

January 8, 2013

Samuel Park
Solar Clam-P
516 Lindenhurst Street
Philadelphia, Pennsylvania 19116

RE: Solar Clam-P Solar Panel Mounting System – Single Bolt and Combo Clam-p

Dear Mr. Park:

At your request, I have reviewed the construction and test results of your Solar Clam-P Solar Panel Mounting System as documented in Architectural Testing report C1940.01-109-44 (Revision -, 10/03/12) to determine if replacing two 1/4-20 clamping bolts with one 5/16-18 clamping bolt will affect structural performance. And, I have evaluated the 4" Combo Clam-p used to link adjacent panels.

As documented in the test report, the clamp uses two (2) 1/4-20 bolts with locking washers. The adequacy of the clamp using one (1) 5/16-18 bolt with locking washers is checked. The capacity of both anchoring conditions are calculated and compared to a load induced by the tested design pressure of 105 psf. The attached calculations show one 5/16-18 bolt is adequate for a 39-1/16" x 65-1/16" panel size and 105 psf uplift pressure.

Also, 4" Combo Clam-p clamps are to be used to connect two adjacent panels. The attached calculations show that this clamp can adequately resist the load induced by a design pressure of 105 psf for two adjacent a 39-1/16" x 65-1/16" panel. One Combo Clam-p is required at each end of the panel junction.

Sincerely,

Joseph A. Reed, P.E.
Director – Engineering

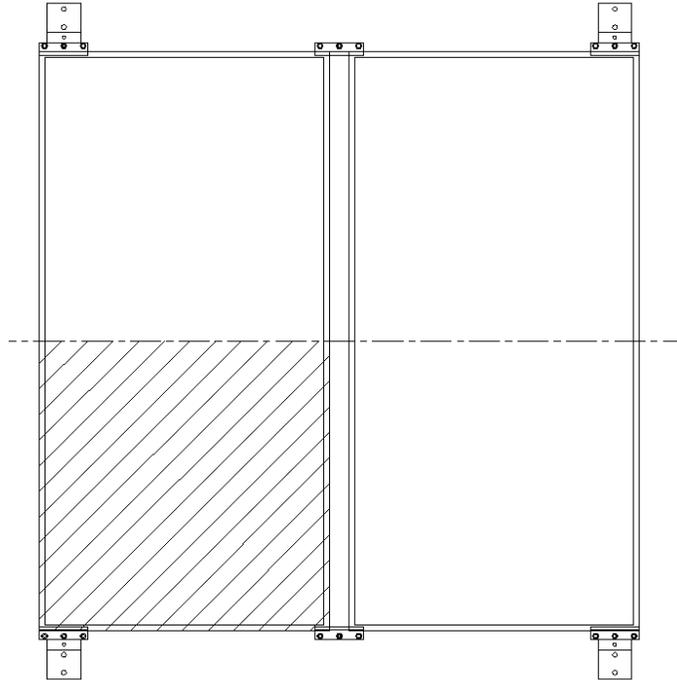
JAR:jar

cc: C2294.01-122-34

Attachments (pages):

Calculations (3)

Clamp Anchorage Load



Design Pressure = 105 psf

Overall Panel Size = 39-1/16" x 65-1/16"

Total Panel Load = $(105 \text{ psf})(1 \text{ ft}^2 / 144 \text{ in}^2)(39\text{-}1/16\text{'')}(65\text{-}1/16\text{'')}$ = 1,853 lb

Load per Clamp = $(1,853 \text{ lb/panel}) / (2 \text{ clamp/panel})$ = 927 lb/clamp

As- Tested Capacity of Two (2) 1/4-20 Grade 2 Bolts through Clamp

Allowable Tension of 1/4-20 Grade 2 Bolt

$$P_{ts}/\Omega = 941 \text{ lb (TIR-A9)}$$

Pull-Over of 1/4-20 Bolt with Locking Washer

$$P_{nov} = C_{pov}t_1F_{tu1}(D_{ws}-D_h)/3.0$$

$$P_{nov} = 1.0(0.75")(22,000 \text{ psi})(0.487" - 0.25")/3.0 = 1,304 \text{ lb}$$

Pull-Out of 1/4-20 Bolt with Locking Washer

$$P_{not} = K_sDL_eF_{ty2}/3.0$$

$$P_{not} = 1.2 (0.25")(0.75")(16,000 \text{ psi})/3.0 = 1,200 \text{ lb}$$

Capacity of Connection is (2)(941 lb) = 1,853 lb > 927 lb, OK

Alternate Capacity of One (1) 5/16-18 Grade 2 Bolts through Clamp

Allowable Tension of 1/4-20 Grade 2 Bolt

$$P_{ts}/\Omega = 1,551 \text{ lb (TIR-A9)}$$

Pull-Over of 5/16-18 Bolt with Locking Washer

$$P_{nov} = C_{pov}t_1F_{tu1}(D_{ws}-D_h)/3.0$$

$$P_{nov} = 1.0(0.75")(22,000 \text{ psi})(0.583" - 0.3125")/3.0 = 1,487 \text{ lb}$$

Pull-Out of 5/16-18 Bolt with Locking Washer

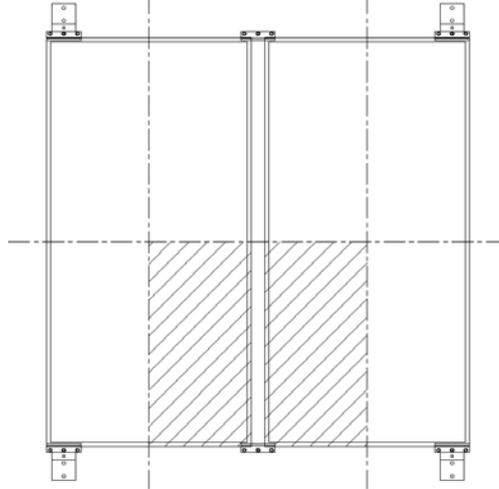
$$P_{not} = K_sDL_eF_{ty2}/3.0$$

$$P_{not} = 1.2 (0.3125")(0.75")(16,000 \text{ psi})/3.0 = 1,500 \text{ lb}$$

Capacity of Connection is 1,487 lb > 927 lb, OK

Panel to Panel Clamp Analysis

Panel to Panel Clamp Load



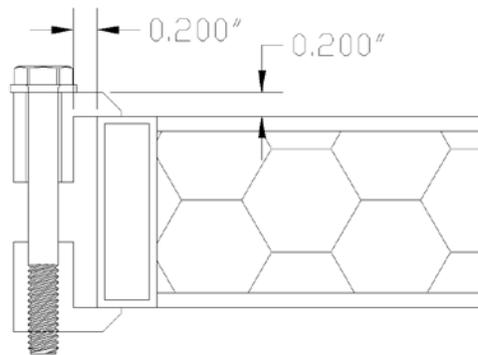
Two (2) Clamps Connecting Two (2) Panels

Design Pressure = 105 psf

Overall Size = 39-1/16" x 65-1/16"

Load per Clamp = $(2)(105 \text{ psf})(1 \text{ ft}^2 / 144 \text{ in}^2)(39\text{-}1/16\text{'}/2)(65\text{-}1/16\text{'}/2) = 927 \text{ lb}$

Clamp Bending Analysis



$F_b = 9,697 \text{ psi}$

Clamp Length = 4"

$S = bh^2/6 = (4\text{'})(0.200\text{'})^2/6 = 0.0267 \text{ in}^3$

$\sigma = PL/S = (927 \text{ lb})(0.200\text{'})/(0.0267 \text{ in}^3) = 6,944 \text{ psi} < 9,697 \text{ psi, OK}$