UniRac®

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Code-Compliant SolarMount™ Installation

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May 14, 2002

Mr. John Liebendorfer
UniRac, Inc.
2300 Buena Vista Dr., SE
Unit 134
Albuquerque, NM 87106

Subject: Engineering Certification for UniRac SolarMount™ Universal Roof Mounts

Dear Mr. Liebendorfer,

I have tested and analyzed the structural design of UniRac's SolarMount Universal PV Module Roof Mount System in the following manner.

(1) Laboratory test reports dated August 28, 2001, August 31, 2001, October 30, 2001, and January 28, 2002, and April 22, 2002.

(2) Structural design calculations based upon:
   (a) "Aluminum Design Manual: Specifications and Guidelines for Aluminum Structures", The Aluminum Association, Washington D.C., 2000.
   (b) "The Uniform Building Code: Structural Engineering Design Provisions", International Conference of Building Officials, Whittier, CA, 1994 and 1997.
   (c) "Manual of Steel Construction: Load Resistance Factor Design", 3rd Ed., American Institute of Steel Construction, Chicago, Il., 2001.

With this letter, I certify that UniRac SolarMount products will be structurally adequate and will satisfy the building codes listed above when they are installed in accordance with UniRac Technical Bulletin 103, "Code-Compliant SolarMount Installation", Publication 020508-1, May 2002.

If you have any questions or concerns regarding the UniRac SolarMount system, please contact me.

Sincerely,

Walter Gerstle, PhD, PE

WALTER H. GERSTLE
NEW MEXICO
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REGISTERED PROFESSIONAL

Procedures for Meeting Building Codes in Installations Using SolarMount Universal Roof Mounts

This bulletin is designed to support applications for building permits for installations using SolarMount™ Universal Roof Mounts, manufactured by UniRac, Inc.

Follow the six steps below to install SolarMount in compliance with the *Uniform Building Code™* (Whittier, Calif.: International Conference of Building Officials, 1997), hearafter *UBC*.

To meet code, follow this bulletin in conjuction with *SolarMount Installation Instructions,* Rev. 2 (UniRac Pub. No. 020507-1, May 2002), which is reproduced on pages 9–14.

Before proceeding, note the following:

- This bulletin addresses only wind loads on the assumption that wind produces the maximum load factor affecting an installation. Verify that other local factors, such as snow loads and earthquake effects, do not exceed the wind loads. Give precedence to any factor that does.
- The roof on which the SolarMount will be installed must be capable of withstanding the Design Dead Load and Live Load per footing listed in Tables 2 and 3 on pages 3–4.
- If the roof on which the SolarMount will be installed has a pitch of greater than 45 degrees, consult UniRac before proceeding.

1. Determine Basic Wind Speed at Your Installation Site

For the United States, see the *UBC* chart, "Minimum Basic Wind Speeds in Miles per Hour," reproduced below.

If your installation is outside the United States or if you need further assistance, consult a local professional engineer or your local building authority.

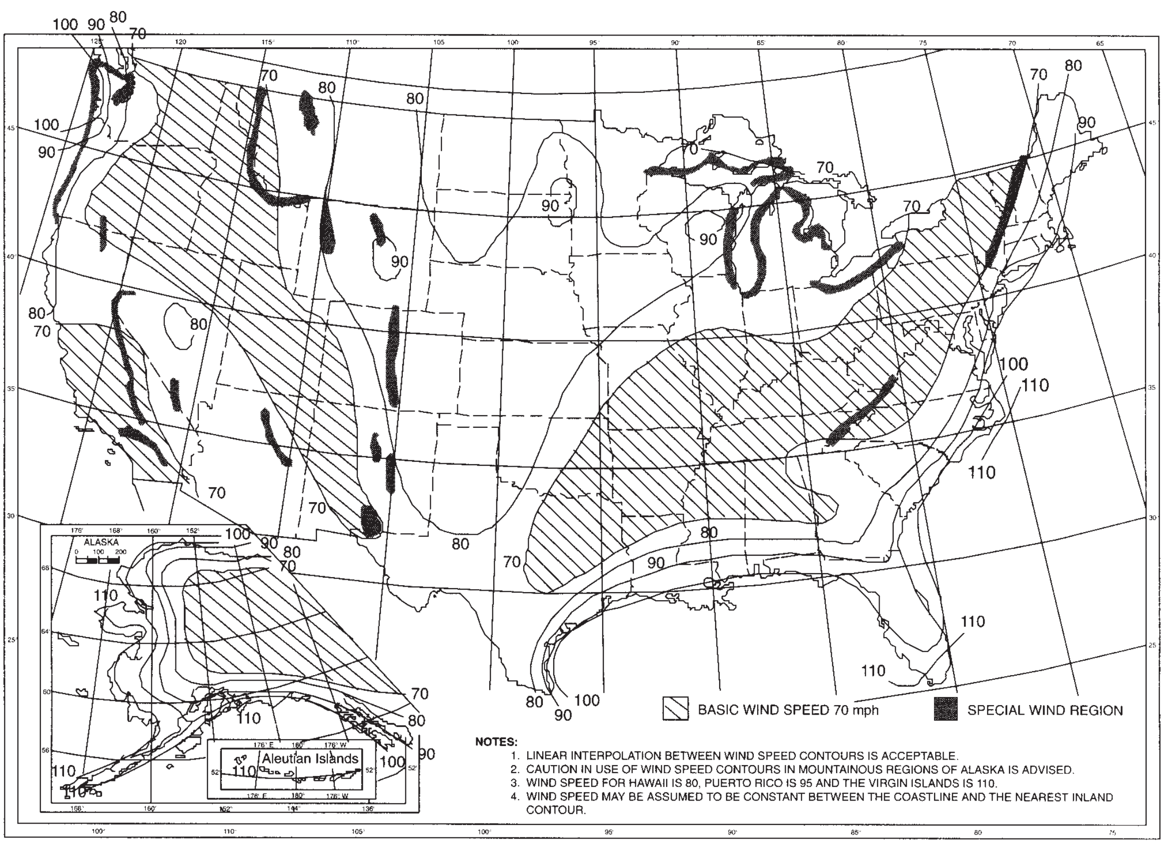

Figure 1. Minimum Basic Wind Speeds. Reproduced from *UBC,* Vol. 2, *Structural Engineering Design Provisions,* Chap. 16, Div. III, Wind Design, Fig. 16.1, "Minimum Basic Wind Speeds in Miles per Hour," p. 36.

2. Determine the Exposure Category of Your Installation Site

The *UBC** defines wind exposure categories as follows:

EXPOSURE B has terrain with buildings, forests or surface irregularities, covering at least 20 percent of the ground level area extending 1 mile (1.61 km) or more from the site.

EXPOSURE C has terrain that is flat and generally open extending ½ mile (0.81 km) or more from the site in any quadrant [or having scattered obstructions extending one-half mile or more from the site in any full quadrant. This category includes flat or gently rolling open country and grasslands. Sites normally considered as Exposure B, but which are subject to topographic amplification or channelization, such as ridgetops or draws, shall be considered as Exposure C].†

EXPOSURE D represents the most severe exposure in areas with basic wind speeds of 80 miles per hour (mph) (129 km/h) or greater and has terrain that is flat and unobstructed facing large bodies of water over 1 mile (1.61 km) in width relative to any quadrant of the building site. Exposure D extends inland from the shoreline ¼ mile (0.40 km) or 10 times the building height, whichever is greater.

3. Determine the Design Wind Pressure Required for Your Installation

Design Wind Pressure is the amount of wind pressure that a structure is designed to withstand, expressed here in pounds per square foot (psf). To determine the Design Wind Pressure required for your installation, apply the following factors using Table 1:

- your Basic Wind Speed (determined in step 1),
- your exposure category (determined in step 2), and
- the height of your roof above the ground.

If your values fall significantly outside the range of the table, or if your Design Wind Pressure requirement exceeds 50 psf, consult UniRac, a professional engineer, or your local building authority.

*UBC, *Vol. 2,* Structural Engineering Design Provisions, *Chapter 16, Div. III, Wind Design, p. 7.*

†*The bracketed material is not included in the* UBC *and applies only to California. See* 1998 California Building Code *(Sacramento: California Building Standards Commission, 1998), vol. 2, p. 38.8.*

4a. Determine Minimum Design Dead and Live Loads for Standard Rafter Spacing . . .

Foot spacing refers to the space between L-feet (or stand-offs, if used) along the same SolarMount rail (see Fig. 2, page 5). If you are spacing feet to match a standard rafter spacing, consult Table 2 to determine your Minimum Design Live and Dead Loads per footing. (If you want to maximize foot spacing to minimize roof penetrations, skip to step 4b on page 5.)

Locate the make and model of the PV module that you plan to install and the rafter spacing at your installation site. Read the Minimum Design Dead Load and read or extrapolate the Maximum Foot Spacing allowable for the Design Wind Pressure you determined in step 3.

To meet code, you must be verify that the rafters at your installation site can withstand the Design Dead and Live Loads. For assistance on this point, consult a local professional engineer.

Go on to step 5 on page 5.

Table 1. Design Wind Pressure (psf) by Wind Speed and Exposure Category

	Basic Wind Speed (mph)						
	70	*80*	*90*	*100*	*110*	*120*	*130*
Category B							
15' roof height	10	13	17	21	25	30	35
20' roof height	11	14	18	22	27	32	38
25' roof height	12	15	19	24	29	35	41
30' roof height	12	16	21	25	31	36	43
Category C							
15' roof height	17	23	29	35	43	51	60
20' roof height	19	24	31	38	46	54	64
25' roof height	19	25	32	40	48	57	67
30' roof height	20	26	33	41	50	59	69
Category D							
15' roof height	23	30	38	46	56	67	78
20' roof height	24	31	39	48	58	70	82
25' roof height	25	32	41	50	60	72	84
30' roof height	25	33	42	51	62	74	87

Source: *These Design Wind Pressure (P) values are based on the formula* $P = C_e * C_q * q_s * I_w$ (UBC, *Vol. 2,* Structural Engineering Design Provisions, *Chapter 16, Div. III, Wind Design, p. 7). Assumptions:* $I_w = 1$ *and* $C_q = 1.3$.

Table 2. SolarMount™ Loads (lbs) per Footing at Standard Rafter Spacings

	Minimum Design Dead Load	*Minimum Design Live Load as a Function of Design Wind Pressure*		
		30 psf	*40 psf*	*50 psf*
ASE 300				
48" rafter (foot) spacing	58	373	497	621
64" rafter (foot) spacing	77	497	662	828
72" rafter (foot) spacing	87	559	745	NA
AstroPower AP65/75				
48" rafter (foot) spacing	33	236	315	393
64" rafter (foot) spacing	43	315	420	524
72" rafter (foot) spacing	49	354	472	590
AstroPower AP110/120				
48" rafter (foot) spacing	33	291	387	484
64" rafter (foot) spacing	44	387	516	646
72" rafter (foot) spacing	50	436	581	726
AstroPower AP150				
48" rafter (foot) spacing	37	369	491	614
64" rafter (foot) spacing	49	491	655	819
72" rafter (foot) spacing	55	553	737	NA
BP Solar 275, 380, 585, SX75TU				
48" rafter (foot) spacing	31	237	316	395
64" rafter (foot) spacing	41	316	421	527
72" rafter (foot) spacing	46	356	474	593
BP Solar SX75/80/85 (old)				
48" rafter (foot) spacing	38	287	382	478
64" rafter (foot) spacing	50	382	509	637
72" rafter (foot) spacing	56	430	573	716
BP Solar 110/120				
48" rafter (foot) spacing	32	287	382	478
64" rafter (foot) spacing	43	382	509	637
72" rafter (foot) spacing	48	430	573	716
BP Solar 850, MST43 (old)				
48" rafter (foot) spacing	40	242	333	403
64" rafter (foot) spacing	54	333	430	538
72" rafter (foot) spacing	60	363	484	605
BP Solar MSX120				
48" rafter (foot) spacing	24	219	292	365
64" rafter (foot) spacing	32	292	390	487
72" rafter (foot) spacing	36	329	439	548
BP Solar 3160, 4160, 5170, SX150				
48" rafter (foot) spacing	33	313	417	521
64" rafter (foot) spacing	44	417	556	694
72" rafter (foot) spacing	50	469	625	NA
Evergreen EC102				
48" rafter (foot) spacing	35	312	416	520
64" rafter (foot) spacing	46	416	555	693
72" rafter (foot) spacing	52	468	624	NA
Kyocera KC80				
48" rafter (foot) spacing	29	192	256	320
64" rafter (foot) spacing	39	256	341	427
72" rafter (foot) spacing	44	288	384	480
Kyocera KC120				
48" rafter (foot) spacing	34	281	374	468
64" rafter (foot) spacing	45	374	499	623
72" rafter (foot) spacing	51	421	561	701
Mitsubishi 120				
48" rafter (foot) spacing	29	247	329	411
64" rafter (foot) spacing	38	329	438	548
72" rafter (foot) spacing	43	370	493	616
Photowatt PW750				
48" rafter (foot) spacing	30	244	325	406
64" rafter (foot) spacing	40	325	433	541
72" rafter (foot) spacing	45	365	487	609
Photowatt PW1000				
48" rafter (foot) spacing	30	263	351	438
64" rafter (foot) spacing	40	351	468	584
72" rafter (foot) spacing	45	395	526	658
Sharp (Schott) 165				
48" rafter (foot) spacing	35	310	413	517
64" rafter (foot) spacing	47	413	551	689
72" rafter (foot) spacing	53	465	620	NA
Siemens SM100/110				
48" rafter (foot) spacing	32	259	345	432
64" rafter (foot) spacing	43	345	460	576
72" rafter (foot) spacing	49	389	518	648
Siemens SP65/70/75				
48" rafter (foot) spacing	31	237	315	394
64" rafter (foot) spacing	41	315	420	526
72" rafter (foot) spacing	46	355	473	591
Siemens SP130/140/150				
48" rafter (foot) spacing	32	319	425	531
64" rafter (foot) spacing	43	425	567	708
72" rafter (foot) spacing	48	478	638	NA
Siemens SR90/100				
48" rafter (foot) spacing	35	295	393	492
64" rafter (foot) spacing	47	393	524	656
72" rafter (foot) spacing	52	443	590	738
SunWize SW85/90/95				
48" rafter (foot) spacing	35	285	380	474
64" rafter (foot) spacing	46	380	506	633
72" rafter (foot) spacing	52	427	569	712
SunWize WS115/120				
48" rafter (foot) spacing	34	285	380	474
64" rafter (foot) spacing	45	380	506	633
72" rafter (foot) spacing	51	427	569	712
UniSolar				
48" rafter (foot) spacing	25	269	359	448
64" rafter (foot) spacing	33	359	478	598
72" rafter (foot) spacing	37	403	538	672

**To meet code, your Design Loads must be at or above those indicated. You, the installer, are solely responsible for verifying that the roof can withstand these design loads. For specifications based on Design Wind Pressure values greater than 50 pounts per square foot, contact UniRac, Inc.*

Table 3. SolarMount™ Loads per Footing at Maximum Foot Spacing

	*Design Wind Pressure**		
	30 psf	*40 psf*	*50 psf*
ASE 300			
Maximum Foot Spacing (inches)	83	72	64
Minimum Foot Design Live Load (lbs)	643	742	830
Minimum Foot Design Dead Load (lbs)	100	87	76
AstroPower AP65/75			
Maximum Foot Spacing (inches)	104	90	81
Minimum Foot Design Live Load (lbs)	512	591	660
Minimum Foot Design Dead Load (lbs)	71	61	55
AstroPower AP110/120			
Maximum Foot Spacing (inches)	94	81	73
Minimum Foot Design Live Load (lbs)	568	655	733
Minimum Foot Design Dead Load (lbs)	65	56	50
AstroPower AP 150			
Maximum Foot Spacing (inches)	83	72	65
Minimum Foot Design Live Load (lbs)	639	738	825
Minimum Foot Design Dead Load (lbs)	63	55	49
BP Solar 275, 380, 585, SX75TU			
Maximum Foot Spacing (inches)	104	90	80
Minimum Foot Design Live Load (lbs)	513	592	662
Minimum Foot Design Dead Load (lbs)	66	58	52
BP Solar SX75/80/85 (old)			
Maximum Foot Spacing (inches)	94	82	73
Minimum Foot Design Live Load (lbs)	564	651	728
Minimum Foot Design Dead Load (lbs)	74	64	57
BP Solar SX 110/120			
Maximum Foot Spacing (inches)	94	82	73
Minimum Foot Design Live Load (lbs)	564	651	728
Minimum Foot Design Dead Load (lbs)	63	54	49
BP Solar 850, MST43 (old)			
Maximum Foot Spacing (inches)	103	89	80
Minimum Foot Design Live Load (lbs)	518	598	669
Minimum Foot Design Dead Load (lbs)	86	75	67
BP Solar MSX120			
Maximum Foot Spacing (inches)	108	94	84
Minimum Foot Design Live Load (lbs)	493	569	637
Minimum Foot Design Dead Load (lbs)	53	46	41
BP Solar 3160, 4160, 5170, SX150			
Maximum Foot Spacing (inches)	90	78	70
Minimum Foot Design Live Load (lbs)	589	680	760
Minimum Foot Design Dead Load (lbs)	63	54	49
Evergreen EC102			
Maximum Foot Spacing (inches)	91	78	70
Minimum Foot Design Live Load (lbs)	588	679	759
Minimum Foot Design Dead Load (lbs)	65	56	51
Kyocera KC80			
Maximum Foot Spacing (inches)	115	100	89
Minimum Foot Design Live Load (lbs)	461	533	596
Minimum Foot Design Dead Load (lbs)	70	61	54

	*Design Wind Pressure**		
	30 psf	*40 psf*	*50 psf*
Kyocera KC120			
Maximum Foot Spacing (inches)	95	83	74
Minimum Foot Design Live Load (lbs)	558	644	720
Minimum Foot Design Dead Load (lbs)	67	58	52
Mitsubishi 120			
Maximum Foot Spacing (inches)	102	88	79
Minimum Foot Design Live Load (lbs)	523	604	675
Minimum Foot Design Dead Load (lbs)	61	52	47
Photowatt PW750			
Maximum Foot Spacing (inches)	102	89	79
Minimum Foot Design Live Load (lbs)	520	600	671
Minimum Foot Design Dead Load (lbs)	64	55	49
Photowatt PW1000			
Maximum Foot Spacing (inches)	99	85	76
Minimum Foot Design Live Load (lbs)	540	624	697
Minimum Foot Design Dead Load (lbs)	62	54	48
Sharp (Schott) 165			
Maximum Foot Spacing (inches)	91	79	70
Minimum Foot Design Live Load (lbs)	586	677	757
Minimum Foot Design Dead Load (lbs)	66	57	51
Siemens SM100/110			
Maximum Foot Spacing (inches)	99	86	77
Minimum Foot Design Live Load (lbs)	536	619	692
Minimum Foot Design Dead Load (lbs)	67	58	52
Siemens SP65/70/75			
Maximum Foot Spacing (inches)	104	90	81
Minimum Foot Design Live Load (lbs)	512	591	661
Minimum Foot Design Dead Load (lbs)	67	58	52
Siemens SP130/140/150			
Maximum Foot Spacing (inches)	90	78	69
Minimum Foot Design Live Load (lbs)	595	687	768
Minimum Foot Design Dead Load (lbs)	60	52	46
Siemens SR90/100			
Maximum Foot Spacing (inches)	93	81	72
Minimum Foot Design Live Load (lbs)	572	660	738
Minimum Foot Design Dead Load (lbs)	68	59	52
SunWize SW85/90/95			
Maximum Foot Spacing (inches)	95	82	73
Minimum Foot Design Live Load (lbs)	562	649	725
Minimum Foot Design Dead Load (lbs)	69	59	53
SunWize SW115/120			
Maximum Foot Spacing (inches)	95	82	73
Minimum Foot Design Live Load (lbs)	562	649	725
Minimum Foot Design Dead Load (lbs)	67	58	52
UniSolar 64			
Maximum Foot Spacing (inches)	98	84	76
Minimum Foot Design Live Load (lbs)	546	631	705
Minimum Foot Design Dead Load (lbs)	50	44	39

**To meet code, your Design Loads must be at or above those indicated. You, the installer, are solely responsible for verifying that the roof can withstand these design loads. For specifications based on Design Wind Pressure values greater than 50 pounts per square foot, contact UniRac, Inc.*

4b. Or Verify Maximum SolarMount Foot Spacing and Determine Minimum Design Dead and Live Loads

To minimize roof penetrations, consult Table 3 to determine Maximum Foot Spacing allowable for the Design Wind Pressure that you determined in step 3.

Find the make and model of the PV module you plan to install, then read or extrapolate Foot Design Live Loads and Dead Loads at the maximum spacing.

To meet the code, SolarMount foot spacing must be at or below the dimension listed. You must be verify that the rafters at your installation site can withstand the Design Live and Dead Loads. For assistance on this point, consult a local professional engineer.

5. Verify Acceptable Rail End Overhang

Rail End Overhang (Fig. 2) must equal 50 percent or less of foot spacing. Thus, if foot spacing is 72 inches, the Rail End Overhang can be up to 36 inches. In this case, two feet can support a rail of as much as 144 inches (72 inches between the feet and 36 inches of overhang at each end).

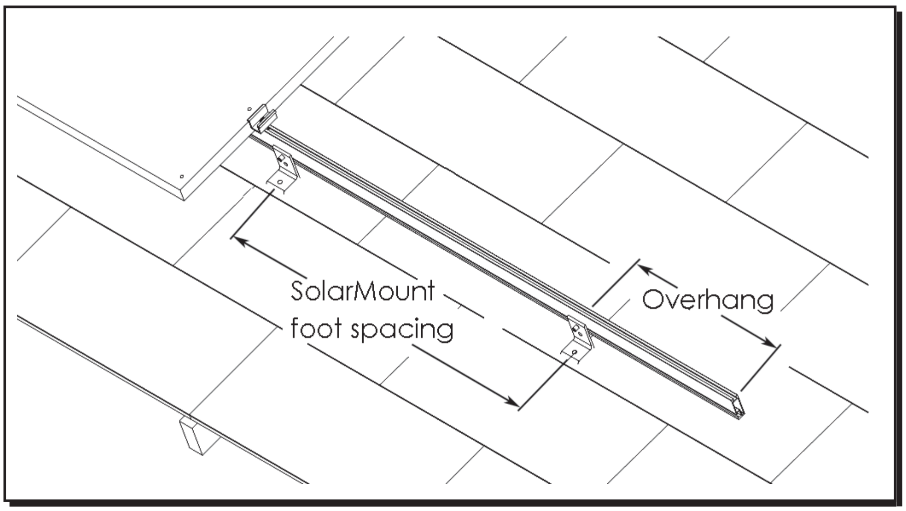

Figure 2. SolarMount foot spacing refers to the distance between feet on the same rail. Overhang, the distance from end of the rail to the first foot, must be no more than half the foot spacing.

6. Ensure That Live Loads Do Not Exceed Pull-Out Limits

Based on the characteristics of your roof truss lumber and the lag screws, consult Table 4 to determine the Lag Pull-Out Value for your installation. Compare that value to the Minimum Design Live Load determined in step 4a or 4b. To ensure code compliance, the Lag Pull-Out Value must be the greater than the Foot Design Live Load multiplied by a safety factor appropriate to your installation.

Table 4. Lag Pull-Out Values (lbs) in Typical Roof Truss Lumber

		Lag Screw Specifications		
	Specific Gravity	*5/16" Shaft, 2-1/2" Thread Depth**	*5/16" Shaft, per 1" Thread Depth*	*3/8" Shaft, per 1" Thread Depth*
Douglas Fir — Larch	0.50	665	266	304
Douglas Fir — South	0.46	588	235	269
Engelmann Spruce, Lodgepole Pine (MSR 1650 f & higher)	0.46	588	235	269
Hem — Fir	0.43	530	212	243
Hem — Fir (North)	0.46	588	235	269
Southern Pine	0.55	768	307	352
Spruce, Pine, Fir	0.42	513	205	235
Spruce, Pine, Fir (E of 2 million psi and higher grades of MSR and MEL)	0.50	665	266	304

Sources: UBC, *American Wood Council.*

**5/16" x 3-1/2" lag screws with 2-1/2" thread depth are provided with all SolarMount racks. Installers must verify that lag pull-out values exceed Mnimum Design Live Load per footing multiplied by an appropriate safety factor for each installation.*

Frequently Asked Questions About SolarMount™ Universal Roof Mounts

How high above the roof does the SolarMount raise the PV module?

Three factors affect the module's height above the roof:

- SolarMount rails use either L-feet (standard) or 3-inch or 6-inch standoffs (optional).
- SolarMount rail may be fastened either to the lower or upper mounting hole of any of these footings.
- L-feet are mounted above the roofing material. However, standoffs can be mounted either above or under the roofing material.

Figure 3 provides dimensions for all these cases.

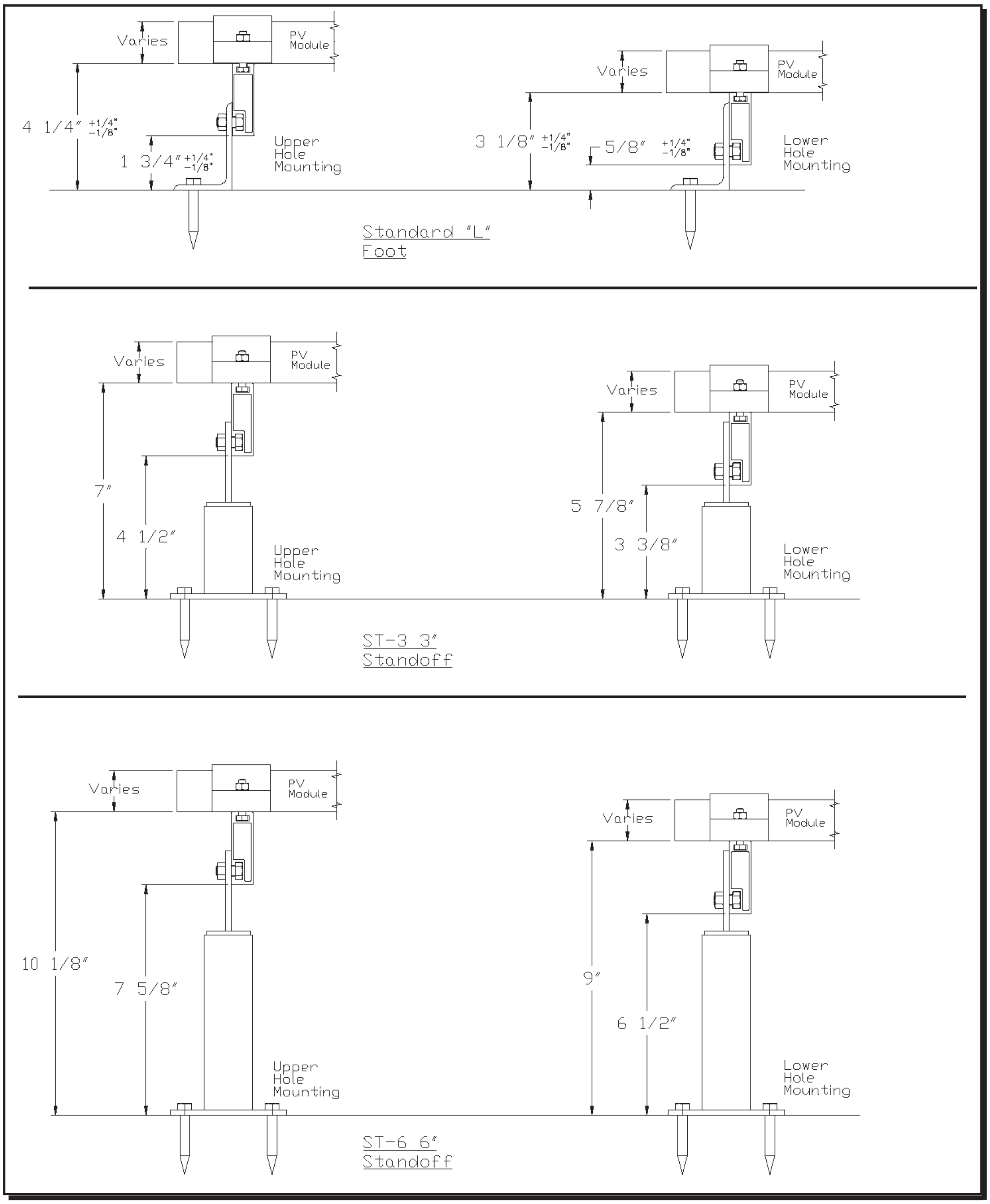

Figure 3. SolarMount Rail Heights

What methods are used to seal the roof penetration required for SolarMount installations?

There are almost as many sealing techniques as there are roofs. So we can't possibly be as thorough as we might like in describing alternatives. Nevertheless, the most common installation method for L-feet (standard) is described in *SolarMount Installation Instructions*, reproduced here (see p. 10).

Many types and brands of flashings can be used with SolarMount standoffs. However, we designed them for use with *Oatey® "No-Calk" flashings*. A wide variety of flashings are described at www.oatey.com.

How do I attach SolarMounts to a standing-seam metal roof?

Some installers simply cut a hole in the roof for each footing and flash the penetration using various techniques. However, there is a better way.

Metal Roof Innovations, Ltd., manufactures the S-5!™ clamp, designed to attach a wide variety of products to most standing-seam metal roofs. It is an elegant solution to the problem of mounting on metal roofs without any penetrations . . . and therefore, eliminating flashings altogether.

Our standard SolarMount L-feet will mount to the top of the S-5! clamps with the 3/8-inch stainless steel bolt provided with the S-5! See www.s-5solutions.com for different clamp models and details regarding installation.

When using S-5! clamps, make sure that there are enough clamp/L-feet attachments to the metal roof to meet the Metal Roof Manufacturers specifications regarding wind loads, etc. To be safe, attach clamps to the SolarMount rail at least every 3 feet.

If you require additional SolarMount L-feet, you can order them from your UniRac distributor as kits with your SolarMounts. Each kit (Item No. SM/FEET) contains two SolarMount L-feet and the stainless steel hardware to attach them to the SolarMount rail, but no lag bolts. Check the SolarMount *Ordering Information, Sizing Chart, and Price List* (for the number of L-feet that are packed with each SolarMount so that you do not over order the kits.

Installation Instructions

SolarMount™

Universal PV Module Roof Mounting System (Revision 2, May 2002)

Please read and understand these instructions completely before installing your SolarMount.

Installer is solely responsible for:

- complying with all applicable building codes,
- ensuring that the roof and its rafters can support the PV array,
- maintaining the waterproof integrity of the roof, and
- installing all electrical aspects of the PV array.

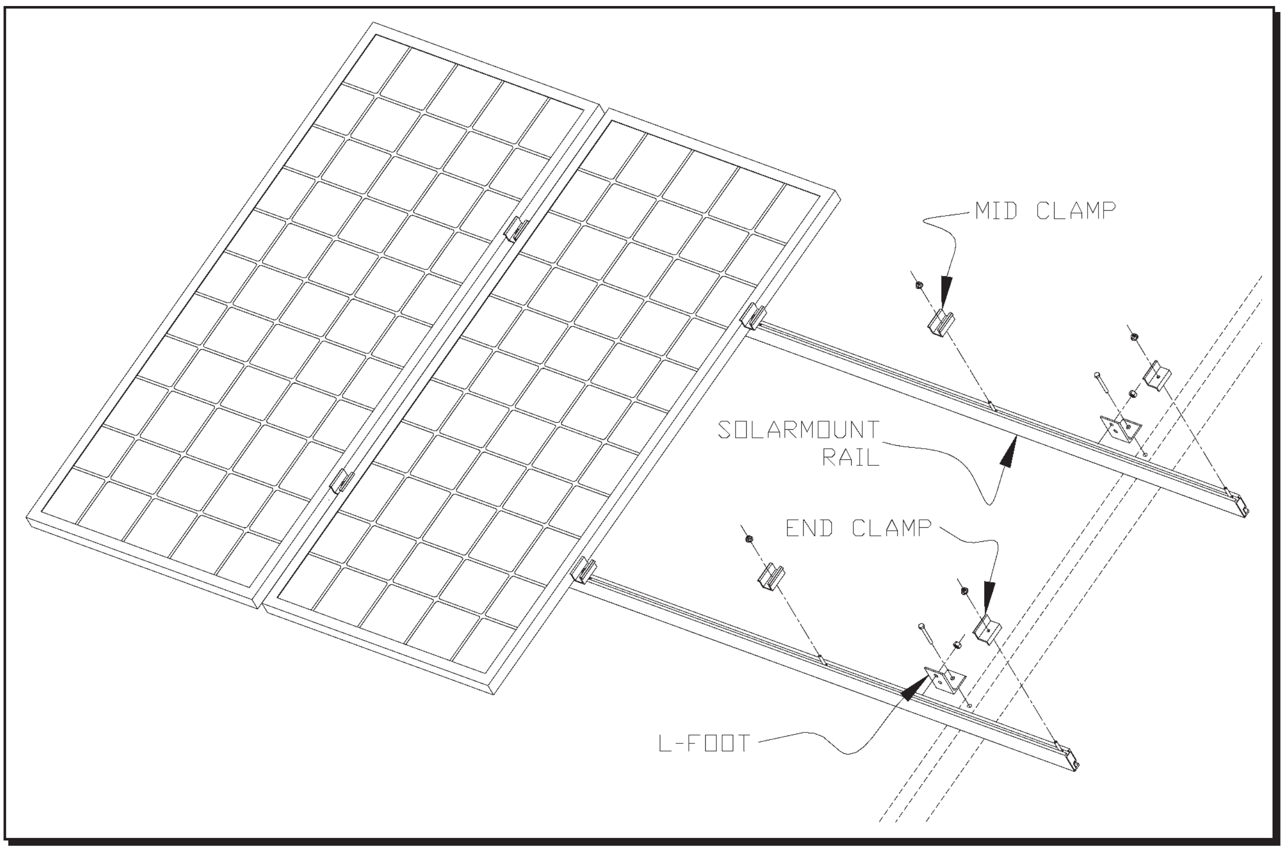

Figure 1. Exploded view of landscape mode installation with L-feet.

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Caution: Stainless steel nuts and bolts can seize up, a process called galling. To significantly reduce the likelihood of galling, a packet of SAF-T-EZE anti-seize lubricant has been included with your rack for use on stainless steel hardware.

Parts List

In addition to the parts listed in the table below, each SolarMount is shipped with:

- two (2) SolarMount rails (model no. equals length in inches)
- two (2) 1/4" safety bolts and nuts
- four (4) end clamps.*

		Number of mid-clamps (by module group‡)						*Sets of ¼" module bolts* and flange nuts (by module group‡)*					
SolarMount model No.	*Foot sets†*	*A*	*B*	*C*	*D*	*E*	*F*	*A*	*B*	*C*	*D*	*E*	*F*
SM-48	4	2	-	2	2	2	2	6	-	6	6	6	6
SM-60	4	2	-	2	-	2	-	6	-	6	-	6	-
SM-72	4	4	2	4	4	4	4	8	6	8	8	8	8
SM-84	4	-	-	4	-	4	-	-	-	8	-	8	-
SM-96	4	6	4	6	6	4	6	10	8	10	10	8	10
SM-108	4	-	-	6	4	4	4	-	-	10	8	8	8
SM-120	6	8	-	8	8	8	8	12	-	12	12	12	12
SM-132	6	-	6	8	-	10	-	-	10	12	-	14	-
SM-144	6	10	-	10	10	8	10	14	-	14	14	12	14
SM-156	6	-	8	12	-	12	-	-	12	16	-	16	-
SM-168	6	12	-	10	12	14	12	16	-	14	16	18	16
SM-180	6	-	-	14	14	8	14	-	-	18	18	12	18
SM-192	8	14	10	12	-	16	-	18	14	16	-	20	-

**SolarMount end clamps and module bolts vary in size depending on the modules to be installed. Module bolt lengths are: module group A, 1" long; groups B–D, 1-1/2"; groups E–F, 2". Check the label of the SolarMount carton to ensure that the SolarMount matches the modules you are installing.*

†Each foot set consists of an L-foot, a 3/8" bolt, a 3/8" flange nut, and a 5/16" x 3-1/2" lag screw.

‡The carton label lists the module group that corresponds to the modules you are installing.

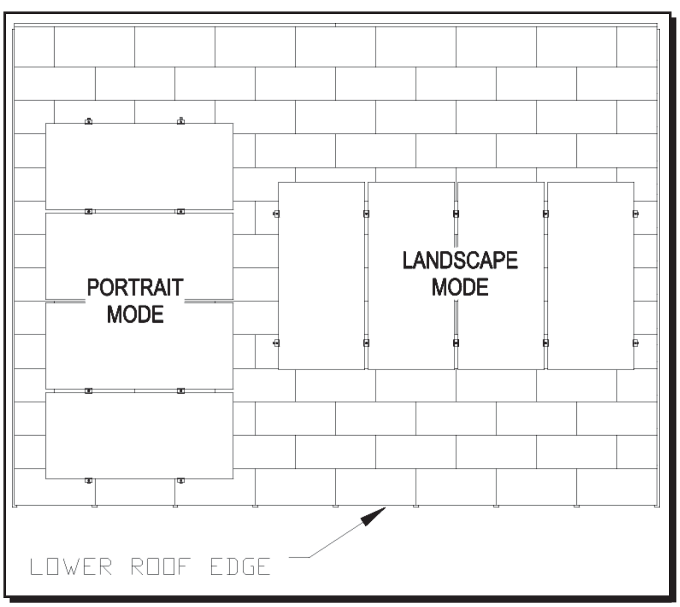

Figure 2

Laying Out the Installation Area

The installation can be laid out in either landscape or portrait mode (Fig. 2). Note that SolarMount rails make excellent straghtedges for doing layouts.

Center the installation area over the rafters as much as possible.

Leave enough room to safely move around the array during installation.

The *width* of the installation area is equal to the *length* of one module.

The *length* of the installation area is equal to:

- the total *width* of the modules,
- *plus* 1 inch for each space between modules (for mid-clamp),
- *plus* 3 inches (1½ inches for each set of end clamps).

Laying Out and Installing L-Feet

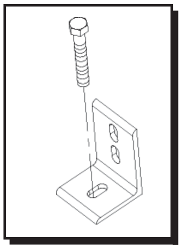

Figure 3

L-feet (Fig. 3) are used for installation through existing low profile roofing material, such as asphalt shingles or sheet metal.

Use Figure 4 or Figure 5 below to locate and mark the L-feet lag bolt holes within the installation area.

Consult UniRac's Technical Bulletin 103, *Code-Compliant SolarMount Installation,* to determine foot spacing that will meet the Uniform Building Code. It can be downloaded at www.unirac.com.

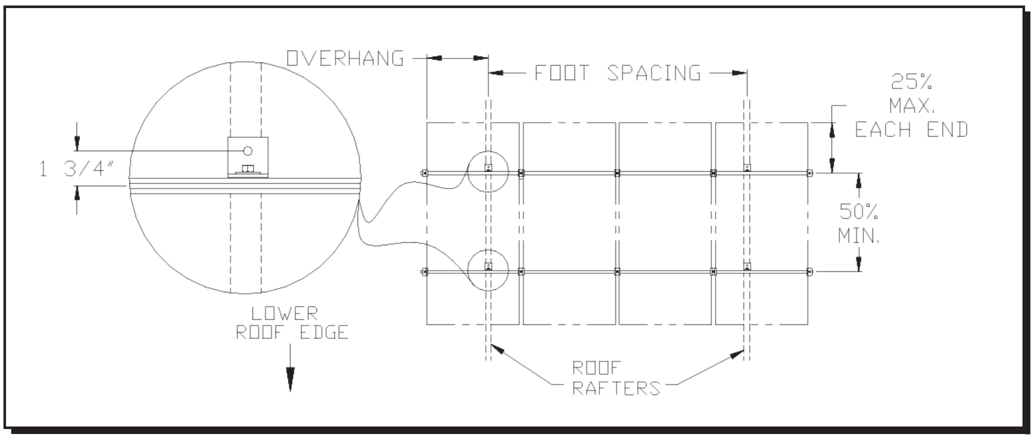

Figure 4. Landscape Layout

When determining the distance between the rails in portrait mode, keep in mind that the center of each rail will be offset from the L-foot lag bolt holes by 1¾ inches.

If multiple portrait mode rows are to be installed adjacent to one another, it will not be possible for each row to be centered above the rafters. Adjust as needed, following the guidelines in Figure 5 as closely as possible.

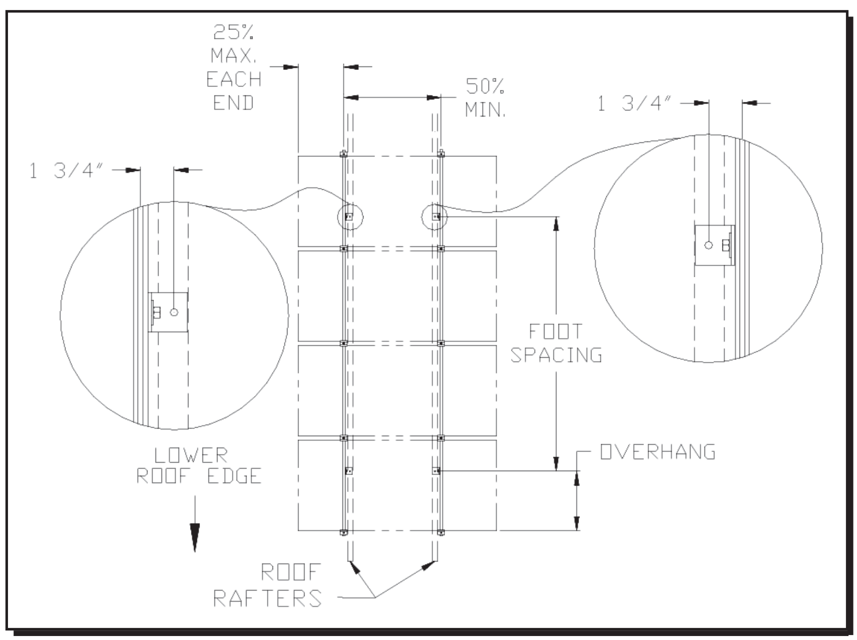

Figure 5. Portrait Layout

Drill 3/16-inch pilot holes through the roof into the center of the rafter at each L-foot lag bolt hole location.

Consult Technical Bulletin 103 for guidelines to determine if the lag bolts provided will be adequate to meet building code wind load requirements for your installation.

Squirt sealant into the hole, and on the shafts of the lag bolts. Seal the underside of the L-feet with a suitable weatherproof sealant.

Securely fasten the L-feet to the roof with the lag bolts. Ensure that the L-feet face as shown in Figure 4 or Figure 5, as appropriate.

Laying Out and Installing Standoffs

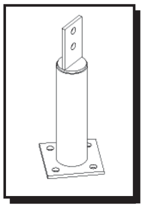

Figure 6

Standoffs (Fig. 6) are used for all flashed installations, such as tile and shake shingles.

Use Figure 7 or Figure 8 to locate and mark the standoff lag bolt holes within the installation area.

Consult UniRac's Technical Bulletin 103, *Code-Compliant SolarMount Installation,* to determine foot spacing that will meet the Uniform Building Code. It can be downloaded at www.unirac.com.

Remove the tile or shake underneath each standoff location, exposing the roofing underlayment. Ensure that the standoff base lies flat on the underlayment, but remove no more material than required for the flashings to be installed properly.

Use the standoff base as a template to mark lag bolt hole locations on underlayment above the center of the rafters (Fig. 7 or Fig. 8).

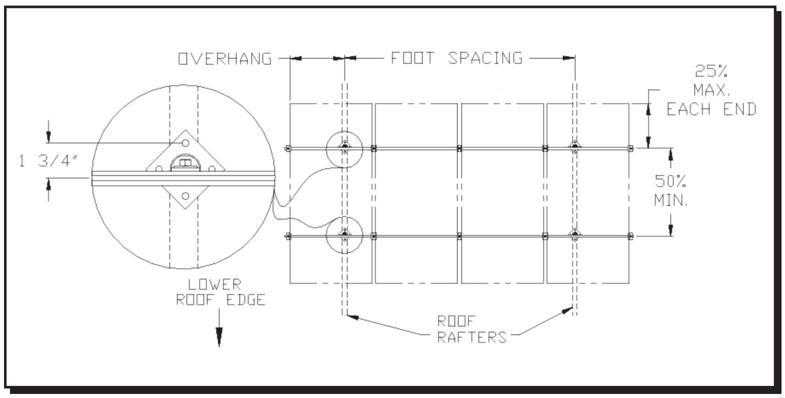

Figure 7. Landscape Layout

When determining the distance between the rails in portrait mode, keep in mind that the center of each rail will be offset from the standoff lag bolt holes by 7/16 inches.

If multiple portrait mode rows are to be installed adjacent to each other, it will not be possible for each row to be centered above the rafters. Adjust as needed following the guidelines in Figure 8 as closely as possible.

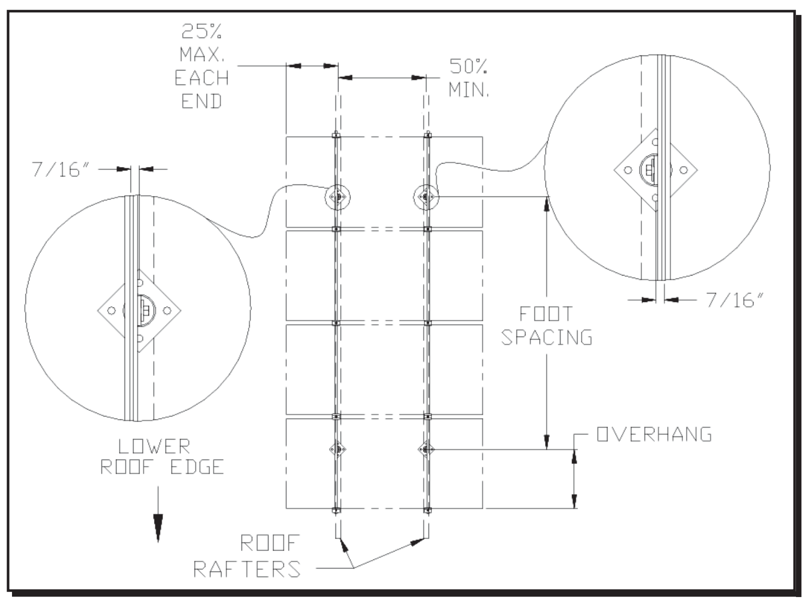

Figure 8. Portrait Layout

Drill 3/16-inch pilot holes through the underlayment into the center of the rafters at each standoff location. Securely fasten standoffs to the rafters with the lag bolts. Ensure that the standoffs face as shown in Figure 4 or Figure 5, as appropriate.

SolarMount standoffs are designed for easiest installation with Oatey® 1¼"–1½" No-Calk® flashings. They can be obtained at most plumbing and roofing supply companies.

Install and seal flashings and standoffs using standard building practices.

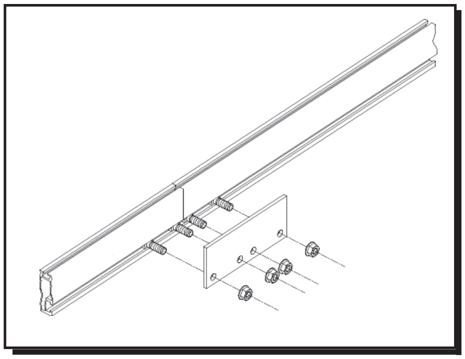

Figure 9

Installing the SolarMount Rails

Keep rail slots free of roofing grit or other debris. *Foreign matter will cause bolts to bind as they slide in the slots*.

Installing Splices. If your installation uses SolarMount splices, attach the rails together (Fig. 9) before mounting the rails to the footings.

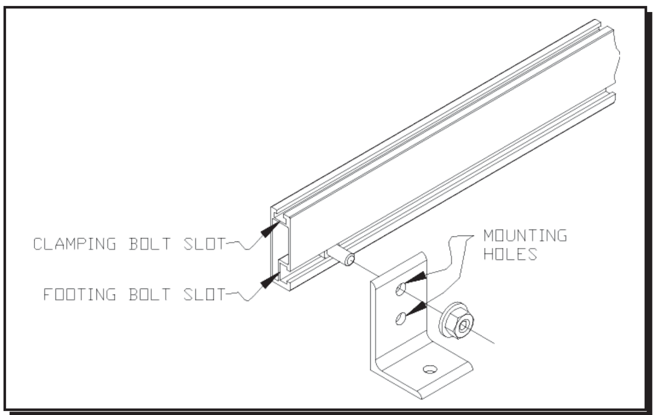

Figure 10

Mounting Rails on Footings. Rails may be attached to either of two mounting holes in the footings (Fig. 10). Mount in the lower hole for a low profile, more aesthetically pleasing installation. Mount in the upper hole for a higher profile, which will maximize airflow under the modules. This will cool them more and may enhance performance in hotter climates.

Slide the 3/8-inch mounting bolts into the footing bolt slots. Loosely attach the rails to the footings with the flange nuts.

Ensure that the rails are oriented to the footings as shown in Figure 4, 5, 7, or 8, whichever is appropriate.

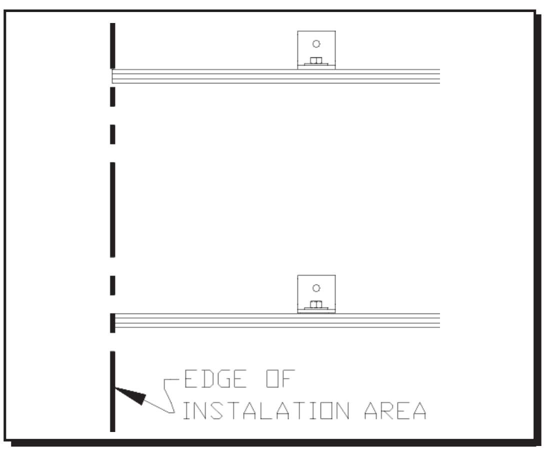

Figure 11. Landscape Mode

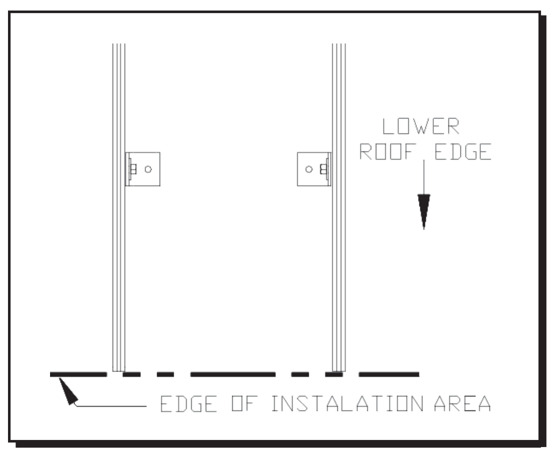

Figure 12. Portrait Mode

Aligning the Rail Ends. Align one pair of rail ends to the edge of the installation area (Fig. 11 or Fig. 12).

The opposite pair of rail ends will overhang the side of the installation area. Do not trim them off until the installation is complete.

In landscape mode (Fig. 11), either end of the rails can be aligned, but the first module must be installed at the aligned end.

For the safest portrait-mode installation (Fig. 12), the aligned end of the rails must face the lower edge of the roof.

Securely tighten the flange nuts on the mounting bolts after alignment is complete (28–32 ft lbs).

Installing the Modules

Prewiring Modules. If modules are the Plug and Play type, no prewiring is required, and you can proceed directly to “Installing the First Module” below.

If modules have standard J-boxes, each module should be prewired with one end of the inter-module cable for ease of installation. For safety reasons, module prewiring should not be performed on the roof.

Leave covers off J-boxes. They will be installed when the modules are installed on the rails.

Installing the First Module. *In portrait-mode installations, the safety bolt and flange nut must be fastened to the aligned (lower) end of each rail. This will prevent the lower end clamps and clamping bolts from sliding out of the rail slot during installation.*

Slide half of the ¼-inch clamping bolts onto each rail, spacing them evenly along the rails.

Drop end clamps over the clamping bolts at the aligned end of each rail. Loosely attach them with flange nuts. Allow half an inch between the rail ends and the end clamps (Fig.13). If there is a return cable to the inverter, connect it to the first module. Close the J-box cover.

Slide the first module under the end clamps. Center and align as needed. Securely tighten the flange nuts onto the end clamps (10–12 ft lbs).

Installing the Other Modules. Slide the next clamping bolt on each rail up to the first module. Drop mid-clamps over these clamping bolts and loosely attach them with flange nuts.

Lay the second module face down (glass to glass) on the first module. Connect intermodule cable to the second module and close the J-box cover.

Turn the second module face up (Fig. 14). Slide it under the mid-clamps. Align it and securely tighten the flange nuts onto the mid-clamps between modules (Fig. 15).

For a neat installation, fasten cable clamps to Rails with self-tapping screws.

Repeat the procedure until all modules are installed. Attach the outside edge of the last module to the rail with end clamps.

Trim off any excess rail, being careful not to cut into the roof. Allow a ½-inch space between the end clamp and the end of the rail (Fig. 13).

Check that all flange nuts on clamping bolts are securely fastened.

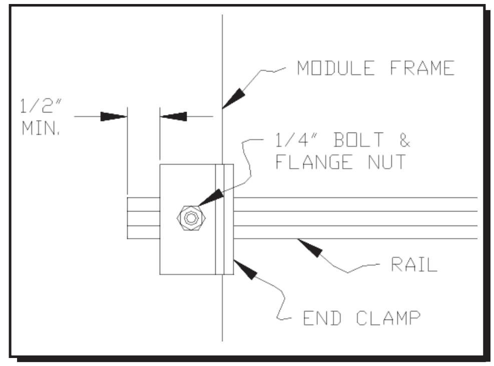

Figure 13

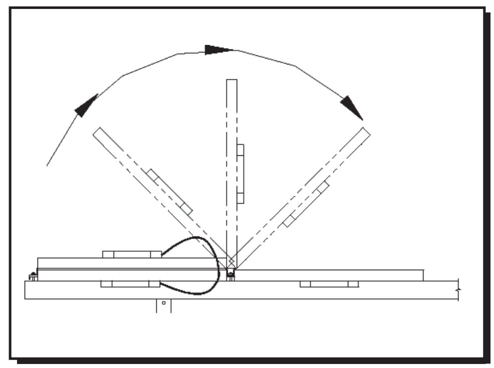

Figure 14

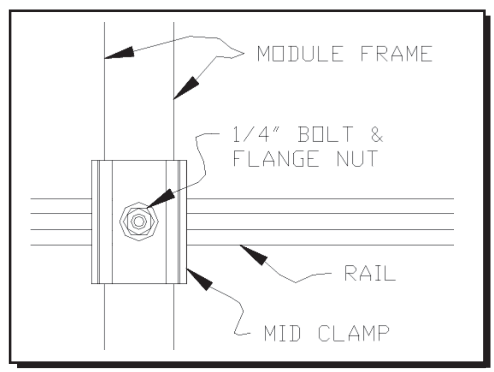

Figure 15

10 Year Limited Warranty

UniRac, Inc., warrants to the original owner at the original installation site that the SolarMount module rack (the “Product”) shall be free from defects in material and workmanship for a period of ten (10) years from the earlier of 1) the date the installation is complete, or 2) 30 days after the purchase of the Product by the original owner. This warranty does not cover damage to the Product that occurs during shipment, or prior to installation.

If within such period the Product shall be reasonably proven to be defective, then UniRac shall repair or replace the defective Product, or part thereof, at UniRac’s sole option. Such repair or replacement shall fulfill all UniRac’s liability with respect to this warranty.

This warranty shall be void if installation of the Product is not performed in accordance with UniRac’s Assembly Instructions for the Product, or if the Product has been modified, repaired, or reworked in a manner not authorized by UniRac in writing, or if the Product is installed in an environment for which it was not designed. UniRac shall not be liable for consequential, contingent, or incidental damages arising out of the use of the Product.

Pub 020508-1
(Technical Bulletin 103)

Pub. 020507-1
(Installation Instructions)

UniRac® The New Standard in PV Module Racks™

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