

April 27, 2001

Engineering Report 21093-5

Construction Metal Products, Incorporated  
CMP Series 2500 16-inch Roof Panel  
ASTM E1680 Air Leakage Test  
ASTM E1646 Water Penetration Test

### **SUMMARY**

On April 9, 2001, water penetration and air infiltration testing were performed on one assembly of 24 gage, CMP Series 2500 G-90 galvanized steel roof panels manufactured by Construction Metal Products, Incorporated. The panels were assembled on a Cerny & Ivey Engineers, Inc. air chamber using sealant and mechanical fasteners.

The panels were tested in accordance with ASTM E1680, "Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems." The specimen was tested at differential pressures of 1.57 PSF, 6.24 PSF and 12.0 PSF. The test determined that the air infiltration rates for the panel assembly at these pressures were 0.0030 SCFM/SF, 0.0000 SCFM/SF and 0.0029 SCFM/SF, respectively.

The panels were also tested in accordance with ASTM E1646, "Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference." The specimen was tested with a water spray of 7.03 gallons per square foot per hour applied and 1/2-inch of water ponding between each panel rib. The specimen was tested at differential pressures of 1.57 PSF, 6.24 PSF and 12.0 PSF. The panel assembly exhibited no evidence of water leakage while being subjected to the test pressures.

If you have any question or need additional information, please contact us.

Respectfully submitted,

Heather R. Herbig  
Engineering Technologist

Phillip B. Plyler  
Staff Engineer

Christopher B. Shiver, P.E.  
Vice President – Principal Engineer

## **INTRODUCTION**

On April 9, 2001, water penetration and air infiltration testing were performed on 16-inch wide 24 gage, CMP Series 2500 steel roof panels manufactured by Construction Metal Products, Incorporated (CMP). The testing was performed in accordance with ASTM E1646, "Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference," as well as ASTM E1680, "Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems." Photographs taken during assembly and testing of the specimen are included in this report.

## **SPECIMEN**

The specimen tested was an assembly of G-90 galvanized steel roof panels manufactured by CMP. The panels were installed on a support structure using the appropriate clips and fasteners by CMP personnel.

The symmetrical panels covered a nominal 16-inches and had nominal 2-inch high ribs (CMP Drawing 1, Figure 21093-5A). The material specified for forming the panels was 24 gage, 50 KSI yield strength, Grade 50 galvanized sheet steel. Non-hardening butyl sealant was applied to the legs of each panel and was supplied by CMP. The supports used for the testing were nominal 2-inch by 8-inch wood purlins with raised steel coverings. The supports were spaced at 33-inches on center for the first span and 48-inches on centers for the second and third spans.

The first panel was attached to the test frame using #14 by 2-inch hex head screws at 12-inches on centers to seal the edges (Photograph 1). 18 gage steel clips were seated against the rib of the first panel and fastened to the support purlins with the same type #14 by 2-inch

hex head screws (Photographs 2 and 3). Each panel was lapped over the preceding panel with the sealant applied between the mating panels (Photograph 4). The panel ribs were then mechanically seamed using a hand seamer (Photograph 5). The final panel was attached to the test frame using the same type #14 screws at 12-inches on centers to seal the edges. These screws were also used along the ends of the middle panels to seal the edges. The final assembly included three seams and the equivalent of four panels (Photograph 6).

#### **PROCEDURE – E1680 AIR INFILTRATION TEST**

The panels were assembled in the test chamber by CMP personnel. The edges of the specimen were sealed to the chamber and secured to resist the pre-load and test pressures using polyurethane roof and flashing sealant provided by Cerny & Ivey Engineers, Inc. (Photograph 7). The specimen was pre-loaded with a positive static air pressure difference of 31.2 PSF for 10-seconds and allowed to recover for 2-minutes (test set-up Photograph 8). The specimen was then pre-loaded with an equivalent negative air pressure difference of 28.6 PSF for 10-seconds and allowed to recover for 2-minutes. This procedure was repeated for a total of three cycles.

A 6-mil thick sheet of polyethylene film was placed by Cerny & Ivey Engineers, Inc. personnel over the panels to provide a vacuum during testing (Photograph 9). A generous amount of plastic film was used; it was pleated in the corners so that it would not affect the test results by creating filets or non-uniform pressure distribution by bridging across members. The plastic sheet was sealed to the edge of the test chamber.

The test chamber was evacuated to the differential test pressure (Photograph 10). When the pressure was stabilized, the extraneous air leakage rate was measured using a

laminar flow element (last calibrated February 24, 2000). The polyethylene sheet was removed and the pressure differential re-established. When the pressure was stabilized, the air leakage rate was again recorded. The air flow rate was calculated as the difference between the two measurements. This procedure was repeated for a total of three test pressures. This test procedure is in accordance with ASTM E1680, "Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems."

#### **PROCEDURE – E1646 WATER PENETRATION TEST**

This procedure was followed after the completion of the ASTM E1680 testing; therefore, the panel was already assembled and sealed in the test chamber. The test air pressure difference was applied and allowed to stabilize. A uniform water spray was applied with nozzles to the exterior face of the specimen at a rate of 7.03 gallons per square foot per hour (last calibrated February 25, 1999) (test set-up Photographs 11 and 12). The spray was applied with nozzles spaced on a uniform grid 12-inches above the panel, with the stream center-line directed at the panel ribs 20-degrees off vertical. The spray was applied for 15-minutes during each test pressure (Photograph 13). The panel ends were sealed to the test chamber to allow the water to pond to a depth of 1/2-inch (Photograph 14). Constant observation was made of the interior face of the specimen and any points of water penetration were noted.

This procedure was repeated for a total of three test pressures. This test procedure is in accordance with ASTM E1646, "Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference."

**RESULTS**

Specimen: CMP Series 2500 G-90

<u>ASTM E1680</u>	<u>Load</u> <u>(PSF)</u>	<u>Ambient</u> <u>Temperature</u> <u>(degrees F)</u>	<u>Air</u> <u>Leakage</u> <u>(SCFM/SF)</u>
	1.57	70	0.0030
	6.24	71	0.0000
	12.0	71	0.0029

<u>ASTM E1646</u>	<u>Load</u> <u>(PSF)</u>	<u>Water</u> <u>Leakage</u>
	1.57	None
	6.24	None
	12.0	None