

November 11, 2002

Engineering Report 22299-2

Construction Metal Products, Incorporated
CMP Series 2500 18-inch Wide Panel
Steel with 24-inch Clip Spacing
ASTM E1592 Uniform Pressure Test

SUMMARY

On October 15, 2002, testing was initiated on Construction Metal Products, Incorporated CMP Series 2500 steel roof panels to determine their loading characteristics under uniform static uplift loads. The panels were 18-inches wide with nominal 2-inch high ribs and were constructed of 24 gage, 50 KSI yield strength, Grade 50 steel. The panels were installed with 18 gage steel clips attached to the support purlins on spans of 24-inches using two fasteners per clip. The panels were tested with both ends open.

The panels were tested in accordance with ASTM E1592, "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference." The panels held a maximum one-minute interval load of 135.2 PSF. The panels failed while going to the next higher pressure. The clips remained firmly attached to the support purlins.

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

Respectfully submitted,

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INTRODUCTION

The 24 gage steel roof panel assembly was tested in conjunction with clips at 24-inches on centers to determine its performance characteristics under uniform static uplift loading conditions. The panels were tested in accordance with ASTM E1592, "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference." The panels were assembled on the test fixture by Construction Metal Products, Incorporated (CMP) personnel and tested to failure. Deflections of the panel rib and pan were monitored on the top surface of the panel. Photographs of the test specimen and failure mode are included in this report.

SPECIMEN

The specimen tested was an assembly of Series 2500 steel roof panels manufactured by CMP. The panels were installed on a steel support structure with zee stiffeners on each edge, clips between panels, and the appropriate fasteners following the manufacturer's instructions. Self-drilling screws were placed through the top of each rib at the ends of the panels to prevent premature "unzipping" of the panel seams during testing.

The symmetrical panels covered a nominal 18-inches and had nominal 2-inch high ribs (CMP Drawing 1, Photograph 1). The material specified for forming the panels was 24 gage, 50 KSI yield strength, Grade 50, sheet steel. The steel supports used for the testing were zee section purlins. The zee purlins were made of cold-formed 16 gage steel and were spaced at 24-inches on centers.

The panels were attached to the formed zee purlins using Buildex 1/4 - 14 x 7/8 screws at 12-inches on centers along the first edge of the panel assembly (Photographs 2 through 4). The screws were provided by Cerny & Ivey Engineers, Inc. Clips were seated against the second rib of the first panel and fastened to the support purlin. The clips were fabricated from 18 gage steel (CMP Drawing 1). The clips were attached at 24-inches on centers to the support purlins with two of the same type Buildex 1/4 - 14 x 7/8 screws. This process was repeated with the remaining panels and clips until the assembly was completed. The remaining rake edge was also fastened with the same type Buildex 1/4 - 14 x 7/8 screws at 12-inches on centers (Photographs 5 through 10).

As the panels were assembled, the panel ribs were mechanically seamed using a hand seamer at each clip location and halfway between clips (Photograph 11). The same type Buildex 1/4 - 14 x 7/8 screws were then placed through the top flange of each seamed rib at the ends of the panels to prevent premature unzipping of the seams during testing. The completed panel assembly was 7-feet, 6-inches wide (5 panels) by 21-feet, 0-inches long (10 spans at 24-inches and 6-inch overhangs at either end) (Photograph 12).

PROCEDURE

The panels were assembled on the test chamber by CMP personnel. A 6-mil thick sheet of plastic film was placed by Cerny & Ivey Engineers, Inc. personnel during panel installation to seal the panel against air leakage. The plastic film was pleated into the standing seams and under the panel flat section so that it would not affect the test results by creating filets or non-uniform pressure distribution by bridging across members. The panel edges and the plastic sheet were sealed to the edge of the test chamber.

Deflection gages, readable to 0.0005-inch, were installed (Photographs 13 through 15) above the ribs on each edge of the third panel at the center of the center span (gages 1 & 3) and the adjacent support location (gages 4 & 6). Two gages were placed on the center of the third panel flat section at these same lines (gages 2 & 5). The chamber pressure was measured at both ends (diagonal corners) of the chamber using water manometers accurate to 0.1-inches of water.

Pressure was applied to the specimen to a reference “zero” load of 1-inch of water (5.2 PSF) and maintained for 60 seconds; the deflection gages were then read. The load was then increased to the next load increment, where it was maintained for 60 seconds; deflections were then read. The load was returned to actual zero for a recovery period and then brought back to the reference zero load and maintained for 60 seconds; set deflections were then read. This procedure was repeated, with increasing uniform loads, until failure of the panel occurred. The procedure was performed in accordance with ASTM E1592, “Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.”

RESULTS

The panel held a maximum one-minute interval load of 135.2 PSF. The panels failed while going to the next higher pressure when one of the panels pulled out of its clips. The clips remained firmly attached to the support purlins (Photographs 16 through 27).

The test results are presented in the tables and graphs on the following pages. All deflection measurements were normalized to a zero reference. Readings of rib

deflections were averaged and plotted as a function of load. Rib deflection and rib permanent set at a clip location (support) and at a midpoint between clips (mid-span) was plotted.

Table 1: Panel Rib Deflections and Permanent Sets

<u>LOAD</u> <u>(PSF)</u>	<u>RIB DEFLECTION (inches)</u>						<u>RIB SET (inches)</u>					
	<u>MIDSPAN</u>			<u>SUPPORT</u>			<u>MIDSPAN</u>			<u>SUPPORT</u>		
	<u>1</u>	<u>3</u>	<u>AVG</u>	<u>4</u>	<u>6</u>	<u>AVG</u>	<u>1</u>	<u>3</u>	<u>AVG</u>	<u>4</u>	<u>6</u>	<u>AVG</u>
0	0.0000	0.0000	0.000	0.0000	0.0000	0.000	0.0000	0.0000	0.000	0.0000	0.0000	0.000
7.8	0.0125	0.0140	0.013	0.0110	0.0145	0.013	0.0070	0.0060	0.007	0.0080	0.0075	0.008
10.4	0.0455	0.0580	0.052	0.0375	0.0595	0.049	0.0000	0.0050	0.003	0.0010	0.0055	0.003
13.0	0.0200	0.1255	0.073	0.0195	0.1400	0.080	0.0035	0.0000	0.002	0.0025	0.0000	0.001
15.6	0.0515	0.1585	0.105	0.0540	0.1770	0.116	0.0060	0.0010	0.004	0.0000	0.0025	0.001
18.2	0.0895	0.2045	0.147	0.0945	0.2265	0.161	0.0320	0.0050	0.019	0.0285	0.0055	0.017
20.8	0.1530	0.2770	0.215	0.1600	0.2990	0.230	0.0325	0.0240	0.028	0.0275	0.0220	0.025
26.0	0.2985	0.4005	0.350	0.2910	0.4115	0.351	0.0180	0.0205	0.019	0.0165	0.0240	0.020
31.2	0.3850	0.4145	0.400	0.3355	0.4235	0.380	0.0375	0.0345	0.036	0.0410	0.0325	0.037
36.4	0.4100	0.4320	0.421	0.3445	0.4425	0.394						

FIGURE 1: CMP SERIES 2500 PANEL DEFLECTION AND SET AT MIDPANEL MIDSPAN

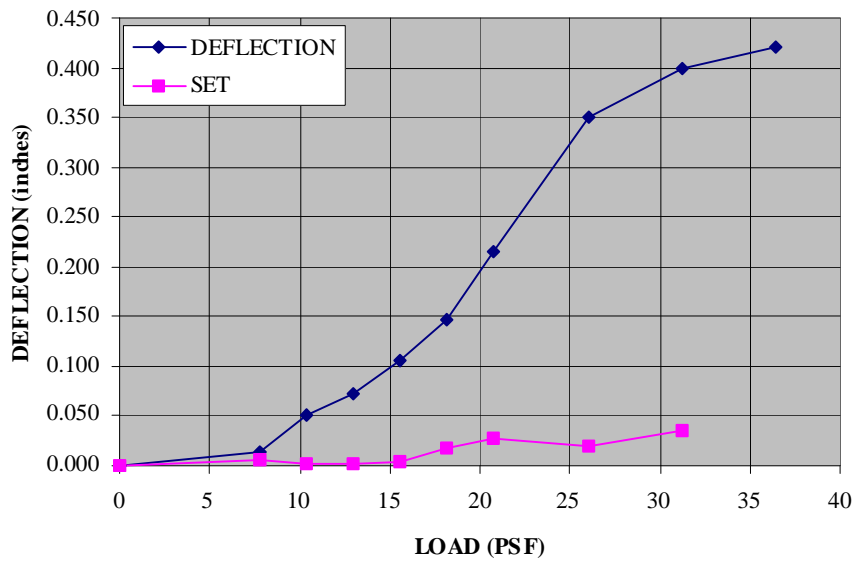


FIGURE 2: CMP SERIES 2500 PANEL DEFLECTION AND SET AT MIDPANEL AT CLIP

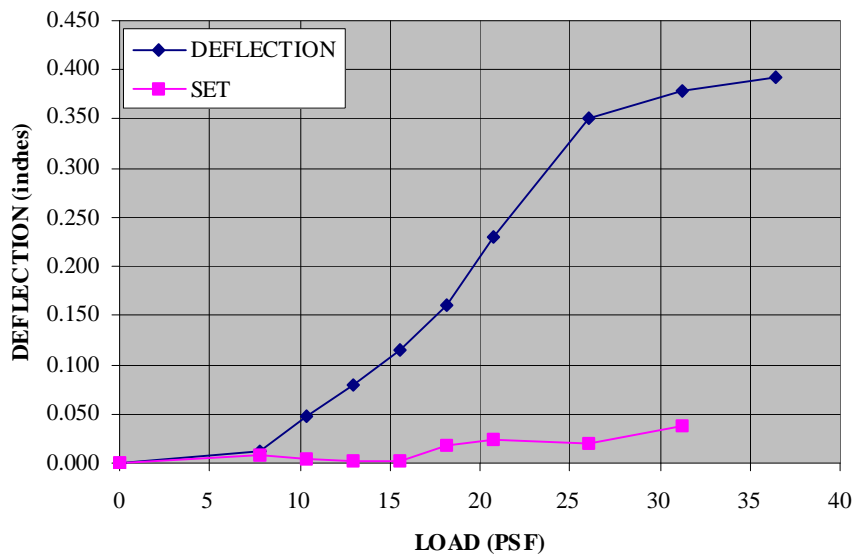


Table 2: Panel Midpanel Deflections and Permanent Sets

<u>LOAD</u> <u>(PSF)</u>	<u>MIDPANEL DEFLECTION (inches)</u>		<u>MIDPANEL SET (inches)</u>	
	<u>MIDSPAN</u> 2	<u>SUPPORT</u> 5	<u>MIDSPAN</u> 2	<u>SUPPORT</u> 5
0	0.0000	0.0000	0.3295	0.0000
7.8	0.0710	0.0210	0.3290	0.18050
10.4	0.1660	0.0405	0.0000	0.1880
13.0	1.9215	2.0505	0.0000	0.0000
15.6	2.3850	2.5335	0.0000	0.0585
18.2	2.8045	2.9620	0.0000	0.0000
20.8	3.3150	3.4700	0.0000	0.0000
26.0	4.1470	4.6000	0.0000	0.0000
31.2	4.6750	4.7865	0.0000	0.0280
36.4	4.9135	5.0220		

Figure 3: CMP Series 2500 Panel Deflection and Set at Seam Midspan

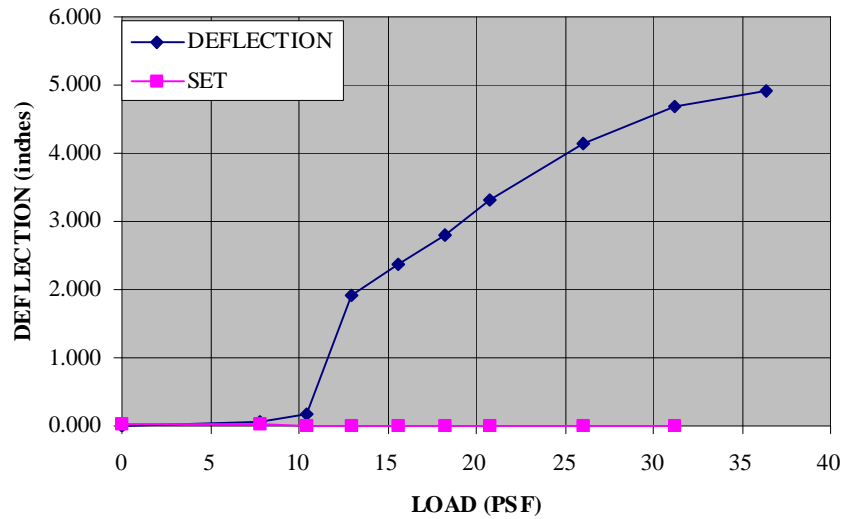


Figure 4: CMP Series 2500 Panel Deflection and Set at Seam at Clip

