the mockup of 22.5 PSF and hold for 10 seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record initial readings. Increase positive pressure to 45.0 PSF and hold for 10 seconds. Reduce pressure to zero. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record zero load readings to determine permanent deformation.

**CRITERIA:**

*Net permanent deflection of framing member shall not exceed 0.1% of the clear.*

Positive Deflections @ 1.5 design load of 45 PSF Perm set Allowable deflection 0.162.5

Transducer #2	0.005
Transducer #3	0.011
Transducer #4	0.004
Transducer #5	0.012
Transducer #7	0.007
Transducer #8	0.008
Net deflection of transducers 2,3,4	<b>0.006</b>
Net deflection of transducers 5,7,8	<b>0.003</b>

**Results Pass.**

**STRUCTURAL TEST AT 75% & 150% OF OUTWARD DESIGN PRESSURE  
(Ref. ASTM E 330)**

**TEST PROCEDURE**

Apply negative pressure to the mockup of 22.5 PSF and hold for 10 seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor

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More than 5 minutes at zero load, record initial readings. Increase negative pressure to 45.0 PSF and hold for 10 seconds. Record deflection readings. Reduce pressure to zero. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record zero load readings to determine permanent deformation.

**ACCEPTANCE CRITERIA:**  
*Same as procedure (above).*

Negative Deflections @ 1.5 design load of 45 PSF Perm set Allowable deflection 0.162.5

Transducer #2	0.001
Transducer #3	0.005
Transducer #4	0.003
Transducer #5	0.004
Transducer #7	0.004
Transducer #8	0.005
Net deflection of transducers 2,3,4	<b>0.002</b>
Net deflection of transducers 5,7,8	<b>0.000</b>

**Results Pass.**

**INTERSTORY DIFFERENTIAL MOVEMENT SEISMIC RACKING SEISMIC RACKING AT DESIGN MOVEMENT.**

**TEST PROCEDURE**

Lateral Seismic test displacement, using a hydraulic jack the floor framing will be displaced relative to the upper level framing by 3.0" three cycles in each direction. One cycle to the left of center and one cycle to the left of center, this procedure is to be completed three times. .

**ACCEPTANCE CRITERIA:**

*There shall be no failure or gross permanent distortion of anchors a visual examination will be performed for any detrimental effects.*

Observation; No visual damage, or cracking was observed on the interior or exterior of the test assembly.

**Results Pass.**

Respectfully submitted,  
SMITH-EMERY COMPANY

  
Dana L. Nelson