GERRITS ENGINEERING
LIMITED

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www.gerreng.com

646-007-16

February 7th, 2019 (Rev 05)

HES PV
320 Mary Street
Victoria, BC, V9A 3V9

Attention: Mr. Dan Partridge

Re: Structural Engineering Review for
HES-PV Fast Rack Mounting Rails and Roof Connections

As requested Gerrits Engineering Ltd. (GEL) has completed a structural engineering review of the following components of the HES-PV Fast Rack (FR) Solar PV racking system;

1. HES-PV HD Rail System
2. HES-PV UL Rail System
3. 5/16" SS Lag Bolt Roof Connection
4. EJOT-8.0-110 Roof Connection

In our opinion, the above racking components are structurally adequate to be used on buildings designed as per either Part 4 or Part 9 of the National Building Code of Canada (sloped roofs) for rooftop solar PV applications in Canada with the limitations, spans and embedment details as per the attached tables.

The capacity of the base building to safely support the racking system is to be determined by others.

Our review considered only the racking components outlined herein. Application of HES-PV FR racking system with alternate anchors (e.g., S-5 clamps on standing seam metal roofs) is not considered herein. Application of alternate anchors and structural adequacy of the respective roofing system/structure must be reviewed a qualified Professional Engineer.

Please contact the undersigned for any inquiry related to this document.

Sincerely,

GERRITS ENGINEERING LIMITED

Jesse Longworth, M.A.Sc., P.Eng.
Senior Structural Engineer

Attachments:

1. HES PV Fast Rack HD Rail Maximum Span Table
2. HES PV Fast Rack UL Rail Maximum Span Table
3. HES PV SS Lag Screw Connection – General Arrangement Drawing No. 103499 Revision F (Sheet 3 of 6)
4. HES PV SS EJOT Hanger Bolt Connection – General Arrangement Drawing No. 103499 Revision F (Sheet 4 of 6)

PROFESSIONAL PROVINCE OF J. M. LONGWORTH # 48297 BRITISH COLUMBIA ENGINEER
19/02/07

PROFESSIONAL ENGINEER J.M. LONGWORTH ALBERTA
19/02/07

PROVINCE OF MANITOBA J. M. LONGWORTH Member 38141 REGISTERED PROFESSIONAL ENGINEER
19\02\07

PROFESSIONAL ENGINEER J.M. LONGWORTH MEMBER 30487 SASKATCHEWAN
19\02\07
YR. MN. DAY

LICENSED PROFESSIONAL ENGINEER J.M. LONGWORTH 100085576 PROVINCE OF ONTARIO
19\02\07

REGISTERED PROFESSIONAL ENGINEER
DATE 19/2/7
F.J. Gerrits
9557
PROVINCE OF NOVA SCOTIA

HESPV FAST RACK HD RAIL MAXIMUM SPAN TABLE /m (in)

Specified Roof Snow Load S, kPa (PSF)	**5/16” SS Lag Bolt w/ min. L_t = 89mm(2)** Mean Hourly Wind Pressure, $q_{1/50}$/kPa (3 Seconds Wind Gust, V_{basic}/mph)			
	0.4 (84)	**0.5 (94)**	**0.6 (103)**	**0.7 (112)**
1.0 (21)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
1.5 (31)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
2.0 (42)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
2.5 (52)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
3.0 (63)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)

Specified Roof Snow Load S, kPa (PSF)	**EJOT-8.0-110 (3)** Mean Hourly Wind Pressure, $q_{1/50}$/kPa (3 Seconds Wind Gust, V_{basic}/mph)			
	0.4 (84)	**0.5 (94)**	**0.6 (103)**	**0.7 (112)**
1.0 (21)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
1.5 (31)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
2.0 (42)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
2.5 (52)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)
3.0 (63)	1.83 (72”)	1.83 (72”)	1.22 (48”)	1.22 (48”)

Notes:
1) Combined dead, wind and snow loads considered as defined by OBC 2012 and NBCC 2015.
2) Pull out strengths for lag bolts defined for SPF Grades 1/2 and seasoned wood as per CSA 086-14; Engineering Design in Wood where **L_t** is the threaded embedment length of the bolt. Minimum joist or truss top chord size is 2x4 (38x89).
3) Pull out strength for EJOT, based on 3 11/32” (85 mm) embedment depth.
4) Normal Importance Category buildings considered as defined in OBC 2012 for wind and snow loads.
5) Results are based on rough wind exposure with maximum wind exposure factor Ce = 0.7 or maximum mean roof height of 6m.
6) Modules are not to overhang from the roof edge and/or ridge.
7) Above tabulated spans are to be reduced half if modules are installed within 1m of a roof edge and/or ridge.
8) Valid only for roof slopes ranging from 7° to 45°.
9) Based on HD & UL Rails made from 6005A-T61 Aluminum.
10) HD & UL rails are not to be spliced within middle 1/3 of the span.
11) Maximum live load deflection of the rails limited to **L/180** (where **L** is the rail span).
12) Results are based on minimum of 3 continuous rail spans.

HESPV FAST RACK UL RAIL MAXIMUM SPAN TABLE /m (in)

Specified Roof Snow Load S, kPa (PSF)	**5/16" SS Lag Bolt w/ min. L_t = 89mm(2)** Mean Hourly Wind Pressure, $q_{1/50}$/kPa (3 Seconds Wind Gust, V_{basic}/mph)			
	0.4 (84)	**0.5 (94)**	**0.6 (103)**	**0.7 (112)**
1.0 (21)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
1.5 (31)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
2.0 (42)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
2.5 (52)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
3.0 (63)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")

Specified Roof Snow Load S, kPa (PSF)	**EJOT-8.0-110 (3)** Mean Hourly Wind Pressure, $q_{1/50}$/kPa (3 Seconds Wind Gust, V_{basic}/mph)			
	0.4 (84)	**0.5 (94)**	**0.6 (103)**	**0.7 (112)**
1.0 (21)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
1.5 (31)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
2.0 (42)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
2.5 (52)	1.83 (72")	1.83 (72")	1.22 (48")	1.22 (48")
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Notes:
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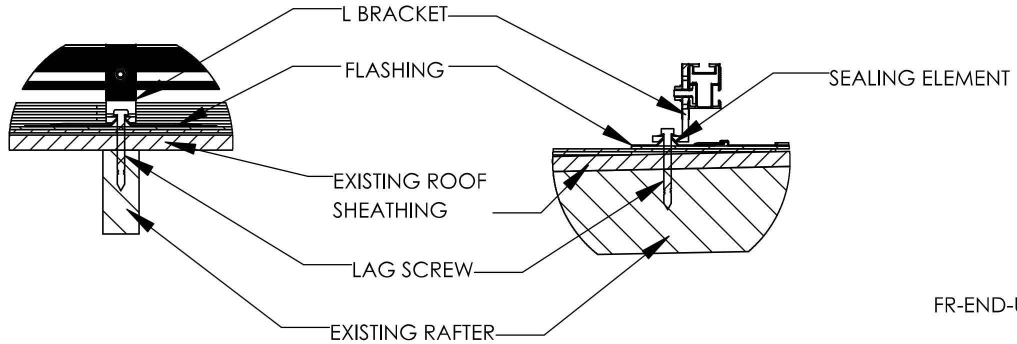
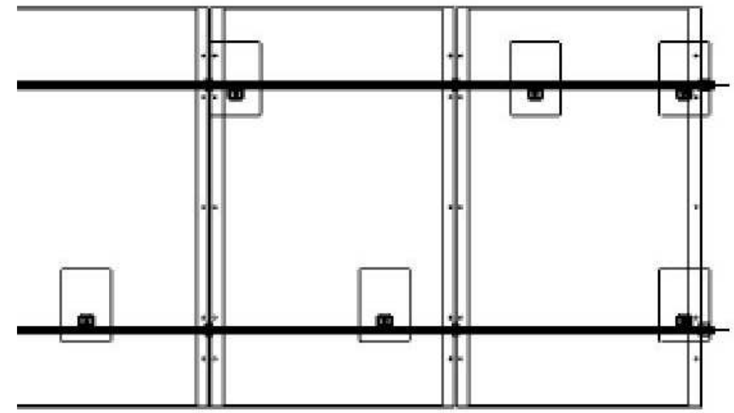
12) Results are based on minimum of 3 continuous rail spans.

NOTES:

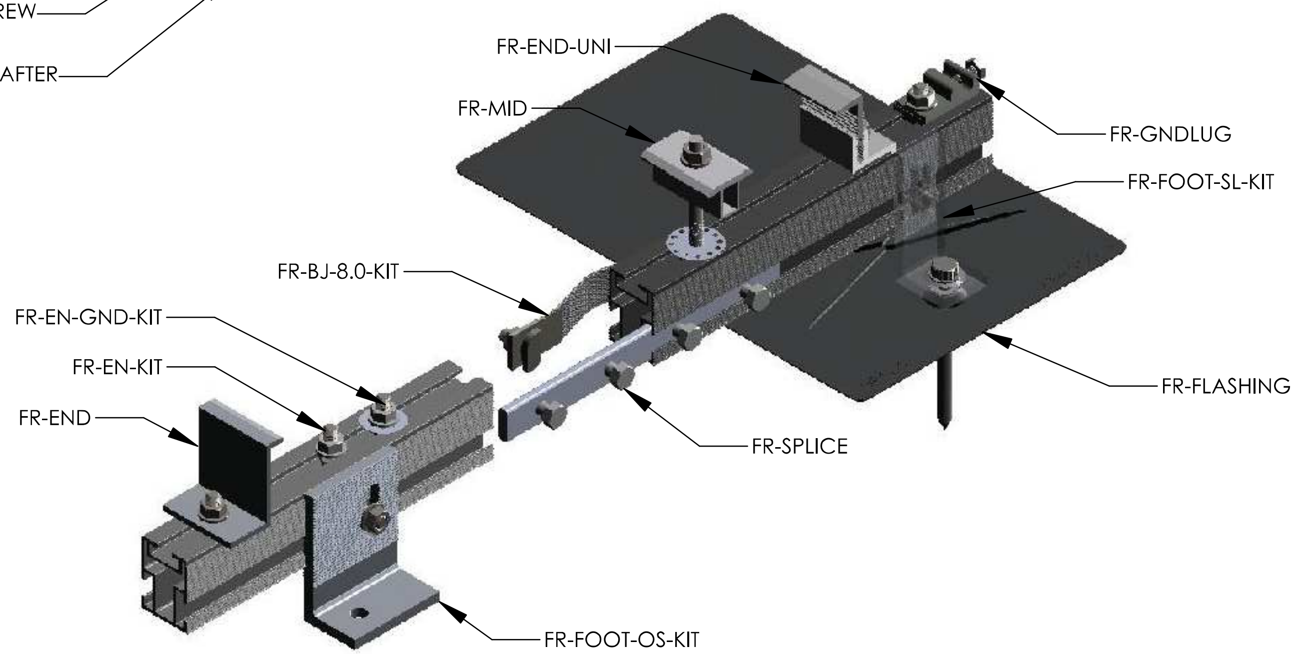
-BONDING WASHER TO BE USED ON EVERY MID CLAMP
-MOUNTING FEET SPACING BASED ON 24" O/C TRUSSES
-MOUNTING FEET ALTERNATE RAILS TO DITRIBUTE LOAD
-MAXIMUM SPAN 64"

FLASHING CROSS-SECTION





TYPICAL MOUNTING FOOT PLACEMENT PATTERN



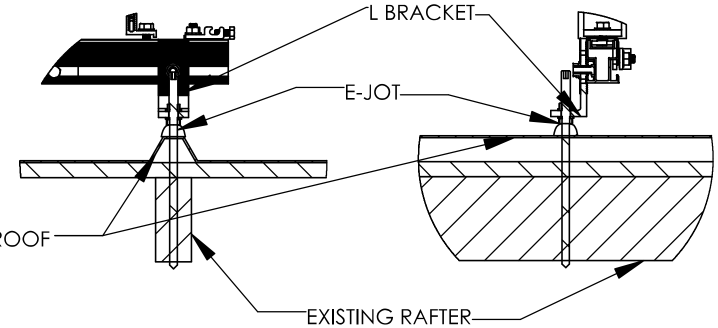
H.E.S. PV		UNLESS OTHERWISE SPECIFIED:		NAME	DATE	TITLE: RESIDENTIAL LAYOUT SAMPLE
84 MORROW RD. BARRIE, ON L4N 3V8 1-866-258-0110 WWW.HESPV.COM	PROJECT: -	DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± 1/16 ANGULAR: MACH± BEND ± TWO PLACE DECIMAL ± 0.06 THREE PLACE DECIMAL ± 0.03	DRAWN	DP	MM/DD/YY	
			CHECKED	-	-	DWG. NO. 103499
		INTERPRET GEOMETRIC TOLERANCING PER:	ENG APPR.			REV -
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF HOME ENERGY SOLUTIONS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF H.E.S. PV IS PROHIBITED.	USED ON ASS'Y: -	MATERIAL:	MFG APPR.			
	CLONE FROM: -	FINISH:	Q.A.			SCALE: NTS SHEET SIZE: **A** SHEET 3 OF 6

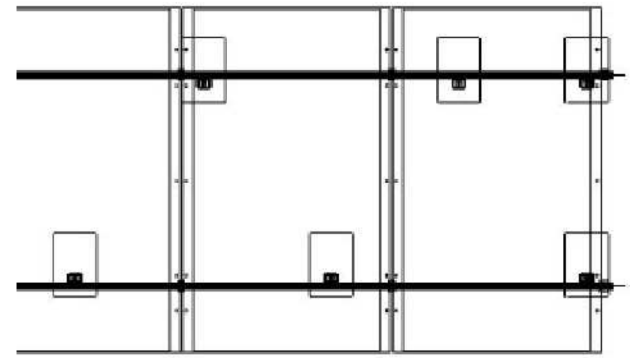
5 4 3 2 1

EJOT HANGER BOLT

NOTES:

-BONDING WASHER TO BE USED ON EVERY MID CLAMP
-MOUNTING FEET SPACING BASED ON 24" O/C TRUSSES
-MOUNTING FEET ALTERNATE RAILS TO DITRIBUTE LOAD
-MAXIMUM SPAN 64"

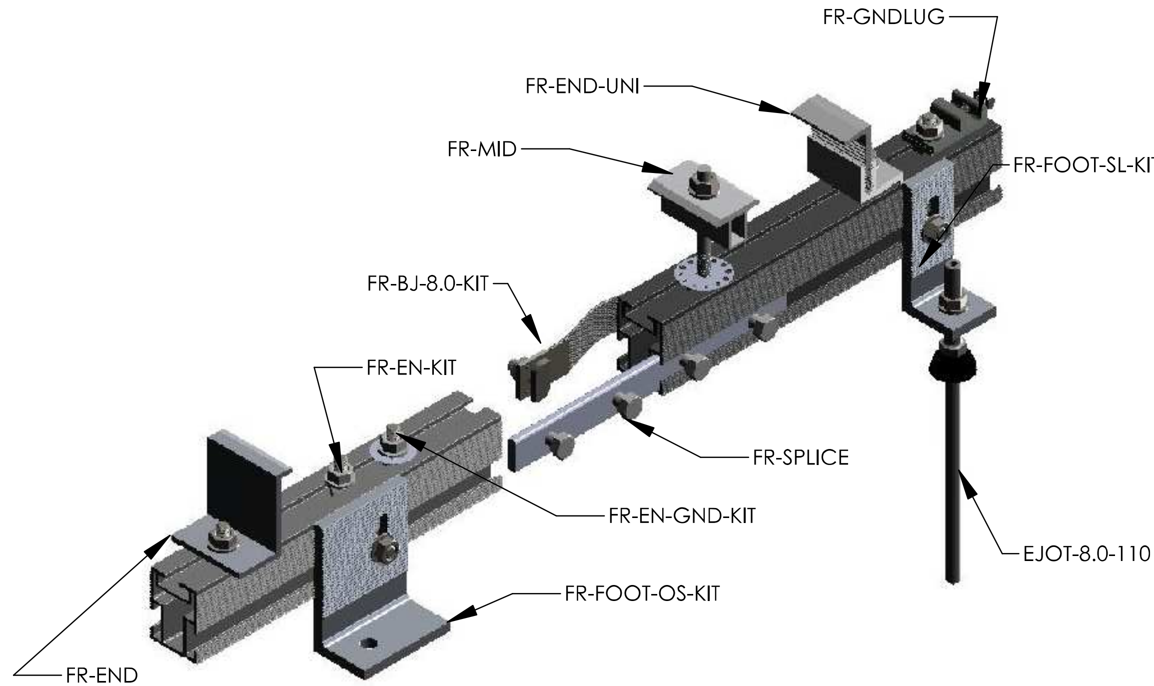




TYPICAL MOUNTING FOOT PLACEMENT PATTERN

EFFECTIVE SCREW IN DEPTH BASED ON INCHES OF THREAD PENETRATION INTO WOODEN SUBSTRUCTURE.

Effective Screw In Depth l_{ef} in inches	**M8 (lbf)**	M10 (lbf)
1.25	**396**	0
1.57	**495**	616
1.77	**555**	695
1.89	**591**	740
1.96	**616**	771
2.2	**690**	863
2.36	**740**	926
2.52	**789**	987
2.76	**863**	1079
2.83	**888**	1111
3.15	**987**	1234
3.35	**1050**	1311
3.46	**1086**	1358
3.54	**1111**	1387
3.78	**1185**	1481
3.93	**1234**	1542
4.04	**1284**	1603
4.33	**1358**	1697
4.4	**1383**	1726
4.72	**1481**	1850



H.E.S. PV

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PROJECT: -

USED ON ASS'Y: -

CLONE FROM: -

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/16
ANGULAR: MACH± BEND ±
TWO PLACE DECIMAL ± 0.06
THREE PLACE DECIMAL ± 0.03

INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL:

FINISH:

	NAME	DATE
DRAWN	DP	MM/DD/YY
CHECKED	-	-
ENG APPR.		
MFG APPR.		
Q.A.		

TITLE: RESIDENTIAL LAYOUT SAMPLE

DWG. NO. 103499

REV -

SCALE: NTS

SHEET SIZE: **A**

SHEET 4 OF 6

5 4 3 2 1