



Fitzpatrick Structural Engineering, P.C.

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January 30, 2009

Mr. Dave Strenski
323 Oak Street
Ypsilanti, MI 48198

RE: Ypsilanti Solar Project – City Hall
Installation Materials Review

Dear Mr. Strenski,

You recently received quotations for materials to use to assemble support frames for the Solar Project to be installed on the Ypsilanti City Hall. Four materials were in the quotation from the Unistrut Representative;

1. All Galvanized.
2. Hot Dipped Galvanized
3. Aluminum (Untreated and Uncoated)
4. Stainless Steel

You specifically asked about the acceptability of using Hot-Dipped galvanized material and its interface with the solar panel frame. Important to this discussion, but based on my interpretation of the whole solar assembly, the aluminum frame around the solar panel is seemingly the most critical metal component.

This letter concerns the minimization of corrosion of the solar panel framing when used with the other materials for the structural support of the solar panels.

When comparing the use of stainless steel and aluminum members in the same structure, galvanic interaction that causes corrosion can occur. Looking at a Galvanic Series Table (ranked from 1-most anodic to 92-most cathodic) Stainless Steel is more cathodic (with rankings ranging from 38 to 43 and 53 depending on the alloy) than Aluminum (with rankings ranging from 6 to 26, depending on the alloy). This means that with these two metals in contact, the aluminum would lose, or donate, ions to the stainless steel. The aluminum panel framing would be the corroding anode material, thus losing its material and strength through galvanic corrosion. Over a period of time, it would probably need replacing. Considering that the solar panel framing is the more critical component of the assembly and

that the quoted cost of stainless steel is very high, we would not recommend the use of stainless steel as the material of choice for the support frame, in spite of what we originally recommended.

The use of aluminum for both the solar panel and the support framing is acceptable. However, depending on the alloys used, a galvanic circuit could still corrode either the solar panel frame or the support structure over time. Also, another consideration to be taken into account is that the solid aluminum channel would have to be drilled to assemble the frame. It's a minor drawback, but still is a negative factor.

The use of hot dipped galvanized channel and fittings by Unistrut would certainly set up a galvanic circuit, but this is more beneficial to the solar panel framing. Looking at the Galvanic Series Table again, the aluminum in the panel framing is more cathodic (with rankings ranging from 6 to 26, depending on the alloy) than the more anodic zinc in the Hot dipped support frame (with a ranking of 4). This means that with these two metals in contact, the zinc coating would loose, or donate, ions to the aluminum panel framing. Because of the 'excess' zinc on the support frame, the base metal support frame would not corrode as long as there is zinc on the framing. The solar frame would not corrode or lose material or strength due to galvanic corrosion.

Also note, the greater amount of zinc on the larger area support frame would distribute any galvanic current over a much larger area and be subject to less attack. Said another way, the larger amount of zinc on the support frame would have less galvanic current density and therefore lose proportionately less sacrificial zinc. From experience and with the materials so close in their galvanic table ranking, it would take a long time for all of the zinc on the support frame to be sacrificed.

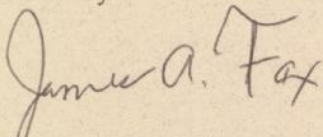
Although the cost of the Hot Dipped materials are more than the uncoated/untreated aluminum Unistrut option, the certainty of the galvanic corrosion makes the hot dipped support frame more beneficial. Also ease of assembly because of the preposition holes is considered a plus.

You also inquired about the use of galvanized or stainless steel rods for the anchors into the brick wall. Stainless steel is more cathodic than either the aluminum or zinc. The use of stainless steel for wall fasteners is a better choice.

In summary, Fitzpatrick Structural Engineering would recommend the use of the hot dipped galvanized channels and fittings by Unistrut. Fitzpatrick Structural Engineering would recommend the use of stainless steel rods as wall fasteners.

If you have any further questions regarding this matter, please contact our office.

Sincerely

A handwritten signature in dark ink, reading "James A. Fox". The signature is written in a cursive style with a large, stylized "F" and "x".

James A. Fox P.E.
Engineer.