



15 February 2011

Mr. Stephen Loyd
Precision Wall Systems, Inc.
1821 Levee Street
Dallas, TX 75207

Project 100931 – Corrosion Evaluation of the Gridworx Mechanical Stone Hanging System

Dear Mr. Loyd:

At your request, we reviewed the product samples, salt-spray test results, tensile strength test results, product chemistry and processing information of the Gridworx mechanical stone hanging system that you provided. This report summarizes our findings.

1. BACKGROUND

The Gridworx mechanical stone hanging system is designed as a field-installed, pre-engineered, hand set stone veneer cladding system. We understand that cementitious grout is not used between the stone panels and that the Gridworx supports are not exposed to pH conditions outside the range of 3-10. Gridworx uses 12 ft long aluminum support channels that are mechanically affixed to the structure with fasteners. The stone panels are delivered with kerf cuts on the horizontal edges. They are set in the J portion of the Gridworx channel: this carries the dead load of the panel. “L Brackets” are placed in the top kerf and rotated inward so the pointed end snaps into a receptacle in the channel above. These provide lateral wind load support.

Gridworx channels are produced from aluminum Alloys 6005 and 6005A with a T-5 temper. Although unprotected aluminum is inherently corrosion resistant through natural oxidation and the formation of a protective oxide film, Gridworx channels offer additional protection with the application of an anodized treatment meeting the specifications of AA M12C22A21 in accordance with AAMA 611-98. The channels are affixed to a steel stud substrate with a special-use fastener possessing a dual temper and a Stalgard coating. Bi-metal stainless steel fasteners are used to attach the aluminum channels to backup systems consisting of concrete masonry units (CMU) or cast-in-place concrete.

2. DOCUMENT REVIEW

You provided two mill certificates showing chemical analysis for the aluminum billets used to extrude the Gridworx support channels. The certificates confirm that both Alloys 6005 and 6005A are used to manufacture the product. The main difference in the requirements between these two alloys is that Alloy 6005A allows for a greater copper and manganese content.

You provided reports for salt spray tests of the Gridworx channels. The salt spray procedure is designed to accelerate the corrosive attack on the subject material in order to predict its corrosion resistance in high-chloride environments. It is often referred to as an accelerated weathering procedure. AADFW, Inc. conducted the salt spray testing for 1,008 hrs on the Gridworx channels holding natural limestone, holding Arriscraft International’s calcium silicate units, and holding no stone at all. The testing procedures are standardized under national and international standards as ASTM B117, Standard Practice for Operating Salt Spray (Fog) Apparatus and ISO 9227, Corrosion

Tests in Artificial Atmospheres – Salt Spray Tests. The tests included nine channels total (three of each). All channels had raw cut edges, punched weep holes and screw slots. This conforms to normal field conditions; the cut edges and weep holes were not anodized.

You provided tensile strength test reports for the Gridworx channels used in the three salt spray test conditions (above) as well as with a control sample that had not been through the salt spray test. These tests were conducted in accordance with the standards set by ASTM B557-06, Standard Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products.

The product literature for the recommend fasteners that you provided describe a 300 series stainless steel with 400 series hardened self-drilling tips and dual tempered fasteners with a Stalgard coating.

3. LABORATORY ANALYSIS

Laboratory Testing, Inc. performed a chemical analysis of a stone support channel using direct-reading atom emissions spectroscopy. This analyzed section came from the no-stone salt-spray specimen. The results of this chemical analysis show that the alloy conforms to the specification for Alloy 6005A as per ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

We used a stereo optical microscope to examine the salt spray channels. We did not see any pitting or material loss as a result of the salt-spray testing, however, the surface of the aluminum was stained by particles on the stone samples.

4. DISCUSSION

The aluminum alloys currently used for the Gridworx mechanical stone supports are 6005 and 6005A, both with a T-5 temper. Manganese is not a critical alloying element in this material from a corrosion standpoint; therefore, the manganese content in either alloy should not affect the corrosion performance of this product. Large amounts of copper, however, can increase the potential for corrosion in series 6000 aluminum alloys, so the copper content of Alloy 6005A must be kept lower than 0.1%, which is the upper limit of Alloy 6005.

Aluminum alloys perform well in coastal locations with high salt content because they are more resistant to the chlorides that cause pitting corrosion than other alternative materials, such as carbon steel and stainless steel. The Gridworx support channels performed well after 1,008 hrs of salt-spray testing and did not show signs of pitting corrosion or other harmful effects of the chloride exposure. This evaluation includes the cut edges, weep holes, and screw slots where the anodized treatment had been removed.

Aluminum Alloys 6005 and 6005A are lighter and more compliant than hot worked stainless steel; however, these materials have similar yield strengths. The tensile test results on the Gridworx aluminum samples showed yield strengths ranging from 29.1 to 33.2 ksi, with an average yield strength of 31.25 ksi. The average yield strength of the Gridworx aluminum samples tested in tension is comparable to the minimum yield strength (30 ksi) of hot worked stainless steel extruded shapes and tubes given by ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes. The yield strength of a material signifies the onset of permanent deformation in the material; therefore, design codes limit the allowable stresses in these materials to a percentage below their yield strength so that the materials will not exceed their elastic limits during their service life. For typical stone hanging systems, the yield strength of the material is the critical design

parameter and the aluminum alloys of the Gridworx system compare favorably with the yield strength of stainless steel.

The dual tempered fasteners with the Stalgard coating and the bi-metal fasteners recommended with the Gridworx system are appropriate selections to provide resistance to hydrogen embrittlement and to minimize galvanic corrosion occurring when dissimilar metals come into contact with the 300 series stainless steel.

5. CONCLUSIONS

Our findings regarding the review of the Gridworx mechanical stone hanging system are summarized as follows:

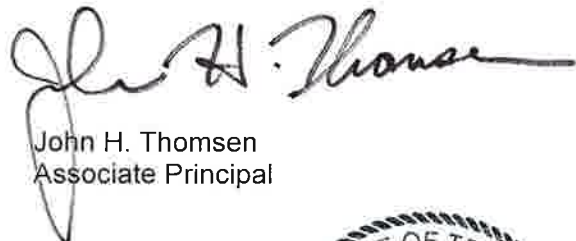
- The Gridworx stone hanging system utilizes aluminum Alloys 6005 and 6005A with less than 0.1% copper by weight.
- These aluminum alloys exhibit excellent corrosion resistance even in the accelerated environment imposed by the salt-spray tests.
- Aluminum Alloys 6005 and 6005A have a yield strength that is comparable to that of hot-worked stainless steel, Grades 304 and 316.
- The metallurgy of the fasteners specified for installation of the Gridworx supports is appropriate to minimize the potential for galvanic corrosion and hydrogen embrittlement.
- The Gridworx aluminum stone hanging system provides strength and corrosion-resistant characteristics that make it an attractive alternative to stainless steel stone hanging systems in a variety of applications.

In the preparation of this report, we reviewed samples of an aluminum material used in the manufacture of the Gridworx stone hanging system for a generic exterior condition. Due to the many variables associated with the use of any building product, including but not limited to, climatic conditions, design, and product application, any specification and/or use of the Gridworx stone hanging system should be evaluated by a licensed design professional on a project-by-project basis. Simpson Gumpertz & Heger disclaims responsibility for any and all claims arising out of the specification and/or use of the Gridworx stone hanging system alleged to have occurred based on reliance on the opinions expressed herein without such independent evaluation.

Sincerely yours,



Simon C. Bellemare, P.E.
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