Test Type:	ASTM 331
Testing Authority:	ASTM
Test Name:	Water Penetration Test
Test Date:	September 12, 2001
Test Completed By:	Tom Shingler, P.E.
Testing Laboratory	Design Dynamics – Richardson, TX
Panel Type:	1 ½ inch Snap Lock with Clip & Sealant
Panel Width:	16 inch
Clip Spacing:	N/A
Decking Construction:	N/A

Introduction:

On September 12, 2001 Design Dynamics, Inc. conducted both ASTM E-283 (air infiltration resistance) and ASTM E-331 (water penetration resistance) testing of the MetalForming Inc. 1 ½" deep x 16" wide Snap-Lock Architectural Standing Seam product at the Design Dynamics, Inc. test facility in Dallas, Texas.

Mock-Up: The roof system test specimen consisted of seven (7) Standing Seam roof panels @ 1 ½" deep x 16" wide x 24 gage steel mounted on a 3:12 pitched chamber.
The test assembly represented eight (8) active sidejoints, each of which contained an approximate 3/16" diameter bead of factory-applied hot-melt butyl sealant.
A one (1) piece clip applied to a center purlin member was used to support the test panel assembly at mid-length.
A continuity seal (gunnable butyl) was applied to the hook portion of the clip for the purpose of preventing an interruption of the panel air/water seal at a clip location.
End seals (not a part of the test) were developed at the upper and lower ends of test panels and edge seals (not a part of the test) were developed along the side edges of the test panel assembly.
The test chamber was 10 ft. wide x 9 ft. long x 1 ft. deep, with two (2) transparent Lucite observation windows on the backside.

This set of observation windows was for the purpose of witnessing the water penetration resistance behavior of the roof panel joint system.
The test panels were installed by test laboratory personnel in accordance with the manufacturer's installation instructions.
The test mock-up contained a total "active" area of 79.48 ftˆ2 or 67.36 linear feet of "active" sidejoint.

Instrumentation:

- Test chamber pressure differential measurements were made using a 0 to 24 in. Dwyer well-type Manometer using red oil at a 0.826 Specific Gravity. This instrument was used to sense chamber pressure values for both the air infiltration and water penetration testing phases.
- Air flow measurements were monitored using a Brooks Instrument Division Rotometer (Model # 1110CM42CMAA) and having a face scale of 0 to 92.2 cfm. Brooks is a Division of Emerson Electric Co. of Hatfield, Pennsylvania.
- Vacuum pressure was developed on the chamber using a 5 hp Shop-Vac set to a suction mode.
- Air flow control was accomplished via two (2) 1" diameter ball valves on the chamber and one (1) 2 ½" diameter gage valve on the Rotometer. The 1" diameter valves were used as a "bleeder" control while the 2 ½" valve was used as a control on the magnitude of vacuum pulled by the 5 hp Shop-Vac.
- Water spray was delivered by twenty-five (25) 90 degree water spray heads with a 360 degree spray cone and occurring at 24" on-centers in both the vertical and the horizontal direction.
  The spray rack was set 24" from the face of the mock-up and operated at 30 psi with a water delivery of 5 gallons/hour/ftˆ2 of roof area.

Air Infiltration Testing: ASTM E-283

The roof panel sidejoints were sealed with 2" wide high-tack Duct Tape such that the "active" joints were sealed against any possible air leakage through the previously described 67.36 lineal feet of seams. The perimeter seal, which handled the transition between test panel and chamber edge, was isolated from the test and therefore not a part of the leakage evaluation.
Following application of the tape seals, a vacuum was pulled on the chamber to a specified value. Typically, a (-) 6.24 psf pressure differential is Specified and represents the velocity pressure created by a 50 mph

wind speed, but additional air infiltration tests will be conducted at higher pressures.
With the tape seals in place, a specific and test-defined negative chamber pressure was maintained for 5 minutes to demonstrate equilibrium and a datum value was recorded on the Brooks Rotometer.
Following the described 5 minutes, the high-tack Duct Tape was stripped from the test specimen joints. The test pressure was held for five (5) minutes and then observations of the Manometer and Rotometer were made for the purpose of determining if deviations in their "equilibrium" values had occurred.
If wall system joint leaks were to occur, the Manometer value (psf) would drop, with a commensurate drop in Rotometer value (cfm).
To adjust the roof system back to the original Manometer pressure value, additional cfm must be pulled through the panel joints. Once the Manometer pressure is adjusted to the original chamber test pressure, the new Rotometer value would be recorded. The difference between the new (adjusted) and the original (datum) Rotometer value would be leakage (cfm) attributed to the specimen joints.

Following the initial air infiltration resistance test at (-) 6.24 psf, additional tests were conducted at values of (-) 12.0 psf and (-) 15 psf.
This multiple test value technique gives a "spectrum" of air infiltration resistance performance and also suggests the Factor-of-Safety which a system has over an accepted industry-standard pressure differential such as the (-) 6.24 psf value.

The ASTM E-283 Air Infiltration Resistance Test results are as follows....

MetalForming Inc.	
1 ½" Snap-Lock @ 16"	
Pressure difference psf	Air infiltration value, cfm/ft^2
6.24	0.006
12.00	0.012
15.00	0.015

Water Penetration Testing: ASTM E-331

There were three (3) separate water penetration resistance tests run on the same specimen.

These individual tests were conducted at pressure differentials of (-) 6.24 psf, (-) 12.00 psf and (-) 15.00 psf.
A specific pressure differential was developed on the specimen area and held at that pressure for an equalization period of 5 minutes.
Following the equalization period, a 15 minute test period ensued with water being dispersed at a rate of 5 gallons/hour/ft^2 of specimen frontal area.
Panel joint performance observations were made through the rear of the test chamber.

The results of each of the three (3) tests were as follows....

MetalForming Inc.	
1 ½" Snap-Lock @ 16"	
Pressure difference psf	Test observation
6.24	No leakage
12.00	No leakage
15.00	No leakage

Test Type:	ASTM 331
Testing Authority:	ASTM
Test Name:	Water Penetration Test
Test Date:	August 24, 2001
Test Completed By:	Tom Shingler, P.E.
Testing Laboratory	Design Dynamics – Richardson, TX
Panel Type:	1 ½ in Mechanical w/ Clip & Sealant
Panel Width:	16 inch
Clip Spacing:	N/A
Decking Construction:	N/A

Introduction:

On August 24, 2001 Design Dynamics, Inc. conducted both ASTM E-283 (air infiltration resistance) and ASTM E-331 (water penetration resistance) testing of the MetalForming Inc. 1 ½" deep x 16" wide structural standing seam product at the Design Dynamics, Inc. test facility in Dallas, Texas.

Mock-Up: The roof system test specimen consisted of seven (7) Standing Seam roof panels @ 1 ½" deep x 16" wide x 24 gage steel mounted on a 3:12 pitched chamber.

The test assembly represented eight (8) active sidejoints, each of which contained an approximate 3/16" diameter bead of factory-applied butyl sealant.

A two (2) piece sliding clip applied to a center purlin member was used to support the test panel assembly at mid-length.

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