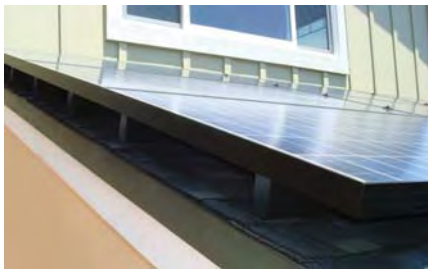


SnapNrack™
PV Mounting System

SERIES 100 ROOF MOUNT

CODE COMPLIANT INSTALLATION MANUAL | 2012

Table of Contents

1. Introduction

1.1 Overview of the SnapNrack System

SnapNrack Series 100 PV Mounting System offers a low profile, visually appealing, photovoltaic (PV) module installation system. This innovative system simplifies the process of installing solar PV modules, shortens installation times, and lowers installation costs.

SnapNrack systems, when installed in accordance with this manual, will be structurally adequate for the specific installation site and will meet the local building code and the International Building Code.

The SnapNrack installation system is a set of engineered components that can be assembled into a wide variety of PV mounting structures. It is designed to be installed by qualified solar installation technicians. With SnapNrack you will be able to solve virtually any PV module mounting challenge.

Figure 1.0 - Placing modules on S100 standard rails installed on L-Feet

1.2 Overview of this Manual

This manual describes the installation procedures for standard roof mounting for common photovoltaic (PV) arrays. It guides you through the correct procedures for mounting the SnapNrack PV module racking system on the major types of roof structures and materials. It also provides layout guidelines, installation tips and directions.

Review this entire manual before installing the SnapNrack system.

Throughout this manual you will see highlighted notes which will provide you with different types of information:

NOTICES indicate important information to help with the installation or to avoid potential damage to the structure or components.

CAUTIONS indicate a potential for property damage, personal injury, or death.

For help with your installation, call SnapNrack technical support. Visit **www.snapNrack.com** and click Contact in the top menu bar.

For information on Ground Mount installation procedures, refer to SnapNrack Ground Mount Installation Manual. It can be downloaded from www.snapNrack.com

1.3 Your responsibility as installer

Comply with all applicable local or national building codes, including any that may supersede this manual.

- Make sure that the SnapNrack components and other products are appropriate for the particular installation and the installation environment.
- Make sure that the roof, its rafters, connections, and other structural members can support the array in compliance with all applicable code requirements.
- Use only SnapNrack parts and components.
- Make sure that lag screws or roof attachment fasteners are properly and securely attached to the roof rafters or structural members and that roof members are structurally sound.

- Maintain the waterproof integrity of the roof, including the proper use of roofing sealant and selection of appropriate flashings for post type installations (see section 4 for flush-mount installations using standoffs and section 6 for tilted installations using standoffs).

Note: L-foot type mounting assembly includes flashing material.

- Ensure safe installation of all electrical aspects of the PV array.

All installers working on any roof surface must always follow necessary and applicable precautions for working in a rooftop environment including maintaining a secure attachment to a regulation fall protection safety harness that conforms to OSHA standards.

If it is raining, or if you anticipate any potentially dangerous conditions, do not proceed with the installation.

All tools and equipment used on the roof should be secured to avoid falling object hazards.

All equipment should be properly maintained and inspected prior to use.

Any exposed studs should be protectively capped to help avoid injury.

1.4 Support

For help with your installation, call technical support. Visit **www.snapNrack.com** and click Contact in the top menu bar.

Figure 1.1 - SnapNrack.com

2. Prepare for the installation

2.1 Identify type of roof

Roofs on residential buildings are constructed primarily of three types of material: asphalt shingles (commonly known as composition shingles), tile or slate (which we will refer to as tile), and wood or shake shingles (which we will refer to as shake).

PV array installations on composition roof surfaces using the SnapNrack flashed L-foot components as described in section 3, offers the quickest and easiest SnapNrack installation solution.

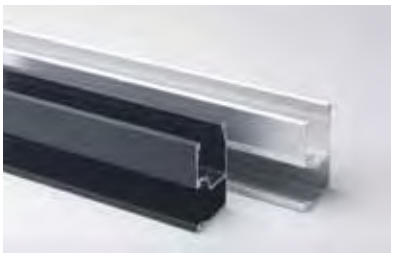
Installations on tile or shake roofs, or thicker composition roofs that exceed a typical 1/8-inch material thickness (often called presidential composition), should not use SnapNrack L-feet and should instead use standoffs as described in section 4.

Installation of PV arrays tilted at an angle to the roof surface is described in section 6.

Sometimes stainless steel hardware has a tendency to seize up when it is exposed to sunlight and gets hot. To reduce the possibility of seizing, apply lubricant to bolts, shade the hardware prior to installation, and avoid spinning on nuts at high speed.

2.2 Identify SnapNrack components

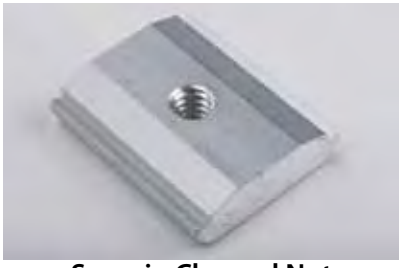
Make sure you have all the necessary SnapNrack system components needed to complete the installation.



SnapNrack Standard Rail

Universal End Clamp Ver1&2

Standard Rail Splice

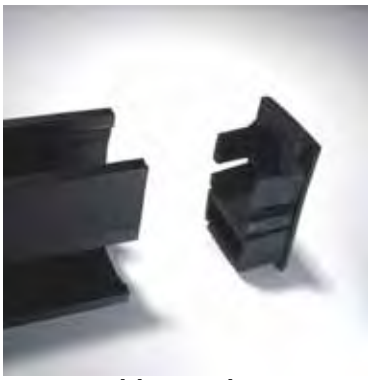


Snap-in Channel Nut

Figure 2.0 - Common System Components

Top-mount End Clamp

Mid Clamp



Rubber end cap

L-foot assembly —base, L-foot, stamped steel flashing

Standoff assembly — base and standoff shaft

L-Foot Base

Standoff base

L-Foot

Standoff Clamp

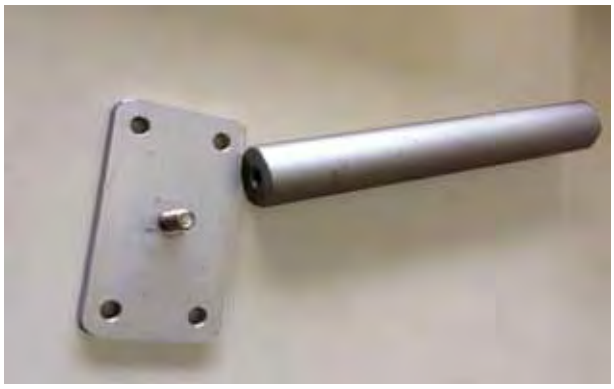
Figure 2.1 - Common System Components - Cont.

Corrugate Roof Block

Standard Base Seam Clamp

Heavy Duty (HD) Standoff and Base

Wide Base Seam Clamp



Four-Hole Standoff Base and Standard Standoff

Hanger Bolt Clamp

Fig 2.2 - Alternate SnapNrack Hardware

2.3 Obtain installer supplied tools and materials

Make sure you have all the necessary additional hardware components, tools, and other material that are needed to complete the installation. These include:

- Appropriate roof flashings for standoff installations
- Lag bolts and washers for roof attachments
- Waterproof roofing sealant (such as Rainbuster) in a color to match the color of the roof
- ½-inch box / open end wrench
- 3/8-inch ratchet wrench with ½-inch socket and short extension
- 3/8-inch torque wrench
- Power drill with 3/16-inch x 6-inch and 12-inch drill bits for lag bolt pilot holes
- 5/32-inch Allen key for leveling spacers on standoffs
- Tools for attaching grounding hardware
- Reciprocating saw (such as a Sawzall or miter box) with correct blade for trimming non-ferrous metal rails
- Metal file for finishing trimmed rails
- Chalk line and grease pens (in two or three different colors) for marking mounting locations on the roof material
- Tape measure
- Flat pry bar
- Structural plans for the building when available
- SnapNrack Rail Cutting Guide (Optional)

Figure 2.3 UEC Rail Cutting Guide

2.4 Survey the site

- Measure the roof surfaces and develop an accurate drawing of the roof and any obstacles such as chimneys and roof vents.
- If plans are available, check to make sure that the plans match the final structure.
- Review the shading pattern across the roof surface from the residence itself, from adjacent structures, and from other nearby features such as trees.
- Identify any roof access areas or keep-out areas as required by the local jurisdiction.
- Confirm roof construction, type, and condition.
- Assess roof rafter size, material, and span to confirm that the structure is sound and can support the additional load of the array.
- Identify any construction anomalies that may complicate the process of locating rafters from the roof surface.

- Measure the spacing between the rafters.
- If you find structural problems such as termite damage or cracked rafters that may compromise the structure's integrity, consult a structural engineer.

Determine the design wind speed and site specific conditions for the site and reference the structural engineering tables (see section 13: Appendix) to determine the maximum allowable rail span for this site.

If you are unsure about the local design wind speed, consult with the local building jurisdiction.

2.5 Lay out system on the roof

Using the information collected in the site survey, complete a system layout showing array location and distances from key roof features. Include any information necessary for the permitting process.

The following definitions are used to describe array layout designs:

- Module length—the measurement along the longest side of the module frame
- Module width—the measurement along the shorter side of the module frame
- Module thickness—the measurement of the thickness of the module

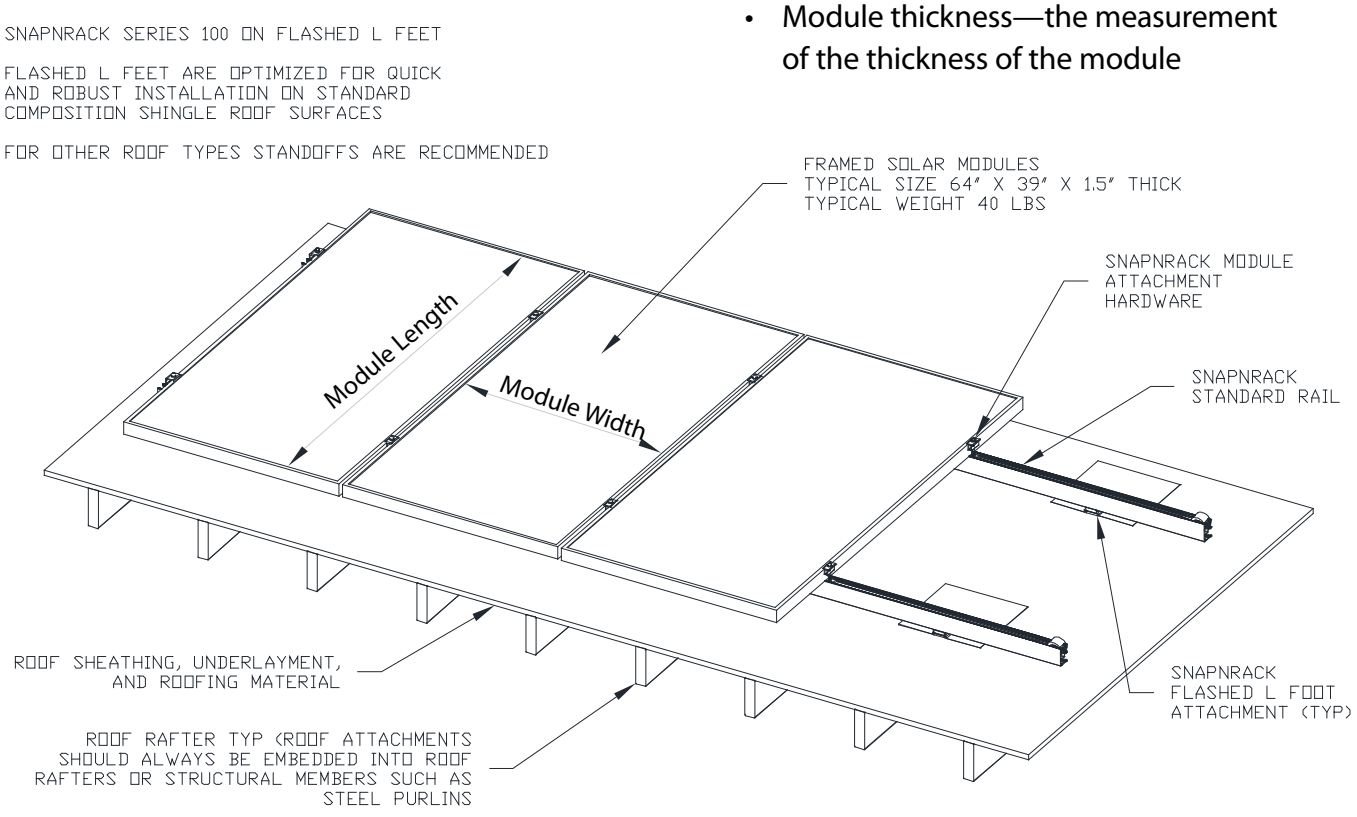


Fig 2.4 - Layout of PV modules showing rail span

Typically, PV modules are installed in portrait mode, with the long side of the module running up the roof slope and the rails running horizontally across the roof perpendicular to the roof rafters, which commonly run down slope.

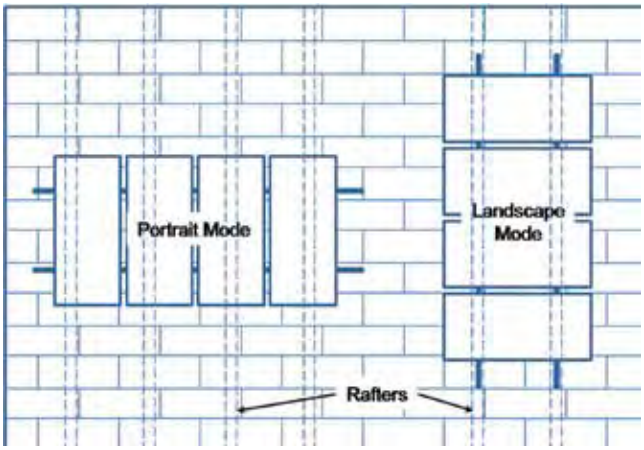


Fig 2.5 - Portrait and Landscape Illustration

Arrays can also be installed in landscape mode, with the modules oriented so that their long edge runs horizontally across the roof and the rails run up the roof slope.

Landscape mode is typically used in cases where the roof has been constructed with structural elements running horizontally across the roof, but can also be used on standard residential buildings for a variety of reasons including to facilitate a convenient layout.

When laying out the array, be sure to leave space for the module clamps on the rails.

Module mid clamps (see Fig 2.1) are installed between modules in a row and require .5 inch of space between the modules.

Standard top-mount end clamps (see Fig 2.1) require 1½ inches of extra rail to extend past the end of the module frame. If using the UEC this does not apply.

The space between rows of modules is not critical, but it is common for rows of modules to be installed so that the modules are flush with each other.

Submit array plans to local permitting jurisdiction and proceed with the roof layout only when all permits for the project have been granted by the authority having jurisdiction.

CAUTION: If possible leave at least 3 to 4 feet around the outside edges of the array to enable safe access during the installation and during maintenance and cleaning.

Transfer the array layout to the roof using grease pens to mark the inside and outside corners of the array.

Locate estimated rafter positions and mark them in the array area with a different color grease pen.

Common techniques for locating rafters include looking under the eaves, measuring from the ends of the roof, using attic access, and using electronic stud and rafter finders.

Transfer rail and estimated attachment locations to the roof, noting that attachments will be located at intersections of rails and rafters.

Layout rails such that module frame ends do not overhang mounting rails by more than 25% of total module frame length.

Verify that mounting rail spans are in accordance with the rail span tables in the Appendix at the back of this manual (section 13).

Verify that rail ends do not overhang by a distance greater than 30% of the acceptable rail span specified in the same table.

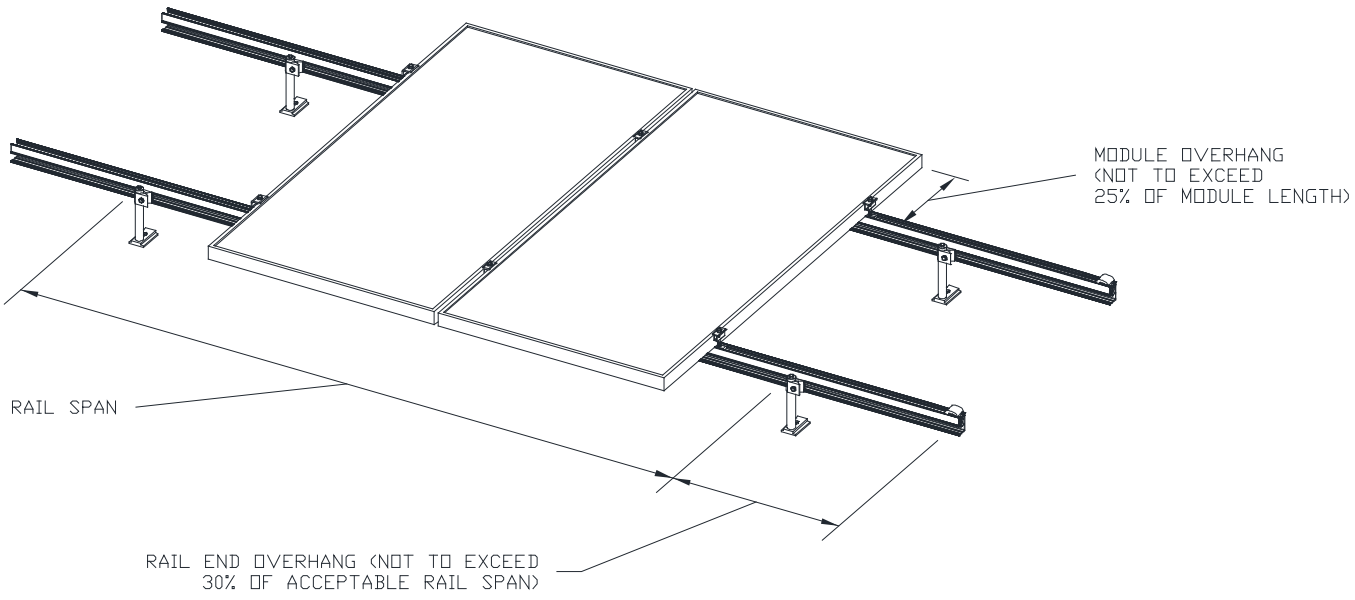


Fig 2.6 - Location of rail end overhang and module overhang

3. Flush mount on composition roofs (using L-feet)

3.1 Introduction

Typically, using flashed L-feet to mount PV modules enables a faster and simpler installation than using standoffs, but the L-foot type of mount can only be used on composition roofs. Installations on shake and tile roof surfaces, as well as thicker composition roofs (that is, thicker than 1/8 inch), require the use of standoffs and standard flashings.

For installations using standoffs, see section 4. For installations where the PV modules will be installed tilted at an angle to the roof surface, see section 6.

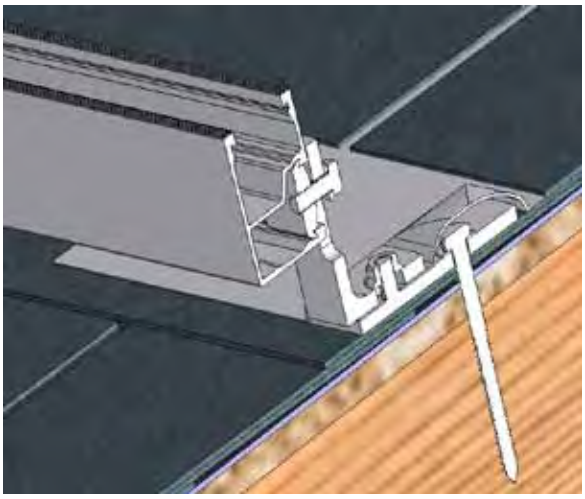


Fig 3.0 - Flashed L-foot section view

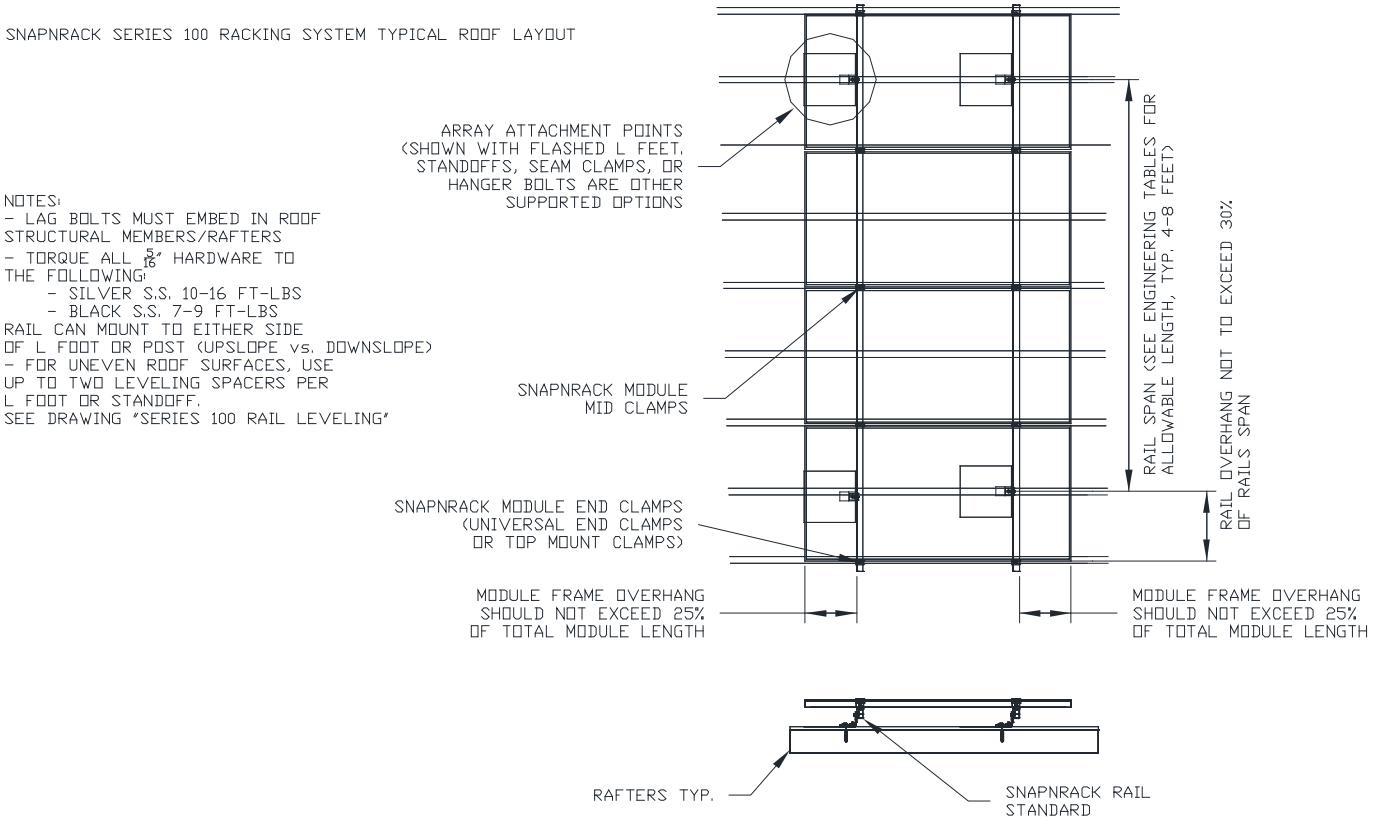


Fig 3.1 - Typical PV module Roof Layout

3.2 Locate attachment points

The location of the attachment points for L-foot mounts depends on the orientation of the modules relative to the rafters as shown in this diagram.

Using the array layout plans and the estimated rafter locations, as described in the previous section 2.5. Determine location of all attachment points and mark the holes for each L-foot base.

Fig 3.2 - Drill pilot holes

3.3 Drill pilot holes

Confirm the location of the rafters by drilling pilot holes into the roof at each of the identified attachment points with a 3/16-inch pilot drill.

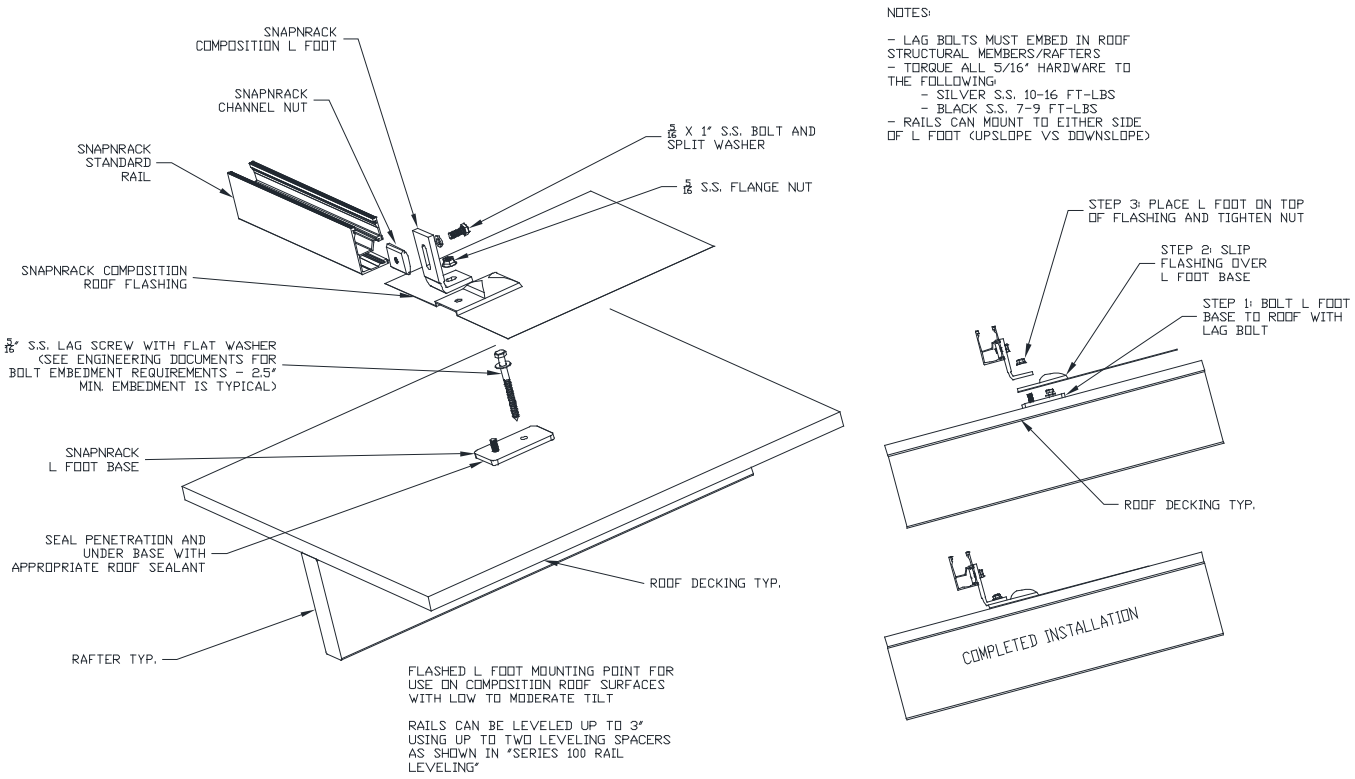


Fig 3.3 - L-foot mount assembly diagram

Be sure to drill the hole deep enough to penetrate the roof decking and enter the rafter by 1 to 1½ inches. If the *drill pushes through* at this point, you have likely missed the rafter and should move ½ inch laterally toward where you estimate the rafter to be and try again.

See Fig 3.3 for L-foot mount assembly details.

3.4 Secure base

Apply a bead of sealant to the underside of the L-foot base and into pilot hole.

Screw 5/16-inch lag bolts with lag bolt washers into the pilot holes and tighten with a ½-inch socket. Using a socket adapter bit in a power driver is a common method.

Make sure the lag bolts used are long enough to embed a minimum of 2 inches into the rafter to secure the L-foot base to the roof. Refer to the lag bolt pullout chart for apprpriate embedment.

The required lag bolt length is based on the roof thickness as measured during the site evaluation.

Check that the lag bolts are secure with a socket and ratchet wrench.

If the bolt spins out, you didn't hit a rafter.

L-foot base

Apply sealant

Secure base to rafter

Fig 3.4 - Attaching L-foot base

Move ½ inch laterally towards where you estimate the rafter to be and try again starting with a new pilot hole.

3.5 Install flashing

Insert the stamped-steel roof flashing over the L- foot base and underneath the upslope shingle.

Note: the L-foot base is different from the standoff base described in section 4 of this manual. Make sure you are using the correct part for the type of roof on which you are installing the array. See Fig 2.1.

3.6 Attach L-foot

Using the provided 5/16" serrated flange nut to attach L-foot to L-foot base, securing the entire assembly to a rafter. Repeat this procedure for each L-foot base.

The orientation of the L-foot on top of the L-foot base is not critical and can be varied based on installer preference.

Check all 5/16-inch bolt hardware is tightened to the correct torque:

- Silver hardware - 10-16 ft-lbs.

- Black Hardware - 7-9 ft-lbs.

After installing all L-feet, go to section 7.

Install Flashing

Secure L-Foot to Base

Completed Flashed L-Foot

Fig 3.6 - Installing Flashing & L-Foot

4. Flush mount on other roof types (using standoffs)

4.1 Introduction

Typically, standoffs are used for installations on tile, shake, or special thick composition roof types.

For installations on standard composition roofs, use flashed L-feet as described in section 3. For installations where the PV modules will be installed tilted at an angle to the roof surface, see section 6.

Diagram below shows standoff mount assembly details.

Fig 4.0 - Standoff section view

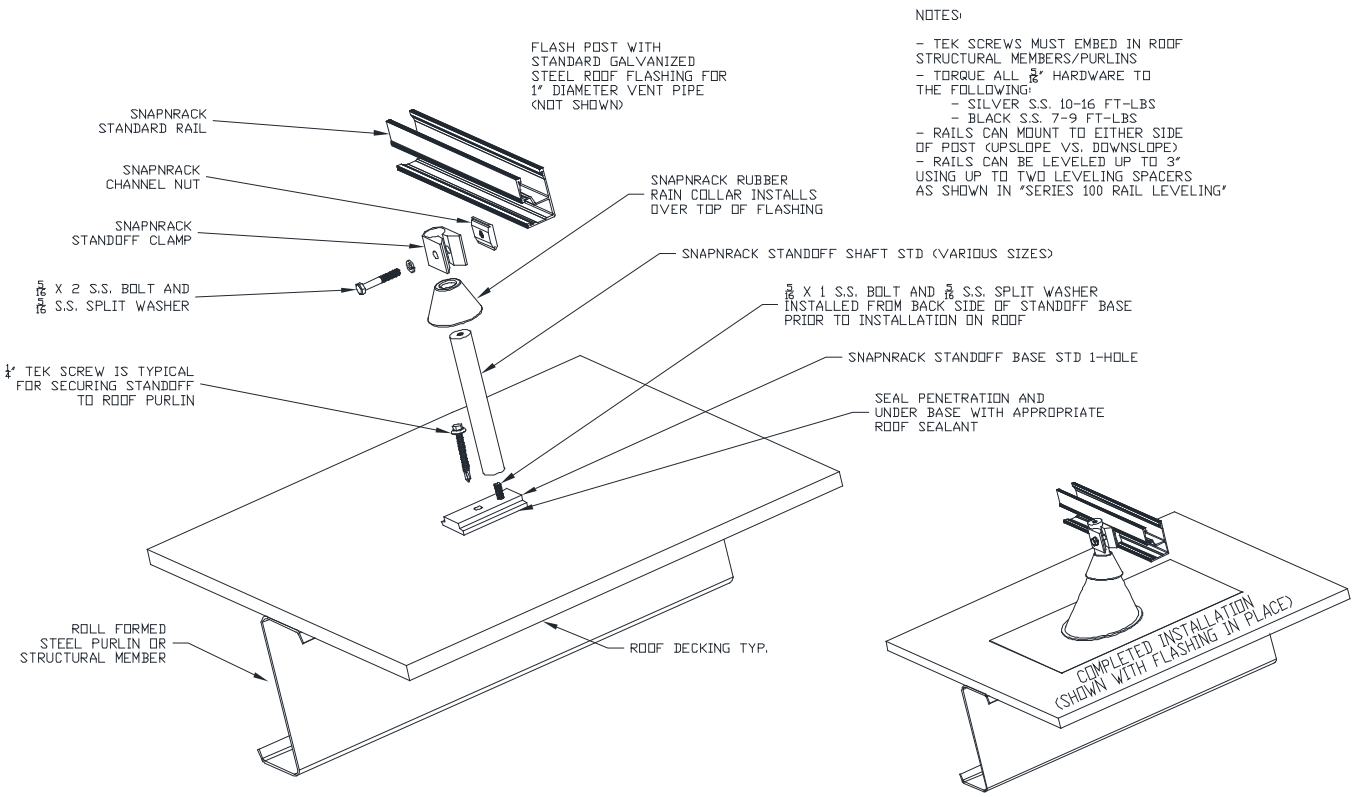


Fig 4.1 - Standoff mount assembly

4.2 Determine type and size of attachment and flashing

Based on the construction type, style of the roof, and type of flashings to be used, determine the size of standoffs needed.

As a general rule, standoffs should be approximately 2½ inches taller than the cone of the flashing selected for the roof type. Some typical roof flashing heights are shown in the list at the beginning of this section:

Fig 4.2 - Standoff installation using Oatey flashing

Roof Type	Flashing Type	Flashing Height	Standoff Height
Composition	Low profile Oatey	3 inches	5½ inches
Shake, Wood	Standard Galvanized Steel	4½ inches	7 inches
Flat Tile, Slate	Dead-soft aluminum	6 inches	8½ inches
S or Mission Tile	Dead-soft aluminum (Same as above except lifted off roof)	7 inches	10 inches

4.3 Standoff Base Options

SnapNrack Series 100 Mounting system has two alternative standoff bases that can be used when roof structures can not accomodate the standard one-hole standoff base. The standard Standoff shafts can be used with the Four-Hole Standoff Base when the roof structure uses laminate I-beams that would be damaged by the one-hole standoff base. When higher load forces are expected or higher standoff heights are required because of roof geomtetry, the Heavy Duty Standoff Base and HD Standoff Shaft can be used.

Fig 4.3 - HD Standoff Installed on Foam Roof

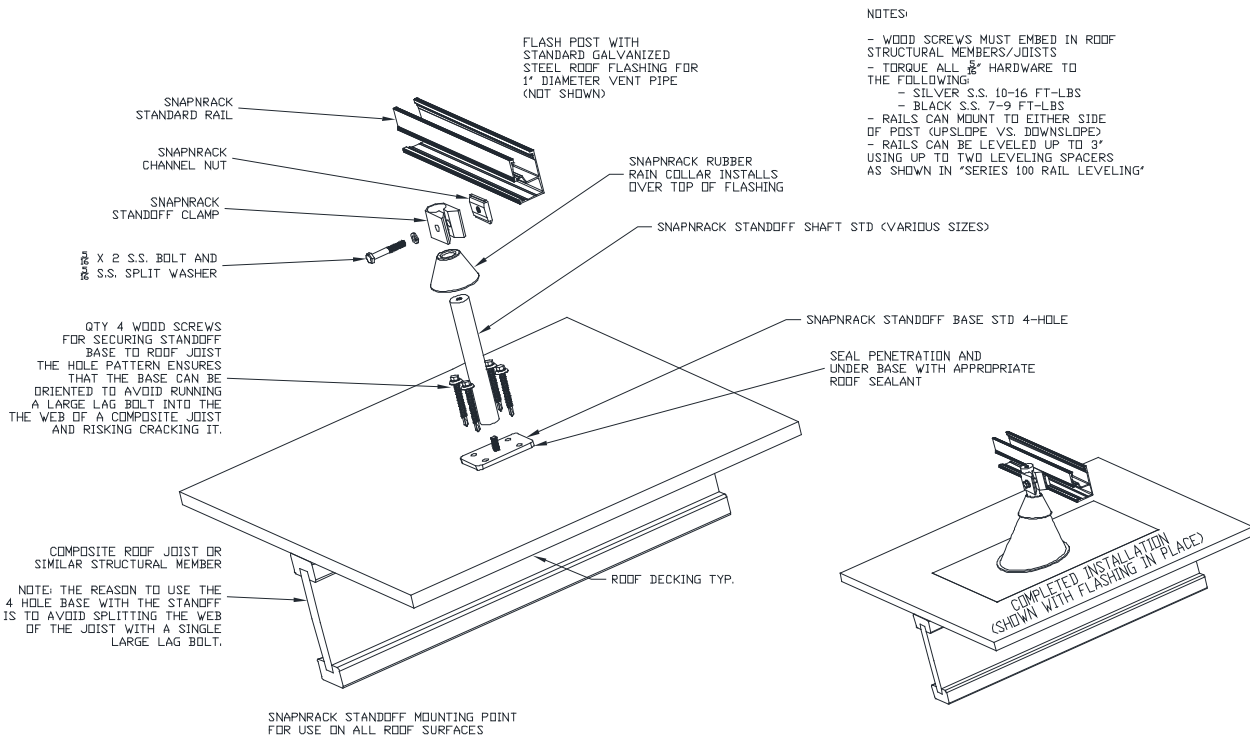


Fig 4.4 - Four-Hole Standoff Detail

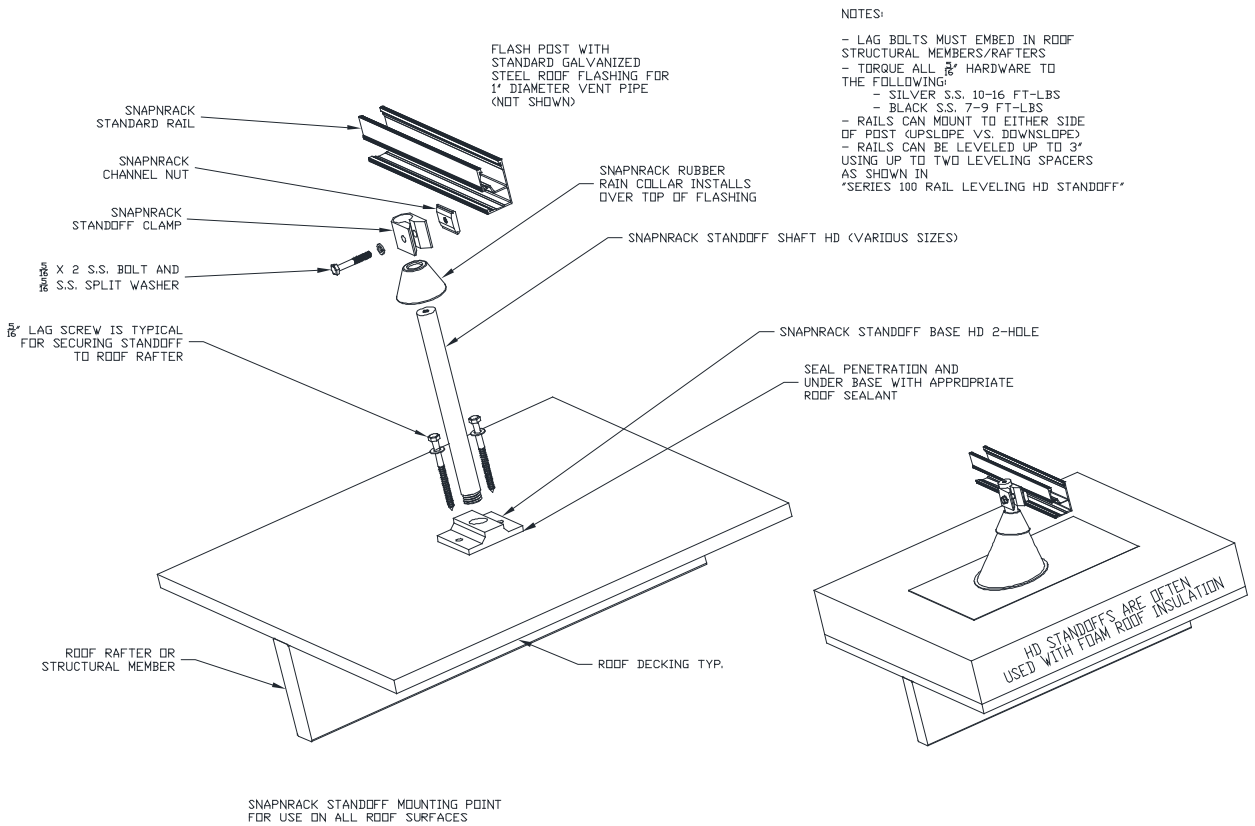


Fig 4.5 - HD Standoff Detail

4.4 Locate attachment points

The location of attachment points for standoff mounts depends on the orientation of the modules relative to the rafters as shown in Fig 2.5Using the array layout plans and the estimated rafter locations, determine the location of all attachment points and mark the holes for each standoff base.

4.5 Mark attachment points

Remove the tile or shake underneath each standoff location, exposing the roofing underlayment. Transcribe the location marks from the roofing material to the roofing underlayment. Ensure that the standoff base lies flat on the underlayment, but remove no more material than required for the flashing 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.

4.6 Drill pilot holes

Confirm the location of the rafters by drilling 3/16-inch pilot holes into the roof at each of the identified attachment points.

Be sure to drill the hole deep enough to penetrate the roof decking and enter the rafter by 1 inch to 1½ inch. If the drill pushes through at this point, you have likely missed a rafter and should move ½ inch laterally and try again.

Remove roofing material to expose roof underlayment

Transcribe layout lines from roofing material to underlayment

Drill pilot holes

Apply Sealant

Fig 4.6 - Installing Standoff Base

4.7 Secure the base

Prior to securing the base to the roof insert the 5/16-inch x 1-inch bolt and lock washer through the tapped hole in the standoff base and tighten.

This piece can be preassembled and taken out to the job site as one part.

Note: the standoff base is different from the L-foot base described in section 3 of this manual. Make sure you are using the correct base.

Make certain you use the correct part for the type of roof on which you are installing the array. See photos of each type in Fig 2.1.

Apply a bead of sealant to the underside of the standoff base and into the pilot hole.

Secure base to the roof by screwing 5/16-inch lag bolts with lag bolt washers into the pilot holes and tightening with a ½-inch socket and socket adapter bit in a power driver.

Make sure the lag bolts used are long enough to embed a minimum of 2 inches into the rafter to secure the standoff base to the roof.

Secure standoff base to rafter

Typical standoff base installation

Fig 4.7 - Installing Standoff Base - Cont.

The required lag bolt length is based on the roof thickness as measured during the site evaluation.

Check that the lag bolts are secure with a socket and ratchet wrench.

If the bolt *spins out*, you didn't hit a rafter. Move ½ inch laterally toward where you estimate the rafter to be and try again starting with a new pilot hole. Most wooden

rafters are only 1.625 inches thick, so you should always attempt to hit a wooden rafter in the center if possible.

4.8 Attach standoff and install flashing

Screw standoff shaft onto the base and tighten. Install flashing over the standoff shaft and base using standard building practices.

Apply a bead of sealant to seal the top of the flashing around the standoff shaft.

Slide rubber rain collar over the standoff and press down to cover the sealant at the top of the flashing.

Every standoff must be firmly secured to a rafter to ensure system integrity. Make sure that all lag screws are securely tightened into roof rafters and are structurally sound.

Repeat this procedure for each array attachment point. After installing all standoffs, go to section 7.

Screw standoff onto base

Install flashing using appropriate methods for roof type.

Slide standoff clamp and hardware

Fig 4.7 - Installing Standoff & Flashing

5.0 Installing on other types of roof penetrations

The SnapNrack Series 100 PV Mounting System includes several specialized roof attachement options to meet the installation needs of even the most challenging roof types.

5.1 Installation with Hanger Bolt

Hanger Bolts can be used to attach to roofs in which L-Feet or Standoff installation is not possible.

Fig 5.0 - Typical Hanger Bolt Installation

5.2 Determine length of hanger bolt

The length of the hanger bolt is based on the construction type, style of the roof, and type of underlayment used, As a general rule, Hanger bolts should be embedded into rafters approximately 2½ inches, and have at least 1¼" of thread available at the top of the bolt to attach to the hanger bolt clamp.

5.3 Locate and Mark attachment points

The location of attachment points for standoff mounts depends on the orientation of the modules relative to the rafters and the allowable rail spans from the engineering tables in Section 13. Determine the location of all attachment points and mark the holes for each Hanger Bolt.

5.4 Drill pilot holes and insert Hanger Bolt

Confirm the location of the rafters by drilling pilot holes into the roof at each of the identified attachment points with a 3/16-inch pilot drill.

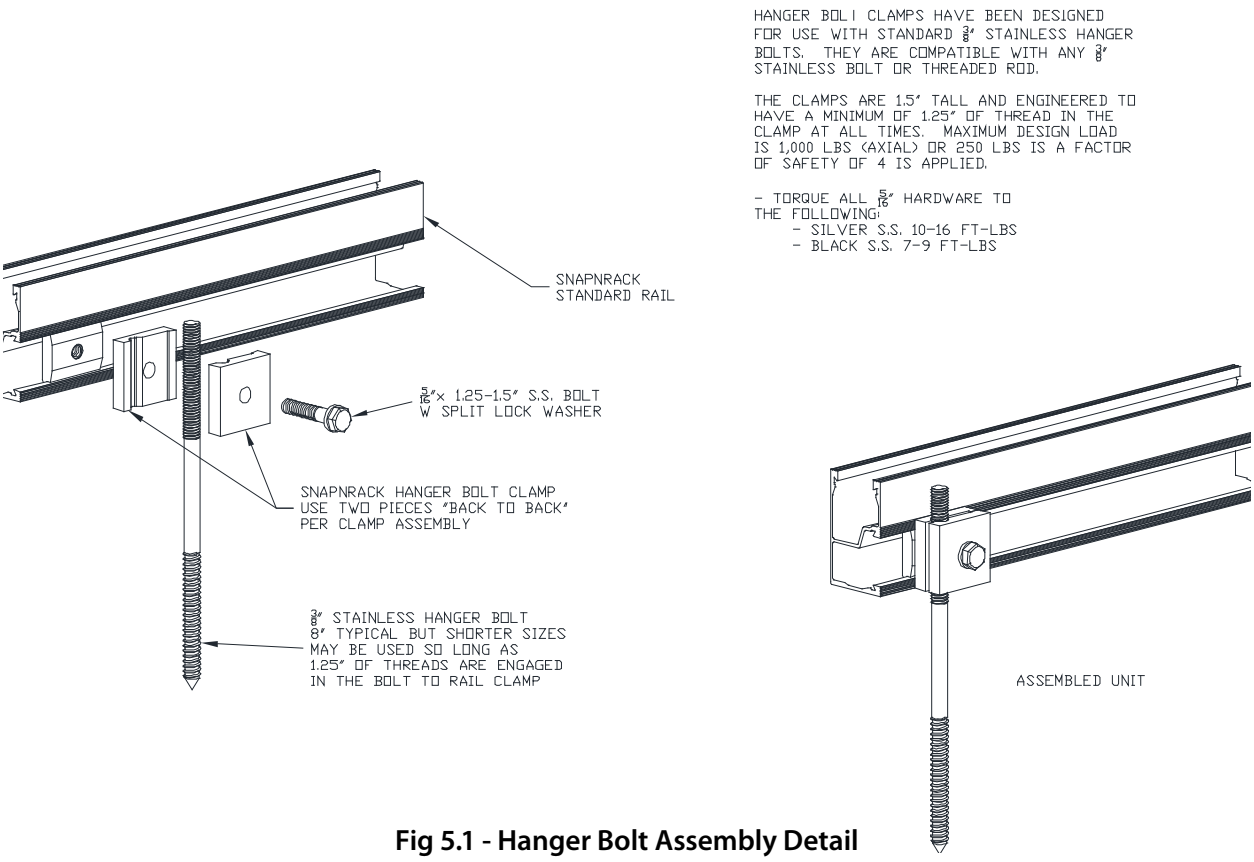


Fig 5.1 - Hanger Bolt Assembly Detail

Be sure to drill the hole deep enough to penetrate the roof decking and enter the rafter by 1 inch to 1½ inch. If the drill pushes through at this point, you have likely missed a rafter and should move ½ inch laterally toward where you estimate the rafter to be and try again. Once the Pilot Hole is drilled, the Hanger Bolt should be installed with care taken to not deform the threads at the top of the bolt.

Fig 5.2 - Corrugated Roof Block with L-Foot

5.5 Fastening Hanger Bolt Clamp

Prior to securing the base to the roof insert the 5/16-inch x 1-inch bolt and lock washer through the tapped hole in the standoff base and tighten.

5.6 Installation with Corrugated Roof Block

Corrugated roofs are typically installed over metal beams or wooden rafters. Deterimine the type of roof structure and use the approriate hardware. Metal beams will require the used of thru-bolts and nuts, wooden rafters will require the use of lag bolts.

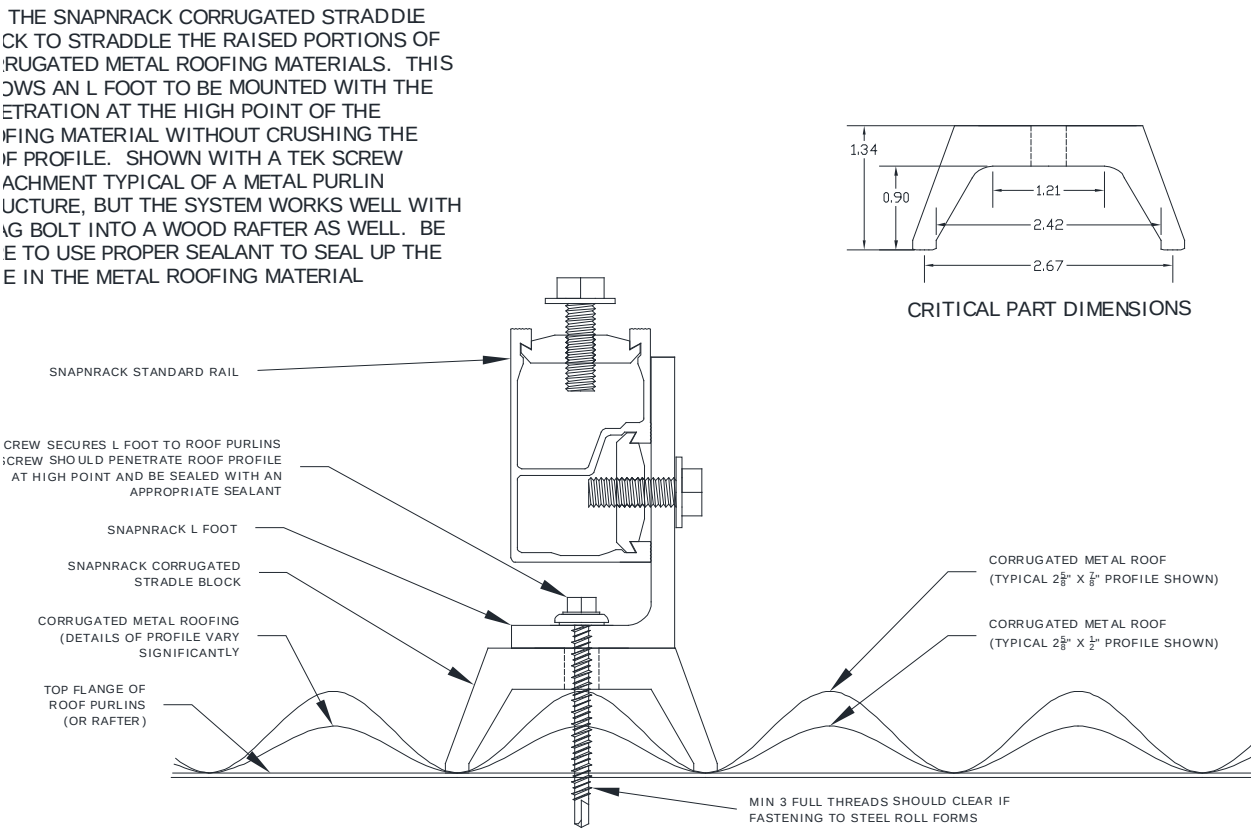


Fig 5.3 - Corrugated Roof Block Details

5.7 Locate, Mark and Drill Attachement points

Confirm the location of the rafters, beams or purlins by drilling pilot holes into the roof at each of the identified attachment points with a 3/16-inch pilot drill. The pilot hole must drill through the corruagetd metal roof and start a pilot hole in the wood beam.

5.8 Install Corrugated Roof Block

Fill the hole and surrounding area between the block and roof surface with an appropriate roof sealant. We recommend a Urethane based roof sealant for optimal durability and long life. Place L-foot or other attachment hardware on top of the roof block. Insert a 5/16-18" Stainless Steel Lag Bolt through the attachment hardware and the block at the pilot hole. Drive the Lag Bolt into the wood beam, securing the roof block and attachment hardware.

Note: the Corrugated Roof Block is designed to be installed over the high ridge of the corrugation, and be directly bolted into an underlying structural member. If a structural member, either a rafter or sufficiently strong purling, is not positioned directly under the high ridge, then additional blocking must be installed to provide a strong connection to the building's frame.

5.9 Installation with Standing Seam Clamps

The Metal Roof Seam Clamp was designed to allow the attachment of the L-Foot or PV module directly to a commercial

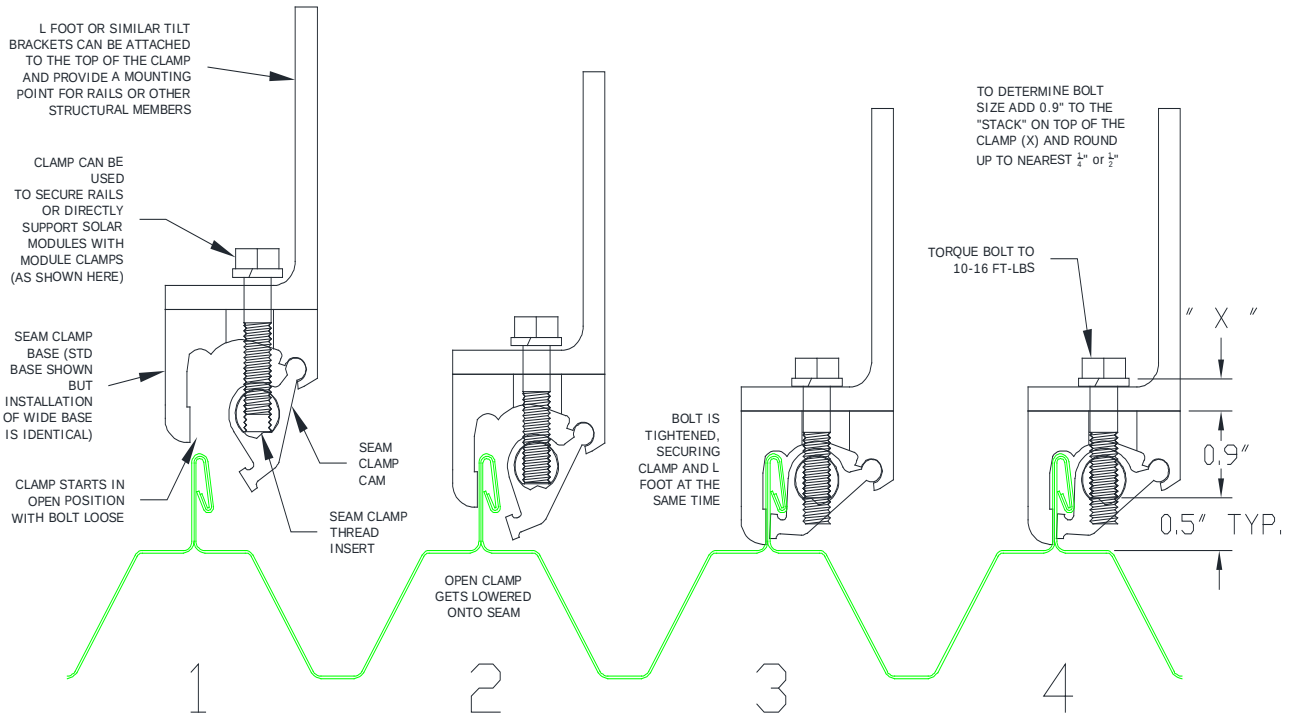


Fig 5.4 - Standing Seam Metal Roof Clamp Detail

grade standing seam metal roof without penetrating the metal or collapsing the ridge in the metal roof material. The design is simple and low cost, but very effective. The clamp is made from high ten-sile strength aluminum and has a shape that will work with several metal roof designs including the Butler MR-24 or similar designs.

5.10 Identification of Seam Type

SnapNrack Seam Clamps are ideally suited for single roll and double roll standing seams. The Standard Base Seam Clamp is designed to clamp below the base of a double rolled (vertical) seam, the Wide Base Seam Clamp has a wider opening to clamp around the base of a single rolled (horizontal) seam. Different roofing types will vary in seam profile, surface finish and thickness. A detailed list of fully tested roof materials is available at http://www.snapnrack.com/metal-roof.html

5.11 Determine layout and hardware

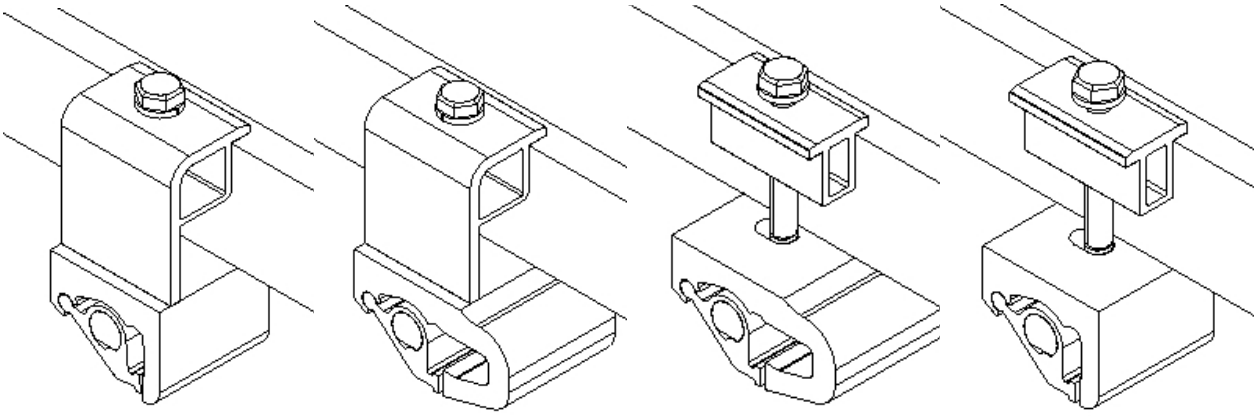
The seam-to-seam distance and the allowable load of the clamp on the particular roof material are going to drive the clamp layout. For mounting modules directly to seam clamps, the modules will want to run in Landscape orientation so the modules will mount to the roof seams as they would mount to the rails in a standard Series 100 installation.

Alternately, the seam clamps can be used as the mounting base for L-Feet supporting standard rail for module mounting.

Layout the array dimensions on the roof and mark the clamp locations.

5.12 Install clamps and top hardware

The seam clamp and top hardware attach with a single bolt. Position the top hardware in the appropriate orientation. With the bolt loose, place the clamp over the seam in the pre-marked position.



End Clamp on Standard Base Seam Clamp | **End Clamp on Wide Base Seam Clamp** | **Mid Clamp on Wide Base Seam Clamp** | **Mid Clamp on Standard Base Seam Clamp**

Fig 5.5 - Mid ClampAnd End Clamp on Seam Clamp Assemblies

6. Tilt mount (using standoffs and extensions)

6.1 Introduction

Installations that require the arrays to be tilted relative to the roof surface can be installed on either standoffs or L-feet, but standoffs are the most common and are the only solution for flat roof surfaces where full flashings will be required.

Fig 6.0 - PV modules installed at shallow angle

For flush mounted (not tilted) installations on standard composition roofs, use flashed L-feet as described in section 3. For flush mounted arrays on thicker composition, shake, or tile roof types, use standoffs as described in section 4.

6.2 Determine type of tilt assembly

There are two types of tilt assemblies for SnapNrack installations depending on the amount of tilt required: shallow tilt assemblies for arrays installed at angles less than 15 degrees and full tilt assemblies for arrays installed at angles greater than 15 degrees (up to 60 degrees).

6.3 Shallow tilt kits

Tilt angles from 0 to 15 degrees can be configured as shown in the following diagram. This configuration uses a standard length standoff for the lower rail and a longer standoff for the upper rail.

Calculate the length of the upper rail standoff to provide the desired module tilt angle. If the length of the standoff needs to exceed 9 inches, please contact SnapNrack tech support for recommendations.

For this type of installation, complete the layout and installation of standoffs as described in section 4.

Attach a standoff clamp and L-foot to each standoff, such that the rail can be bolted to the L-foot at the appropriate angle for the two rails to provide a flush mounting surface for the modules at the desired tilt angle.

Proceed with mounting rails and modules as described in section 7.

6.4 Full tilt kits

Tilt angles from 10 to 60 degrees can be configured as shown in the diagram on this

page. This configuration uses a standard length standoff for both upper and lower rails and adds an extension to the standoff supporting the upper rail using a section of rail cut to the appropriate length and drilled with two holes.

Calculate the length of the upper rail standoff extension to provide the desired module tilt angle. If the length of the cut rail exceeds 4 feet, consult a structural engineer before proceeding.

Tilt leg rails can be cut and drilled ahead of time to save time on the job site. A simple drill guide will help with locating the holes in the tilt leg.

For this type of installation, complete the layout and installation of standoffs as shown in Section 4. Attach the lower or front rail mounting hardware as described in section 6.3 *Shallow Tilt Kits.*

Bolt the pre-drilled tilt leg rail to the standoff clamp on the back row of standoffs by passing a bolt through one of the holes in the rail and into a channel nut as shown in the drawing.

Similarly, bolt an L-foot to the upper end of the tilt leg rail and attach the upper rail to the L-foot.

Tighten all hardware at the appropriate angle

If rear standoff height exceeds 18 inches contact SnapNrack tech support staff for recommendations.

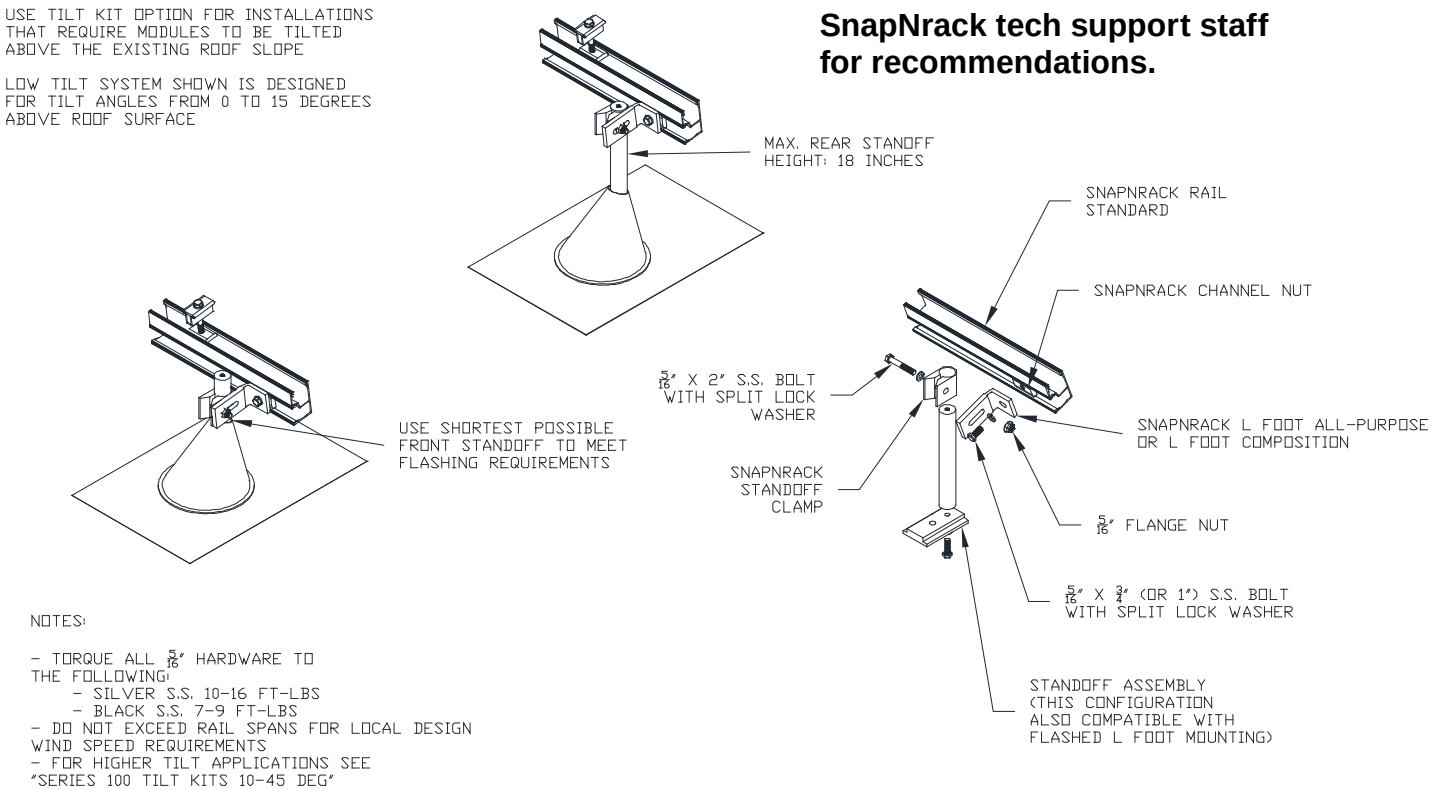


Fig 6.1 - Tilt assembly detail for angles less than 15 degrees

for the two rails to provide a flush mounting surface for the modules at the desired module tilt angle.

Note that when tall tilt angles are used, the upper rail may seem a bit precarious until the first two or three modules are installed.

Take care that you don't put excessive force on the rear leg standoffs such as to compromise their integrity over the duration of the installation.

Proceed with installing mounting rails and modules in Section 7.

6.5 Installing on L-feet

In some cases it may be desirable to install tilt kits on L-feet. Often, this is done when a

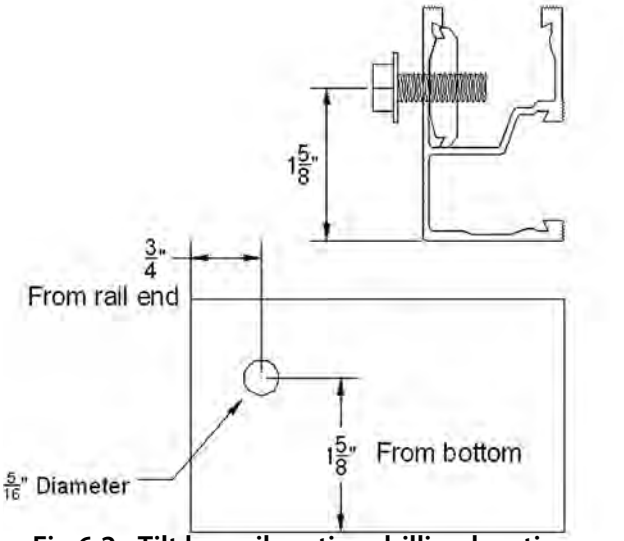


Fig 6.2 - Tilt leg rail section drilling location

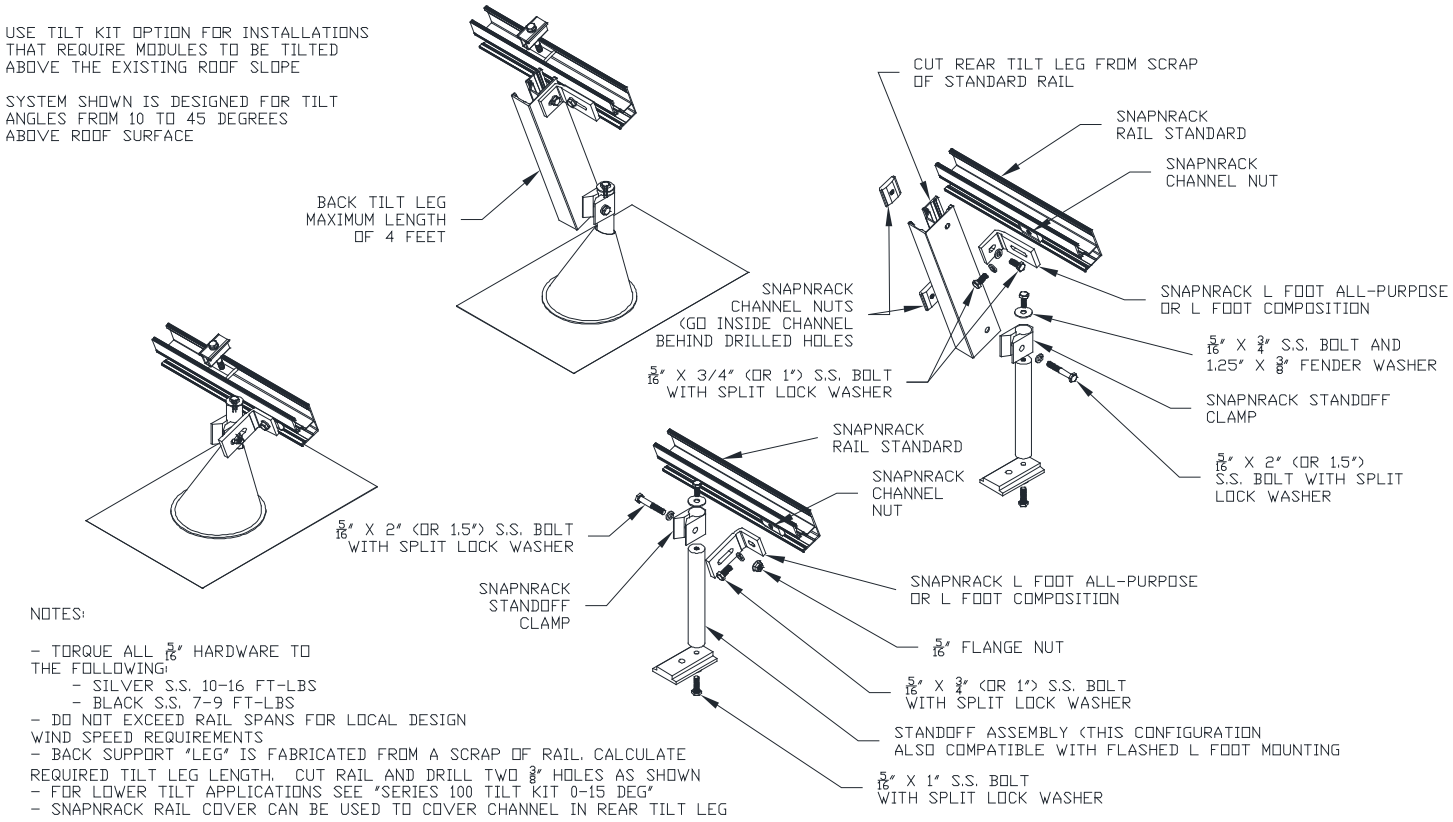


Fig 6.3 - Tilt assembly detail for angles greater than 15 degrees

row of modules along the top of a north facing roof slope is "tilted back" to match the south facing roof slope on the other side of the ridge line, and the building has a basic composition roof.

In these cases, proceed with installation as described in section 6.4 *Full Tilt Kits* substituting L-feet for the standoff/standoff clamp assemblies.

7. Install rails

7.1 Snap in channel nuts

Snap in channel nuts and attach rails to mounting hardware using 5/16-inch bolts as shown in the photo.

Channel nuts are designed to snap in and out of rail channels. This enables you to quickly assemble systems without having to slide nuts from the end of a rail.

Rails can be mounted to either side of the L-feet or standoffs — upslope or downslope, as seen in the Fig 9.1 & 9.2.

The rail nearest the low edge of the roof should be mounted in such a way that it presents an even, clean face as seen from the ground.

Leave bolts finger tight to facilitate rail leveling in the next section.

8. Install rail splices

8.1 Snap in splice insert

At every junction of two rails, snap or slide in a rail splice insert and attach a rail splice top using the provided 5/16-inch bolts and lock washers.

On combined single row rail length longer then 35 feet a thermal expansion joint is required. A gap in the rails of 1/4 inch is recommended.

Check all bolt torques to ensure that all 5/16-inch hardware is tightened to correct torque.

Fig 8.0 - Standard Rail Splice Assembly

Fig 8.1 - Cross-Section of Splice in Rail

9. Level rails

9.1 Overview

Rails can be leveled by raising or lowering the points where they attach to the L-foot or standoff assembly.

Up to 1 inch of adjustment is achieved with the basic sliding features built into both L-foot and standoff clamp components.

Use a spare rail or a string line to level the rails and make sure the tops of all of the rails are in the same plane.

9.2 Additional leveling for L-foot mounted rails

An additional 1 inch or 2 inches of height can be added by installing one or two 1-inch standoff spacers between the L-foot and its base. When necessary, use spacers as follows:

- Remove L-foot.
- Thread 1-inch standoff onto standoff bases threaded stud.
- Screw 1-inch set screw into 1-inch standoff with 5/32-inch Allen wrench.
- Reinstall L-foot as before by tightening the original nut and lock washer onto the threads of the set screw.
- Repeat process to add a second 1-inch spacer if needed.

Check all 5/16-inch bolt hardware is tightened to the correct torque:

- Silver hardware - 10-16 ft-lbs.

- Black Hardware - 7-9 ft-lbs.

Fig 9.0 - Snap in channel nuts

Fig 9.1 - Standard rail mounting

Fig 9.2 - Down-slope mounted rail

9.3 Additional leveling for standoff mounted rails

An additional 1 inch or 2 inches of height can be added by installing one or two 1-inch standoff spacers to the top of the standoff shaft. When it is necessary to use spacers, adjust the level as follows:

- Remove standoff clamp or simply slide down standoff shaft.
- Screw 1-inch threaded stud into top of standoff so that half the threads are into the standoff.
- Thread 1-inch spacer onto set screw using 5/32-inch Allen key to hold set screw still and ensure even thread engagement into both shafts.
- Reinstall standoff clamp as before.
- Repeat process to add a second 1-inch spacer if needed.

Check all 5/16-inch bolt hardware is tightened to the correct torque:

- Silver hardware - 10-16 ft-lbs.

- Black Hardware - 7-9 ft-lbs.

If the standoff clamp extends above the top surface of the standoff, spacers need to be added.

Never use more than two spacers. If more height is required, use a taller standoff.

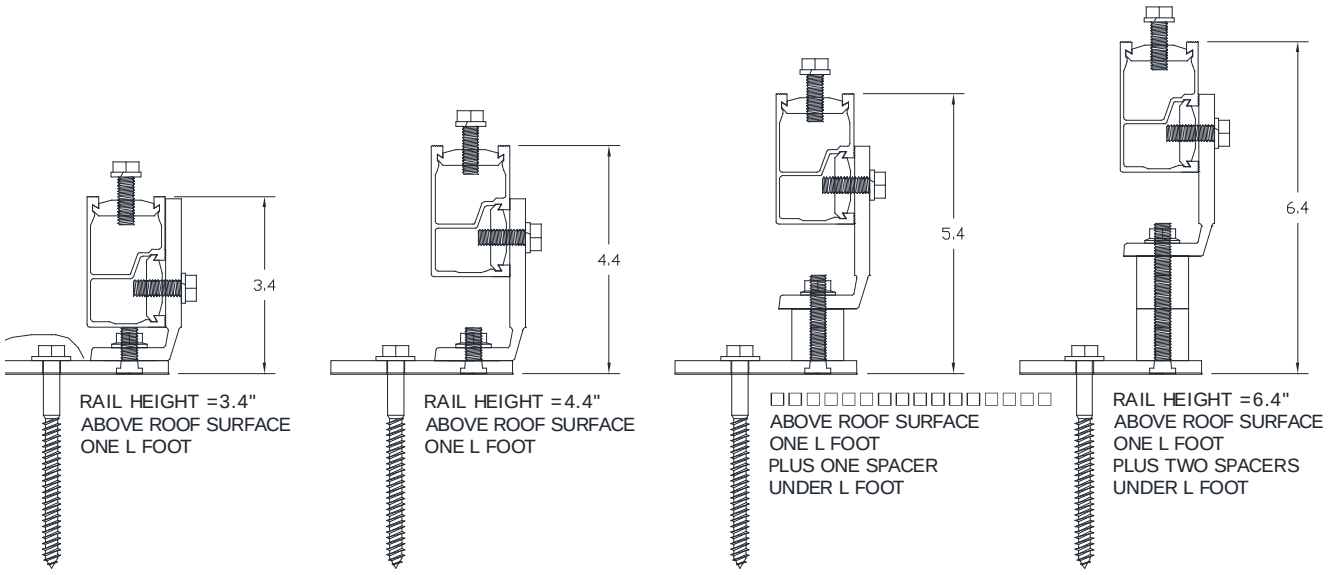


Fig 9.3 - Up to three inches of leveling capablity for L-foot mounts

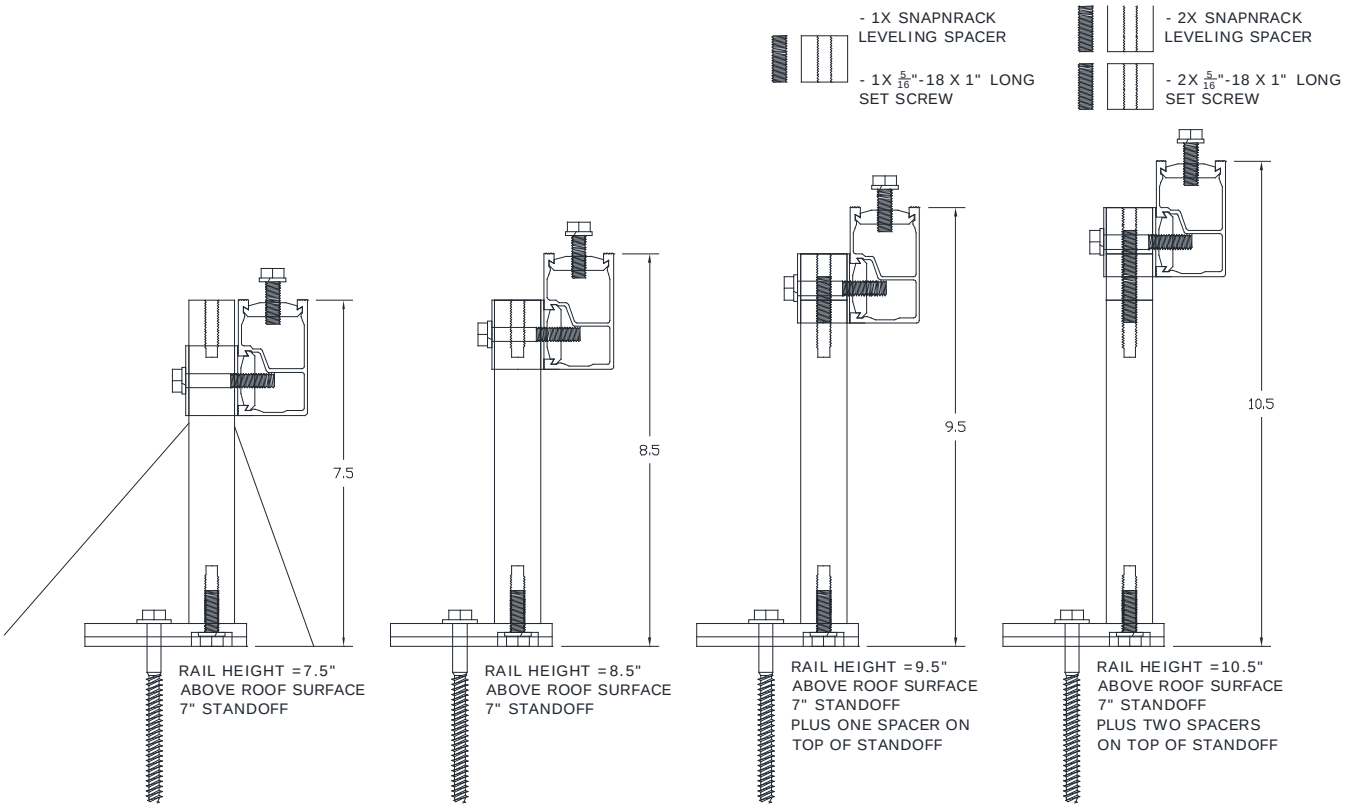


Fig 9.4 - Up to three inches of leveling capablity for standoff mounts

10. Install modules on rails

10.1 Prepare clamping hardware

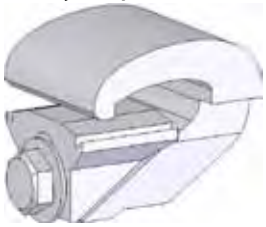
Preassemble module clamping hardware. Each clamp assembly consists of a module clamp, a channel nut, and a 5/16-inch bolt and split lock washer.

When using standard End Clamps the end clamp size and bolt length are specific to the thickness of the module. Make sure you have the right size for the modules being installed.

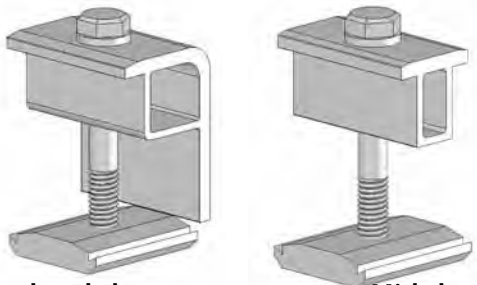
If using the UEC make certain it is slide all the way up on the module frames lip before tightneing the clamp.

To speed the installation, measure out the location of mid-clamps and end clamps on rails with a tape measure.

Snap in clamps on all the rails so the clamps will be ready when you place the modules.



Universal End Clamp



Standard end clamp **Mid clamp**

Flg 10.0 - Module Clamps

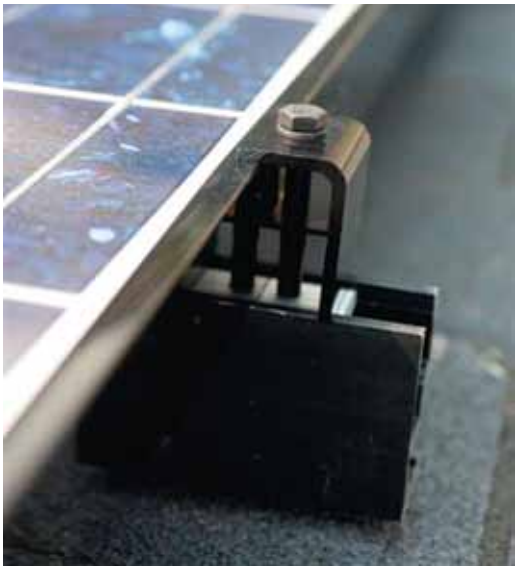


Fig 10.1 - Installed Top-Mount End Clamp

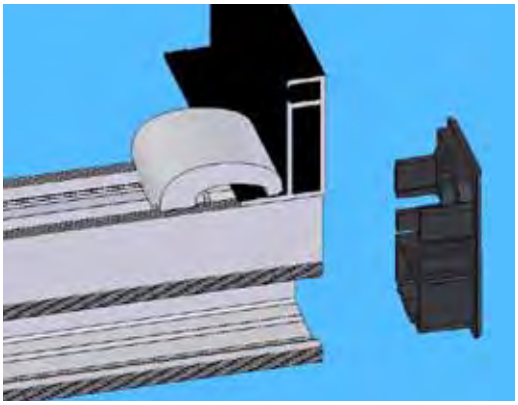


Fig 10.2 - Installed Universal End Clamp

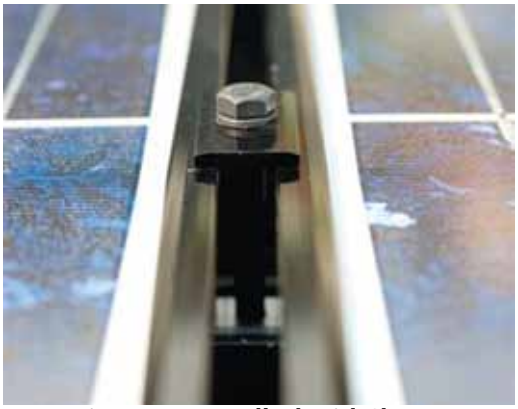


Fig 10.3 - Installed Mid Clamp

Fig 10.4 - Snap Mid Clamp Assembly into Rail

10.2 Set first module

Place the first module, taking care to line the module up to the rails and roof edges.

Module installation will go more smoothly if you take the time to get the first module lined up properly.

Tighten the two end clamps on the first module and snap in the next two clamps, which will typically be mid clamps, to prepare to receive the next module.

Proceed down the row placing one module at a time and tightening clamps as you go.

When you place the last module in the row,

secure it with end clamps to finish the row and repeat the process for the next row of modules.

10.3 Connect wiring

Connect module leads and train the wires into the rail channels as the modules are being installed. This will ensure a clean, robust electrical installation with no dangling wires. Use module lead clips as necessary to insure that module leads are secured to module frames until they drop into the rail channel. SnapNrack rail cover can be used to help retain the wire in the channel.

10.4 Connect grounding

Install grounding hardware per PV module manufacturer's specifications.

The Wiley Electronics WEEB is an acceptable grounding device for use with the SnapNrack rails. For istallation instruction download the WEEB installation guide from www.snapNrack.com

It is often convenient to install grounding hardware as modules are being installed but this will vary with the type of PV modules used.

10.5 Trim rails

Trim rail ends to leave about ½-inch of rail extending past the end of all module end clamps when the standard end clamps are

Connect wiring

Team work makes the job easier

Trim rails

Channel cover

used. If the UEC is used then the rails can be trimmed flush with the module frames.

Take care not to cut into the roof surface with the saw while trimming rails.

File off rail ends with a hand file and vacuum up metal shavings.

Careful planning will enable you to cut rails before they are installed on the roof.

11. Final check

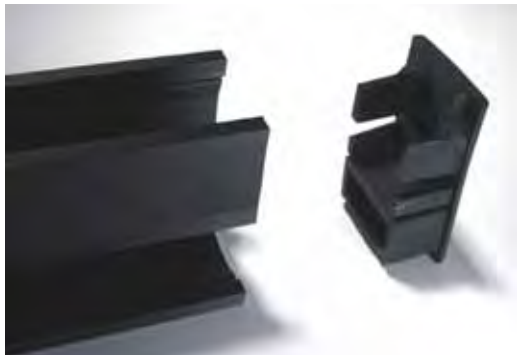
11.1 Check tightness of all bolts

Check all bolt torques to ensure that all 5/16-inch hardware is tightened to correct torque:

- **Silver hardware - 10-16 ft-lbs.**
- **Black Hardware - 7-9 ft-lbs.**

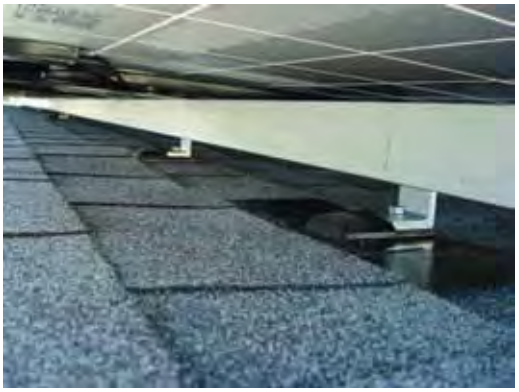
11.2 Check wires and grounding

Check under the array to ensure all wires are tucked up with module clips along the module frames and trained into the cable channels of the rails. The SnapNrack Channel cover can be used to retain the wires in the channels. It can be cut to short sections with a saw and snapped on to the channel as

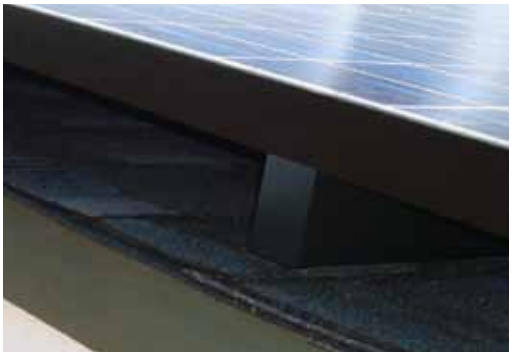


Rubber end cap

Check all bolts



Check under tha array for dangling wires



Rubber end cap installed

needed. Make certain you file down any sharp edges before installing it.

11.3 End Caps

The SnapNrack black rubber end caps should be installed now. They are simply pressed on to the end of the rail or if needed a rubber mallet can be used to tap them in place.

12.0 Array Edge Screen

12.1 Edge Screen Overview

SnapNrack Array Edge Screen is a complete solution for installing a barrier around the array to prevent the accumulation of large debris and the infiltration of the array by birds, rodents or other animals and pests.

12.2 Measure Array Perimeter

Measure the totla continuous perimter of each array. Screen comes in 100 fott rolls, if the perimeter is longer than 100 feet, an overlap of 2-3" should be used where screen edges meet.

12.3 Install Array Edge Screen Clips

Array Edge Clips can be snapped to length. Choose the break line closest to the necessary clip length. Break the clip in a vise or other fixture at that break line.

12.4 Trim and Install Edge Screen

Check under the array to ensure all wires are not in the path of the screen and then trim the screen to length with metal cutters. Put the screenin place making sure to minimize the gap between the bottom of the screen and the roof surface. If the screen is taller than the array, it can be trimmed to height as well.

Attach screen to clips with rivets and washers included in the kit. Thread forming screws can be used in place of rivets if desired. Make sure to use screws taht will not rust or corrode with weather exposure.

Fig 12.0 - Array Edge Screen Kit

Fig 12.1 - Array Edge Screen Assembly

Fig 12.2 - Array Edge Screen Installed

13. Appendix

13.1 Engineering certification letter

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STRUCTURAL CALCULATIONS, SPECIFICATIONS & SUMMARY

PREPARED FOR:

SYSTEM:

SnapNrack Series 100 PV Mounting System

DESIGNER:

SnapNrack
775 Fiero Lane, Suite 200
San Luis Obispo, CA 93401

PROJECT ENGINEERS:

Matthew Gilliss, P.E., LEED AP
Amy Ransom
Nathan White, P.E., S.E., LEED AP^{BD+C}
Michelle McCovey-Good, P.E.

We also have letters with engineering seals for other states. All engineering is done to IBC2009.

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SUMMARY LETTER

Date: January 1, 2012

To: SnapNrack

From: Matthew Gilliss
Taylor & Syfan Consulting Engineers

Project: SnapNrack Series 100 PV Mounting System

T&S Job No.: 10500

Subject: Summary Letter for Series 100

INTRODUCTION

This Project Summary Letter is in reference to the Structural Calculation Packet for the SnapNrack Series 100 Mounting System titled "Structural Calculations, Specification & Summary", dated January 2012. The calculations have been performed in accordance with the 2010 California Building Code (CBC), the governing structural code in California, which is based on the 2009 International Building Code (IBC). The 2009 IBC references the 2005 *Minimum Design Loads for Buildings and Other Structures*, including Supplement No. 1, No. 2, and Errata, by the American Society of Civil Engineers (ASCE) referred to as ASCE 7-05. The racking system has been designed to withstand code-prescribed forces due to the racking system's own weight, the weight of the solar panels, snow loads, and wind forces.

RAIL SPANS

In terms of variable conditions for the racking system, the main rails which support the solar panels (referred to as the "standard rails") have an adjustable length, which is the distance between their attachments to the roof (called standoffs). For the purpose of the calculation packet, that length was taken to be 8'-0", 6'-0", 4'-0", or 2'-0".

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Due to the many variables that are required to be taken into account during a wind analysis, we have determined multiple common cases for analysis. These cases are based upon several factors which include building height, pitch of the panels, wind exposure region, wind speed, snow loads, and topographic factors. Please note that panel tilts should be rounded to the nearest whole degree when using the provided charts to determine the maximum rail span(s).

SITE-SPECIFIC ANALYSIS

We have determined that the rails are able to span a maximum of 8'-0" for some of the common cases, but that there are certain cases which will require shorter spans and/or a location-sensitive analysis to be performed on a case-by-case basis. A site-specific analysis may be required if it is found that the location of the solar panel installation corresponds to any of the following criteria:

- The total pitch of the solar panel (solar panel pitch & roof pitch) is greater than 60 degrees above the horizontal. (Special note should be taken to measure the array tilt from the horizontal and NOT the mounting surface.)
- A topographic factor applies to the location. Topographic factors apply, for general purposes, when the structure is on a hill, mesa or bluff, or is adjacent to a large body of water. For complete descriptions of topographic factors, please refer to ASCE 7-05 Section 6.5.7.
- The roof of the structure that the solar panels will be installed on is greater than 50 ft. above grade.
- A combination of loads and/or site conditions applies that is not addressed in the attached rail span charts.

Verify all conditions with the local building official or a registered professional engineer. If one of more of these factors applies to the project location, please contact Taylor & Syfan, and we will be able to analyze the site conditions and recommend a standoff spacing for each specific site.

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RAIL DESIGN & TESTING

The aluminum rails have been designed in accordance with the 2005 Aluminum Design Manual (ADM) as referenced in the IBC. Conservative assumptions have been made when determining the allowable stresses in the analytical design, but due to the shape of the rails, testing was conducted per the standards set forth by the IBC Section 1715: Preconstruction Load Tests. The results of this testing procedure were used in comparison with the calculated values to help establish the maximum load allowed by the rails. The full procedure and results of these tests may be submitted upon request.

RACKING CONNECTIONS TO THE EXISTING ROOF

Also contained within the calculation packet are calculations for the connection of the rails to the roof framing. Using the sizes provided by SnapNrack, we have calculated the maximum forces that will be resisted based on the withdrawal value of the lag screws, and the strength of the aluminum components which are involved in transferring these forces from the rail to the roof framing. These components consist of the L-foot (SnapNrack Drawing PEN-D01), Standoff (PEN-D02, D03, D08, D09), Hybrid (PEN-D04), Seam Clamp (PEN-D05), Corrugated Block (PEN-D06), and Hanger Bolt (PEN-D07). All (6) options are acceptable under the parameters shown in SnapNrack's plans. The results from our analysis have been integrated into the summary charts.

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SUMMARY CHARTS AND TOPGRAPHIC FACTORS

The attached pages of this summary contain common building configurations with varying wind speeds. These charts can be used as a quick reference for looking up maximum rail span lengths based on the building and site conditions, but it must be noted that for any building where a topographic factor is to be applied (e.g. hills, bluffs, water) the rail span lengths given may exceed what is allowed for the given site condition. A registered professional engineer should evaluate the exact topographic conditions for the specific site prior to construction. (Taylor & Syfan may be retained for this evaluation, however they or another registered professional engineer should evaluate the site.)

EXISTING BUILDING LIMITATIONS

This summary letter discusses the structural adequacy of the solar racking system itself only and does not investigate or validate the adequacy of the structure that the racking system is being placed upon. It does not address the ability of the existing roofing or roof framing to support the new loads imposed upon them by the new system nor does it address the new localized forces between the roofing and the roof framing that may be imposed by the new standoff connections. It also does not address the additional lateral forces that will be imposed upon the building due to the seismic mass the new system adds to the existing roof. These various building-specific issues need to be evaluated by the appropriate registered professional(s) prior to the addition of the photovoltaic and racking systems. Taylor & Syfan may be consulted for building-specific structural evaluation. Taylor & Syfan assumes that systems are installed to the specifications presented here and using good structural judgment by the installer. Additionally, as an optional service, we recommend the performance of structural observations of the installation, as a best practice service, by Taylor & Syfan.

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Please note that all sizes, material specifications, and weights have been provided by SnapNrack. Installation must be in accordance with SnapNrack drawings as noted:

DRAWING TITLE	REVISION
S100-D00	E
S100-D01	E
S100-D02	E
S100-D03	E
S100-D04	E
S100-D05	E
S100-D06	E
S100-D07	E
S100-D08	E
S100-D09	E
S100-D10	E
S100-D11	E
PEN-D01	E
PEN-D02	E
PEN-D03	E
PEN-D04	E
PEN-D05	E
PEN-D06	E
PEN-D07	E
PEN-D08	E
PEN-D09	E
S100-RSD	E
S100-TKT	E

Please see SnapNrack's plans for limits on the bolt parameters. Torque all 5/16" diameter hardware as specified in SnapNrack's plans (10-16 ft-lbs for Silver Stainless Steel and 7-9 ft-lbs for black Stainless Steel). Torque bolts sufficiently to prevent loosening, but do not damage bolts or threaded parts. Periodic inspection of connections is required. It is the

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SUMMARY LETTER

responsibility of SnapNrack's customer to verify the site-specific design forces (wind speed, ground snow load, etc.) before using the charts contained in this packet.

All waterproofing, corrosion protection, roofing, egress and access pathways, setbacks, non-structural issues and drainage issues are the responsibility of SnapNrack's customer, otherwise known as the contractor or professional solar installer. Construction of any and all structures is under the jurisdiction of the local building official and building enforcement agency, which shall review and approve all projects prior to commencement of construction.

Please let us know if you have any questions or comments. Thank you.

Sincerely,

Matthew B. Gilliss, P.E., LEED A.P.
Senior Managing Engineer
Taylor & Syfan Consulting Engineers

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STRUCTURAL SPECIFICATIONS

GENERAL

1. Do not scale drawings. Contractor shall use dimensions on architectural plans to lay out array, foundations and other elements. If dimensional questions occur, REC Solar, Inc. / SnapNrack (REC) must be consulted.

2. All construction and materials shall comply with and be installed in accordance with all the requirements of all legally constituted public authorities having jurisdiction, including all county and local ordinances, and the Safety Orders of the State Industrial Accident Commission, OSHA.

3. The Contractor shall be responsible for shoring and providing bracing during construction and/or erection to support all loads to which the structure may be subjected.

4. The Engineer will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the construction delineated by these plans. It should be understood that the contractor or his/her agent(s) shall supervise and direct all work and shall be solely and completely responsible for all construction means, methods, techniques, sequences, procedures, and conditions on the job site, including safety of all persons and property during the entire period of construction. Periodic observations by Taylor & Syfan Consulting Engineers Incorporated (or "Taylor & Syfan" typ.) personnel or representatives are not intended to include verification of dimensions or review the adequacy of the contractors safety measures on or near the construction site.

5. No deviations are allowed from the structural details without the written approval of the Engineer. Approval by Building Enforcement Agency, Inspector, Special Inspector, or any other party does not constitute authority to deviate from plans or specifications. All plan changes or addenda are subject to approval of the Building Enforcement Agency. The processing of changes, assembly of permit documents, and acquisition of permits is the responsibility of the Contractor.

6. Special Inspectors shall obtain Building Enforcement Agency clearance prior to any work commencement. Copies of the inspection report(s) to be filed by the special inspector(s) shall be given to the Engineer. The Contractor is responsible for scheduling, coordination, and expenses involved in any and all inspections.

7. Taylor & Syfan's drawings are prepared to convey only the specific structural aspects of each detail. Non-structural information, including but not limited to fenestrations, fire-resistance, insulation, finishes, waterproofing, drainage and flashing may not be included on the structural plans. Taylor & Syfan is not responsible for non-structural information. The Contractor shall obtain the non-structural information for each detail from REC and Others.

Central Coast:
684 Clarion Court
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(805)547.2000
(805)547.2001 fax
(800)579.3881

Southern California:
1276 E. Colorado Blvd.
Suite 201
Pasadena, CA 91106
(626)793.7438
(626)793.7439 fax

STRUCTURAL SPECIFICATIONS

8. The Building Inspector shall inspect and approve all construction for conformance to the construction documents and building code. Additionally, structural observation by Taylor & Syfan or another structural engineer is recommended to verify general conformance.

9. All construction projects require inspection and maintenance following completion. Operation, inspection, and maintenance are the sole responsibility of the Owner. The Engineer shall have no responsibility for any failures due to deviance from or neglect of the proper installation procedures presented in this installation packet. Ensure that workers, equipment and other loading are not applied to the PV modules or racking throughout the life of the structure.

10. The drawings, calculations, notes and specifications contained herein and provided herewith are the exclusive property of Taylor & Syfan, Copyright © 2012. The use of these calculations and specifications shall be restricted to the original plans, provided by REC, for which they were prepared and publication thereof is expressly limited to such use. Reproduction or publication by any method, in whole or in part, is prohibited without written permission of Taylor & Syfan. Title to these drawings, calculations, notes and specifications shall remain with Taylor & Syfan without prejudice.

STEEL REQUIREMENTS

1. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

1. Cold-formed metal, other steel, and hardware exposed to weather, soil, or moisture shall be galvanized or have similar corrosion protection. Finishing requirements for exposed steel and hardware are by others.

ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size:	**39" x 66"**
Building Ht.:	**30 ft. or Less**

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)									Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120	0	10	20	30	40	60	80	100	120
85	8	8	6	6	4	2	2	2	NG	8	8	6	6	4	4	2	2	2
90	8	8	6	6	4	2	2	2	NG	8	8	6	6	4	4	2	2	2
100	6	6	6	6	4	2	2	2	NG	8	8	6	6	4	4	2	2	2
105	6	6	6	6	4	2	2	2	NG	8	8	6	6	4	4	2	2	2
110	6	6	6	6	4	2	2	2	NG	8	8	6	6	4	4	2	2	2
120	6	6	6	6	4	2	2	2	NG	6	6	6	6	4	4	2	2	2
135	4	4	4	4	4	2	2	2	NG	6	6	6	6	4	4	2	2	2
150	4	4	4	4	4	2	2	2	NG	6	6	6	6	4	4	2	2	2

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)									Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120	0	10	20	30	40	60	80	100	120
85	8	8	6	6	6	4	2	2	2	8	8	8	8	6	6	4	4	4
90	8	8	6	6	6	4	2	2	2	8	8	8	8	6	6	4	4	4
100	8	8	6	6	6	4	2	2	2	8	8	8	8	6	6	4	4	4
105	8	8	6	6	6	4	2	2	2	8	8	8	8	6	6	4	4	4
110	8	8	6	6	6	4	2	2	2	8	8	8	8	6	6	4	4	4
120	6	6	6	6	6	4	2	2	2	6	6	6	6	6	6	4	4	4
135	6	6	6	6	6	4	2	2	2	6	6	6	6	6	6	4	4	4
150	6	6	6	6	6	4	2	2	2	6	6	6	6	6	6	4	4	4

TILT = 20° to < 30°

TILT = 45° to < 60°

Notes:
Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.

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ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size:	**39" x 66"**
Building Ht.:	**31 ft. to 50 ft.**

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	6	4	2	2	2	NG
90	8	8	6	6	4	2	2	2	NG
100	6	6	6	6	4	2	2	2	NG
105	6	6	6	6	4	2	2	2	NG
110	6	6	6	6	4	2	2	2	NG
120	6	6	6	6	4	2	2	2	NG
135	4	4	4	4	4	2	2	2	NG
150	4	4	4	4	4	2	2	2	NG

TILT = 20° to < 30°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	6	4	4	2	2	2
90	8	8	6	6	4	4	2	2	2
100	8	8	6	6	4	4	2	2	2
105	8	8	6	6	4	4	2	2	2
110	6	6	6	6	4	4	2	2	2
120	6	6	6	6	4	4	2	2	2
135	6	6	6	6	4	4	2	2	2
150	4	4	4	4	4	4	2	2	2

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	6	6	4	2	2	2
90	8	8	6	6	6	4	2	2	2
100	8	8	6	6	6	4	2	2	2
105	8	8	6	6	6	4	2	2	2
110	6	6	6	6	6	4	2	2	2
120	6	6	6	6	6	4	2	2	2
135	6	6	6	6	6	4	2	2	2
150	4	4	4	4	4	4	2	2	2

TILT = 45° to < 60°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	8	8	6	6	4	4	4
90	8	8	8	8	6	6	4	4	4
100	8	8	8	8	6	6	4	4	4
105	8	8	8	8	6	6	4	4	4
110	8	8	8	8	6	6	4	4	4
120	6	6	6	6	6	6	4	4	4
135	6	6	6	6	6	6	4	4	4
150	6	6	6	6	6	6	4	4	4

Notes:

Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.

ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size:	**39" x 78"**
Building Ht.:	**30 ft. or Less**

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	4	4	2	2	NG	NG
90	8	8	6	4	4	2	2	NG	NG
100	6	6	6	4	4	2	2	NG	NG
105	6	6	6	4	4	2	2	NG	NG
110	6	6	6	4	4	2	2	NG	NG
120	6	6	6	4	4	2	2	NG	NG
135	4	4	4	4	4	2	2	NG	NG
150	2	2	2	2	2	2	2	NG	NG

TILT = 20° to < 30°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	6	4	2	2	2	NG
90	8	8	6	6	4	2	2	2	NG
100	8	8	6	6	4	2	2	2	NG
105	8	8	6	6	4	2	2	2	NG
110	6	6	6	6	4	2	2	2	NG
120	6	6	6	6	4	2	2	2	NG
135	6	6	6	6	4	2	2	2	NG
150	4	4	4	4	4	2	2	2	NG

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	6	4	4	2	2	2
90	8	8	6	6	4	4	2	2	2
100	8	8	6	6	4	4	2	2	2
105	8	8	6	6	4	4	2	2	2
110	6	6	6	6	4	4	2	2	2
120	6	6	6	6	4	4	2	2	2
135	6	6	6	6	4	4	2	2	2
150	4	4	4	4	4	4	2	2	2

TILT = 45° to < 60°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	8	6	6	6	4	2	2
90	8	8	8	6	6	6	4	2	2
100	8	8	8	6	6	6	4	2	2
105	8	8	8	6	6	6	4	2	2
110	6	6	6	6	6	6	4	2	2
120	6	6	6	6	6	6	4	2	2
135	6	6	6	6	6	6	4	2	2
150	4	4	4	4	4	4	4	2	2

Notes:
Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.

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ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size:	**39" x 78"**
Building Ht.:	**31 ft. to 50 ft.**

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	4	4	2	2	NG	NG
90	6	6	6	4	4	2	2	NG	NG
100	6	6	6	4	4	2	2	NG	NG
105	6	6	6	4	4	2	2	NG	NG
110	6	6	6	4	4	2	2	NG	NG
120	4	4	4	4	4	2	2	NG	NG
135	4	4	4	4	4	2	2	NG	NG
150	2	2	2	2	2	2	2	NG	NG

TILT = 20° to < 30°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	6	4	2	2	2	NG
90	8	8	6	6	4	2	2	2	NG
100	8	8	6	6	4	2	2	2	NG
105	6	6	6	6	4	2	2	2	NG
110	6	6	6	6	4	2	2	2	NG
120	6	6	6	6	4	2	2	2	NG
135	6	6	6	6	4	2	2	2	NG
150	4	4	4	4	4	2	2	2	NG

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	6	6	4	4	2	2	2
90	8	8	6	6	4	4	2	2	2
100	8	8	6	6	4	4	2	2	2
105	6	6	6	6	4	4	2	2	2
110	6	6	6	6	4	4	2	2	2
120	6	6	6	6	4	4	2	2	2
135	6	6	6	6	4	4	2	2	2
150	4	4	4	4	4	4	2	2	2

TILT = 45° to < 60°

Wind Speed Nominal 3 Sec. Gust (MPH)	Ground Snow Load (PSF)								
	0	10	20	30	40	60	80	100	120
85	8	8	8	6	6	6	4	2	2
90	8	8	8	6	6	6	4	2	2
100	8	8	8	6	6	6	4	2	2
105	6	6	6	6	6	6	4	2	2
110	6	6	6	6	6	6	4	2	2
120	6	6	6	6	6	6	4	2	2
135	6	6	6	6	6	6	4	2	2
150	4	4	4	4	4	4	4	2	2

Notes:

Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.

ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size: 39" x 66"
Building Ht.: 30 ft. or Less

THIS CHART IS FOR ESTIMATION PURPOSES ONLY. SITES WITH TOPOGRAPHIC FACTORS SHALL HAVE A STRUCTURAL ENGINEER CALCULATE THE EXACT FACTOR PRIOR TO CONSTRUCTION.

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	6	6	6
90	6	6	6
100	6	6	6
105	6	4	4
110	6	4	4
120	4	4	4
135	4	2	2
150	2	2	2

TILT = 20° to < 30°

Topographic Conditions		
Top Half of Hill	Water Condition	Bluff Condition
8	8	8
8	6	6
6	6	6
6	6	6
6	6	6
6	6	4
6	4	4
4	2	2

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	8	8	8
90	8	6	6
100	6	6	6
105	6	6	6
110	6	6	6
120	6	6	4
135	6	4	4
150	4	2	2

TILT = 45° to < 60°

Topographic Conditions		
Top Half of Hill	Water Condition	Bluff Condition
8	8	8
8	6	6
8	6	6
6	6	6
6	6	6
6	6	6
6	4	4
4	2	2

Notes:
Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.
No snow load taken into account with topographic effects. If site has snow loads AND topographic effects, please contact Taylor & Syfan.

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ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size:	**39" x 66"**
Building Ht.:	**30 ft. to 50 ft.**

THIS CHART IS FOR ESTIMATION PURPOSES ONLY. SITES WITH TOPOGRAPHIC FACTORS SHOULD HAVE A STRUCTURAL ENGINEER CALCULATE THE EXACT FACTOR PRIOR TO CONSTRUCTION.

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	6	6	6
90	6	6	6
100	6	4	4
105	6	4	4
110	4	4	4
120	4	2	2
135	2	2	2
150	2	2	2

TILT = 20° to < 30°

Topographic Conditions		
Top Half of Hill	Water Condition	Bluff Condition
8	6	6
8	6	6
6	6	6
6	6	6
6	6	6
6	4	4
4	4	4
4	2	2

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	8	6	6
90	8	6	6
100	6	6	6
105	6	6	6
110	6	6	6
120	6	4	4
135	4	4	4
150	4	2	2

TILT = 45° to < 60°

Topographic Conditions		
Top Half of Hill	Water Condition	Bluff Condition
8	8	6
8	6	6
6	6	6
6	6	6
6	6	6
6	4	4
4	4	4
4	2	2

Notes:

Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.

No snow load taken into account with topographic effects. If site has snow loads AND topographic effects, please contact Taylor & Syfan.

ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size:	**39" x 78"**
Building Ht.:	**30 ft. or Less**

THIS CHART IS FOR ESTIMATION PURPOSES ONLY. SITES WITH TOPOGRAPHIC FACTORS SHOULD HAVE A STRUCTURAL ENGINEER CALCULATE THE EXACT FACTOR PRIOR TO CONSTRUCTION.

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	6	6	6
90	6	6	6
100	6	4	4
105	6	4	4
110	4	4	4
120	4	2	2
135	2	2	2
150	2	2	2

TILT = 20° to < 30°

Topographic Conditions		
Top Half of Hill	Water Condition	Bluff Condition
8	6	6
8	6	6
6	6	6
6	6	6
6	6	6
6	4	4
4	4	2
4	2	2

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	8	6	6
90	8	6	6
100	6	6	6
105	6	6	6
110	6	6	6
120	6	4	4
135	4	4	2
150	4	2	2

TILT = 45° to < 60°

Topographic Conditions		
Top Half of Hill	Water Condition	Bluff Condition
8	6	6
8	6	6
6	6	6
6	6	6
6	6	6
6	4	4
4	4	4
4	2	2

Notes:

Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.

No snow load taken into account with topographic effects. If site has snow loads AND topographic effects, please contact Taylor & Syfan.

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ASCE 7-05 Roof Wind Force Analysis - Version 2.00a

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.)

Maximum Panel Size: 39" x 78"
Building Ht.: 30 ft. to 50 ft.

THIS CHART IS FOR ESTIMATION PURPOSES ONLY. SITES WITH TOPOGRAPHIC FACTORS SHOULD HAVE A STRUCTURAL ENGINEER CALCULATE THE EXACT FACTOR PRIOR TO CONSTRUCTION.

TILT = 0° to < 20°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	6	6	6
90	6	4	4
100	6	4	4
105	4	4	4
110	4	2	2
120	4	2	2
135	2	2	2
150	2	2	2

TILT = 20° to < 30°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	8	6	6
90	6	6	6
100	6	6	6
105	6	6	6
110	6	4	4
120	4	4	4
135	4	2	2
150	2	2	2

TILT = 30° to < 45°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	8	6	6
90	6	6	6
100	6	6	6
105	6	6	6
110	6	4	4
120	4	4	4
135	4	2	2
150	2	2	2

TILT = 45° to < 60°

Wind Speed Nominal 3 Sec. Gust (MPH)	Topographic Conditions		
	Top Half of Hill	Water Condition	Bluff Condition
85	8	6	6
90	6	6	6
100	6	6	6
105	6	6	6
110	6	4	4
120	6	4	4
135	4	2	2
150	2	2	2

Notes:
Shaded cells indicate a required 2 ft. reduction in rail span for panels within roof edge zones. See page S19 for roof edge zone description.
No snow load taken into account with topographic effects. If site has snow loads AND topographic effects, please contact Taylor & Syfan.

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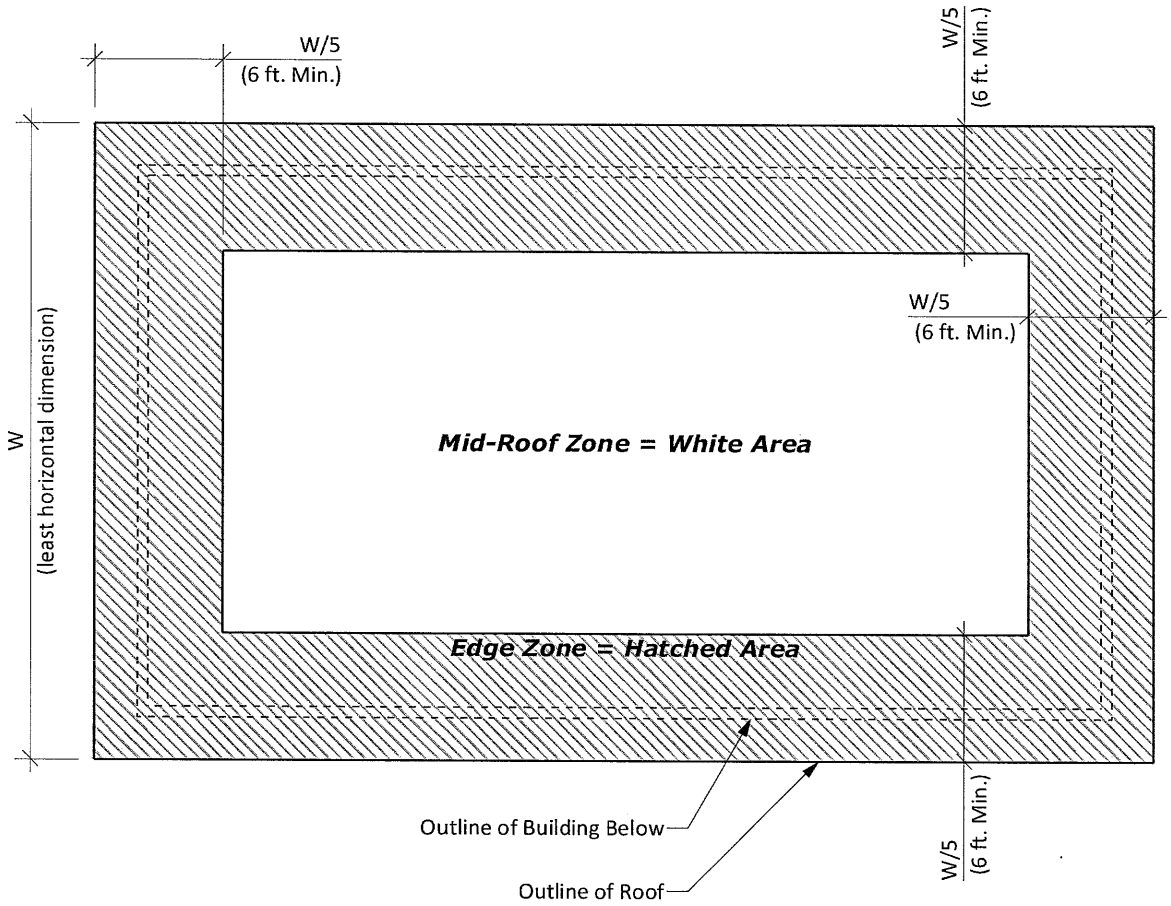
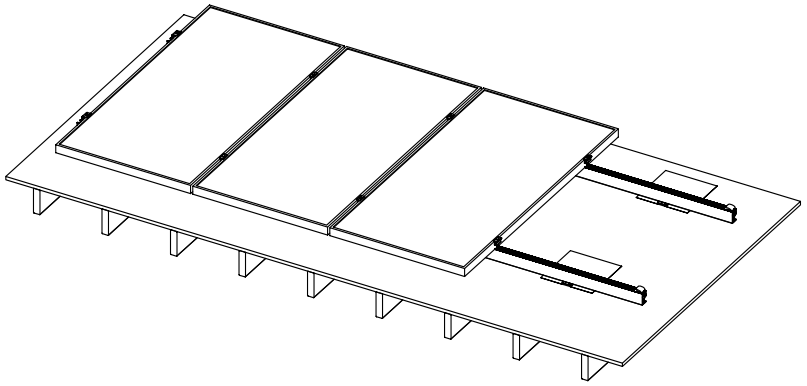
EDGE ZONE DEFINITION (Plan View):

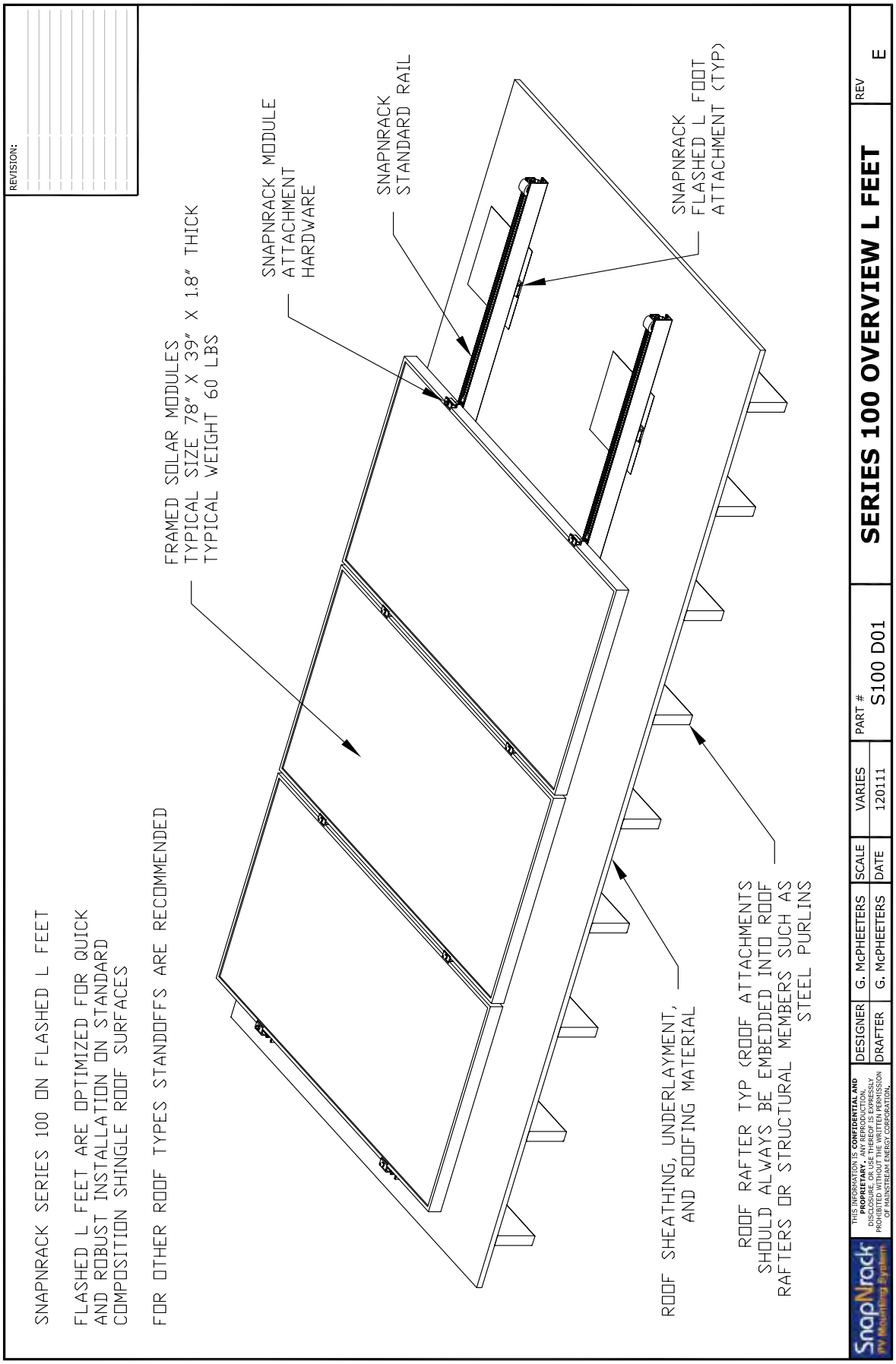


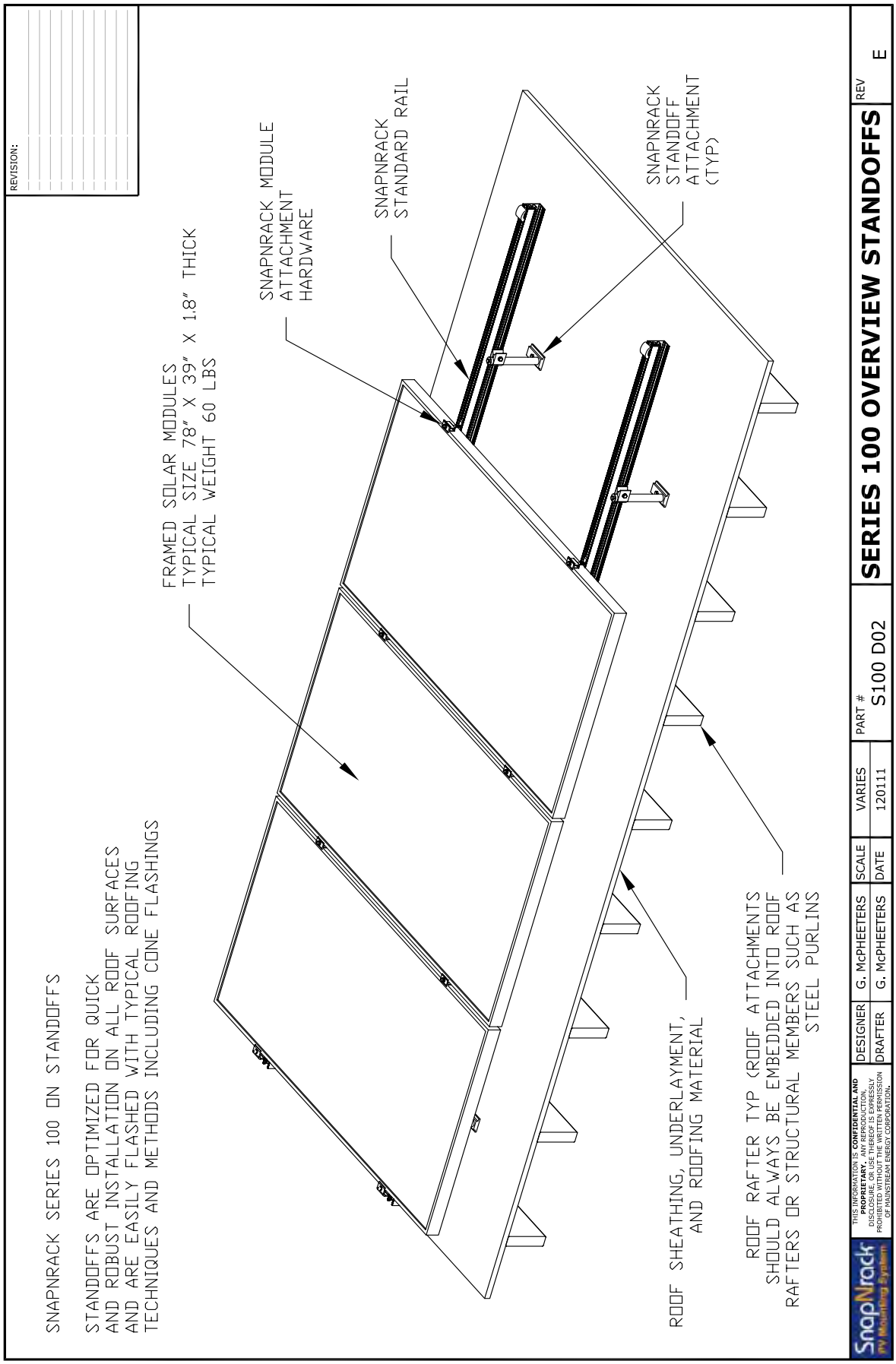
REVISION:

S100 D00 2012 SERIES 100 DRAWING SET COVER
S100 D01 2012 SERIES 100 OVERVIEW L FEET
S100 D02 2012 SERIES 100 OVERVIEW STANDOFFS
S100 D03 2012 SERIES 100 ASSEMBLY DETAILS UEC
S100 D04 2012 SERIES 100 ASSEMBLY DETAILS TOP MT.
S100 D05 2012 SERIES 100 TYPICAL LAYOUT
S100 D06 2012 SERIES 100 RAIL LEVELING
S100 D07 2012 SERIES 100 TILT KITS 0-15 DEG
S100 D08 2012 SERIES 100 TILT KITS 10-45 DEG DRILLED
S100 D09 2012 SERIES 100 TILT KITS 10-45 DEG GRIP NUT (IN DEVELOPMENT)
S100 D10 2012 SERIES 100 RAIL LEVELING HD STANDOFF
S100 D11 2012 SERIES 100 TILT KITS 10-45 DEG SEAM CLAMPS
S100 PEN D01 2012 PEN DETAIL 01 FLASHED L FOOT
S100 PEN D02 2012 PEN DETAIL 02 STANDOFF
S100 PEN D03 2012 PEN DETAIL 03 STANDOFF TO PURLIN
S100 PEN D04 2012 PEN DETAIL 04 STANDOFF ON L FOOT BASE
S100 PEN D05 2012 PEN DETAIL 05 SEAM CLAMP
S100 PEN D06 2012 PEN DETAIL 06 CORRUGATED BLOCK
S100 PEN D07 2012 PEN DETAIL 07 HANGER BOLT
S100 PEN D08 2012 PEN DETAIL 08 STANDOFF JOIST
S100 PEN D09 2012 PEN DETAIL 09 HD STANDOFF
S100 TKT 2012 SERIES 100 TILT KIT TOOL



DESIGNER	G. McPHEETERS	SCALE	VARIES	PART #	**SERIES 100 DRAWING SET COVER**	REV
DRAFTER	G. McPHEETERS	DATE	120111	S100 D00		E


REVISION:
SNAPNRACK SERIES 100 ON FLASHED L FEET
FLASHED L FEET ARE OPTIMIZED FOR QUICK AND ROBUST INSTALLATION ON STANDARD COMPOSITION SHINGLE ROOF SURFACES
FOR OTHER ROOF TYPES STANDOFFS ARE RECOMMENDED
FRAMED SOLAR MODULES
TYPICAL SIZE 78" X 39" X 1.8" THICK
TYPICAL WEIGHT 60 LBS
SNAPNRACK MODULE ATTACHMENT HARDWARE
SNAPNRACK STANDARD RAIL
SNAPNRACK FLASHED L FOOT ATTACHMENT (TYP)
ROOF SHEATHING, UNDERLAYMENT, AND ROOFING MATERIAL
ROOF RAFTER TYP (ROOF ATTACHMENTS SHOULD ALWAYS BE EMBEDDED INTO ROOF RAFTERS OR STRUCTURAL MEMBERS SUCH AS STEEL PURLINS
SnapNrack PV Mounting System
THIS INFORMATION IS CONFIDENTIAL AND PROPRIETARY. ANY REPRODUCTION, DISCLOSURE, OR USE THEREOF IS EXPRESSLY PROHIBITED WITHOUT THE WRITTEN PERMISSION OF MAINSTREAM ENERGY CORPORATION.
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE VARIES
DATE 120111
PART # S100 D01
SERIES 100 OVERVIEW L FEET
REV E


REVISION:
SNAPNRACK SERIES 100 ON STANDOFFS
STANDOFFS ARE OPTIMIZED FOR QUICK AND ROBUST INSTALLATION ON ALL ROOF SURFACES AND ARE EASILY FLASHED WITH TYPICAL ROOFING TECHNIQUES AND METHODS INCLUDING CONE FLASHINGS
FRAMED SOLAR MODULES
TYPICAL SIZE 78" X 39" X 1.8" THICK
TYPICAL WEIGHT 60 LBS
SNAPNRACK MODULE ATTACHMENT HARDWARE
SNAPNRACK STANDARD RAIL
SNAPNRACK STANDOFF ATTACHMENT (TYP)
ROOF SHEATHING, UNDERLAYMENT, AND ROOFING MATERIAL
ROOF RAFTER TYP (ROOF ATTACHMENTS SHOULD ALWAYS BE EMBEDDED INTO ROOF RAFTERS OR STRUCTURAL MEMBERS SUCH AS STEEL PURLINS
SnapNrack PV Mounting System
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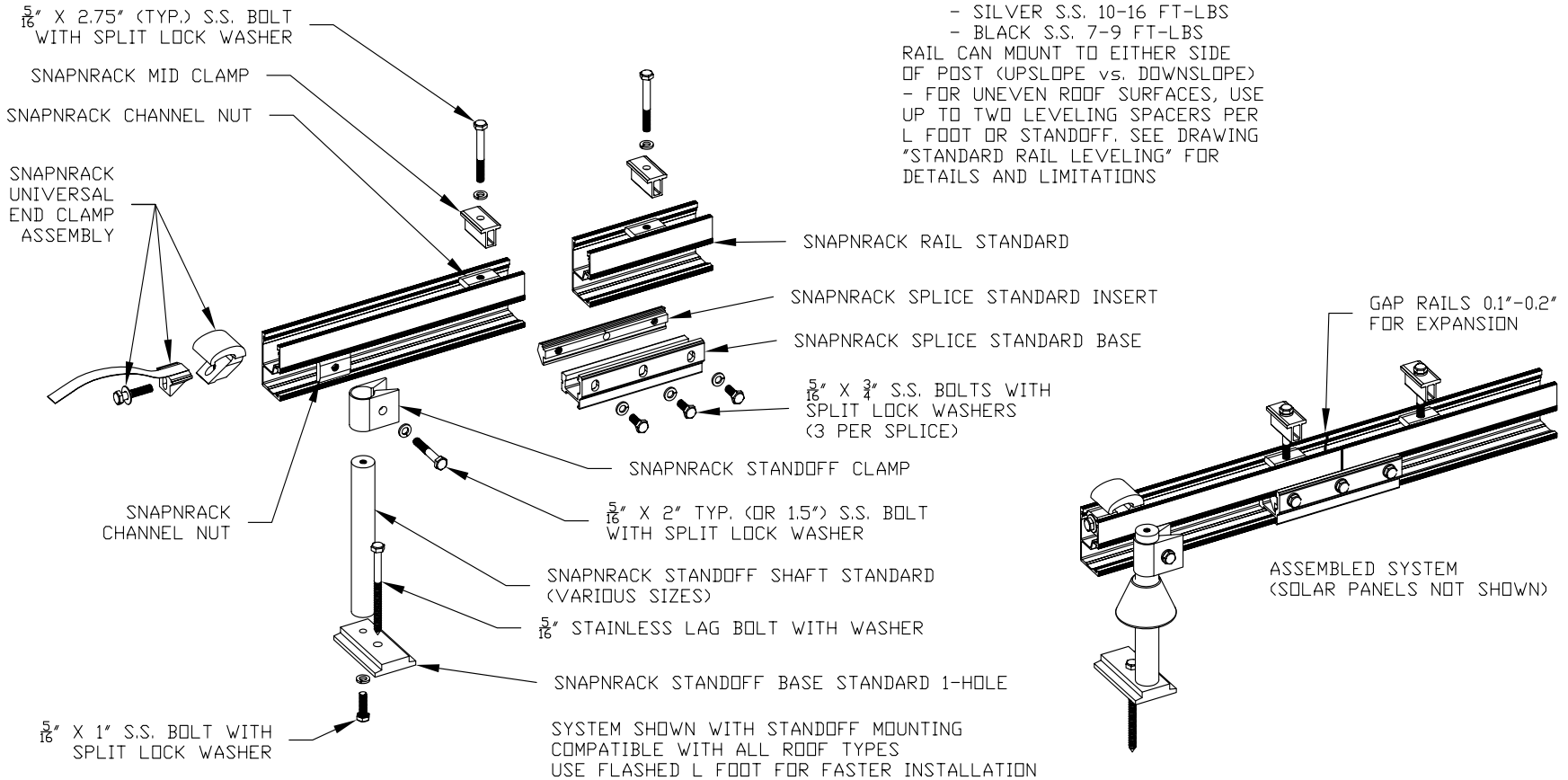
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE VARIES
DATE 120111
PART # S100 D02
SERIES 100 OVERVIEW STANDOFFS
REV E

REVISION:

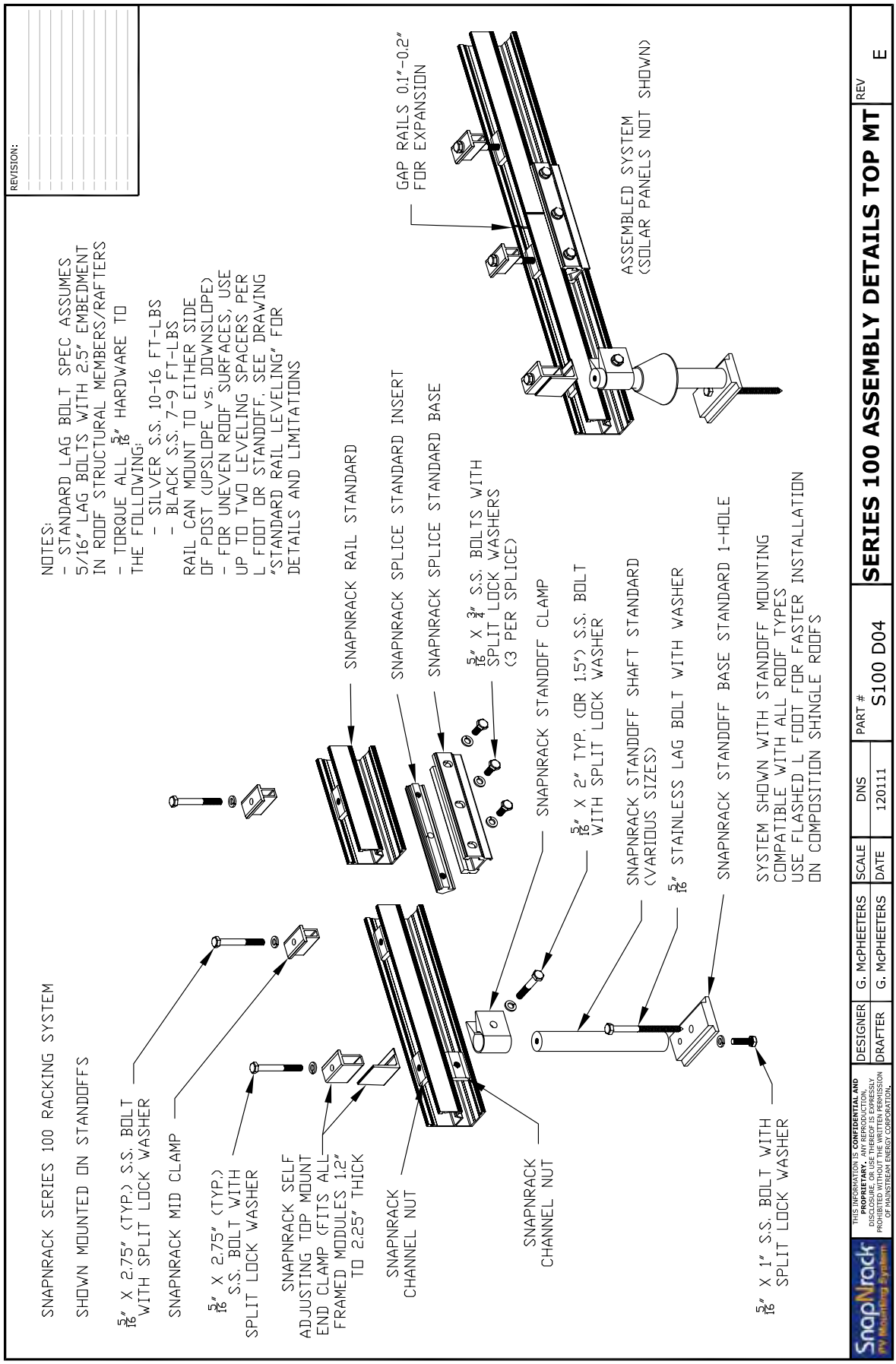
SNAPNRACK SERIES 100 RACKING SYSTEM

SHOWN MOUNTED ON STANDOFFS

NOTES:
- STANDARD LAG BOLT SPEC ASSUMES 5/16" LAG BOLTS WITH 2.5" EMBEDMENT IN ROOF STRUCTURAL MEMBERS/RAFTERS
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS
RAIL CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE vs. DOWNSLOPE)
- FOR UNEVEN ROOF SURFACES, USE UP TO TWO LEVELING SPACERS PER L FOOT OR STANDOFF. SEE DRAWING "STANDARD RAIL LEVELING" FOR DETAILS AND LIMITATIONS



SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	DNS	PART # S100 D03	**SERIES 100 ASSEMBLY DETAILS UEC** REV E
		DRAFTER	G. McPHEETERS	DATE	120111		

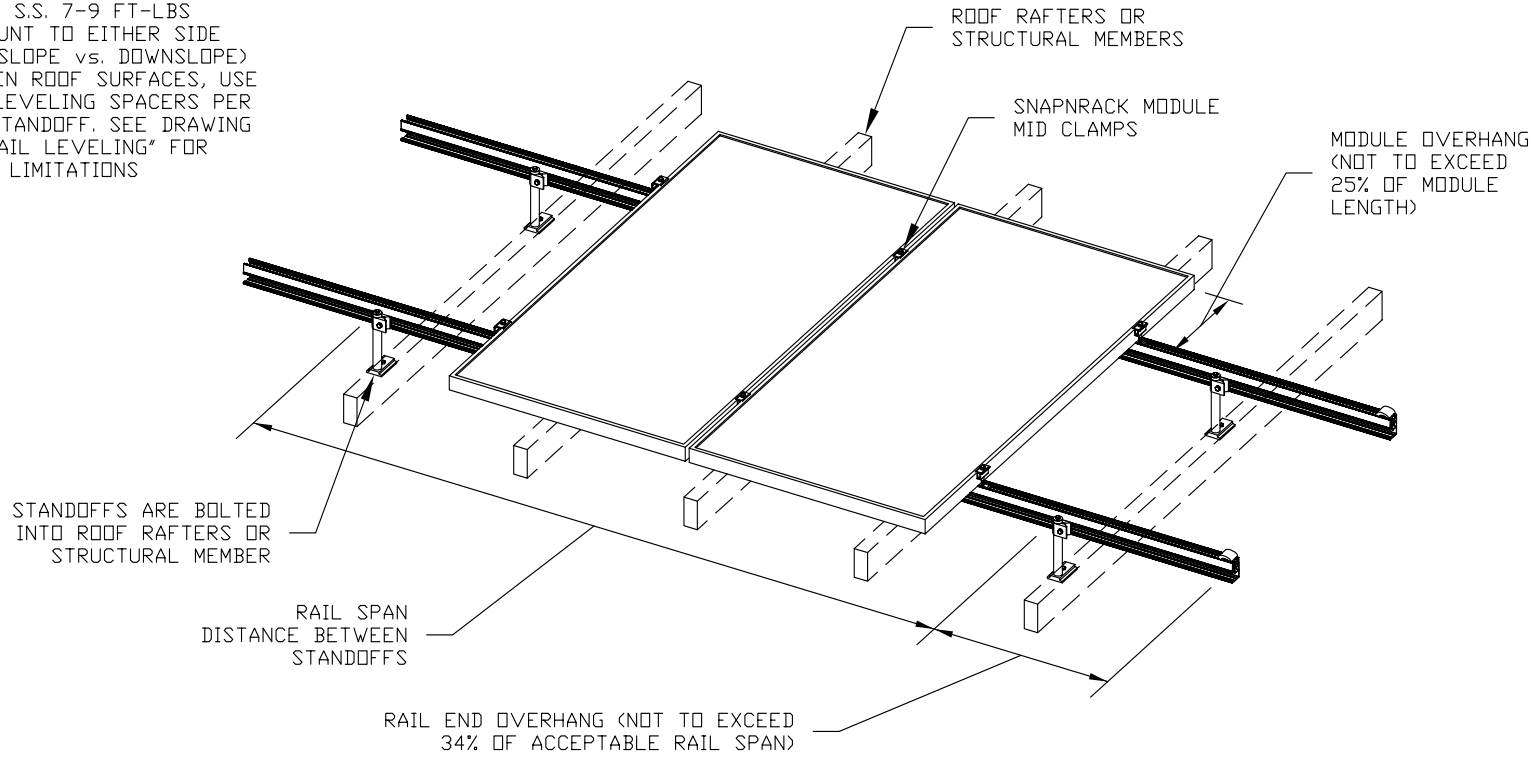

SNAPNRACK SERIES 100 RACKING SYSTEM
SHOWN MOUNTED ON STANDOFFS
5/16" X 2.75" (TYP.) S.S. BOLT WITH SPLIT LOCK WASHER
SNAPNRACK MID CLAMP
5/16" X 2.75" (TYP.) S.S. BOLT WITH SPLIT LOCK WASHER
SNAPNRACK SELF ADJUSTING TOP MOUNT END CLAMP (FITS ALL FRAMED MODULES 1.2" TO 2.25" THICK
SNAPNRACK CHANNEL NUT
5/16" X 1" S.S. BOLT WITH SPLIT LOCK WASHER
NOTES:
- STANDARD LAG BOLT SPEC ASSUMES 5/16" LAG BOLTS WITH 2.5" EMBEDMENT IN ROOF STRUCTURAL MEMBERS/RAFTERS
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
- SILVER S.S. 10-16 FT-LBS
- BLACK S.S. 7-9 FT-LBS
RAIL CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE vs. DOWNSLOPE)
- FOR UNEVEN ROOF SURFACES, USE UP TO TWO LEVELING SPACERS PER L FOOT OR STANDOFF. SEE DRAWING "STANDARD RAIL LEVELING" FOR DETAILS AND LIMITATIONS
SNAPNRACK RAIL STANDARD
SNAPNRACK SPLICE STANDARD INSERT
SNAPNRACK SPLICE STANDARD BASE
5/16" X 3/4" S.S. BOLTS WITH SPLIT LOCK WASHERS (3 PER SPLICE)
SNAPNRACK STANDOFF CLAMP
5/16" X 2" TYP. (OR 1.5") S.S. BOLT WITH SPLIT LOCK WASHER
SNAPNRACK STANDOFF SHAFT STANDARD (VARIOUS SIZES)
5/16" STAINLESS LAG BOLT WITH WASHER
SNAPNRACK STANDOFF BASE STANDARD 1-HOLE
SYSTEM SHOWN WITH STANDOFF MOUNTING COMPATIBLE WITH ALL ROOF TYPES
USE FLASHED L FOOT FOR FASTER INSTALLATION ON COMPOSITION SHINGLE ROOFS
GAP RAILS 0.1"-0.2" FOR EXPANSION
ASSEMBLED SYSTEM (SOLAR PANELS NOT SHOWN)
REVISION:
SnapNrack PV Mounting System
THIS INFORMATION IS CONFIDENTIAL AND PROPRIETARY. ANY REPRODUCTION, DISCLOSURE OR USE OF THIS DRAWING IS EXPRESSLY PROHIBITED WITHOUT THE WRITTEN PERMISSION OF MAINSTREAM ENERGY CORPORATION.
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE
DATE
DNS 120111
PART # S100 D04
SERIES 100 ASSEMBLY DETAILS TOP MT
REV E

REVISION:

SNAPNRACK SERIES 100 RACKING SYSTEM TYPICAL ROOF LAYOUT

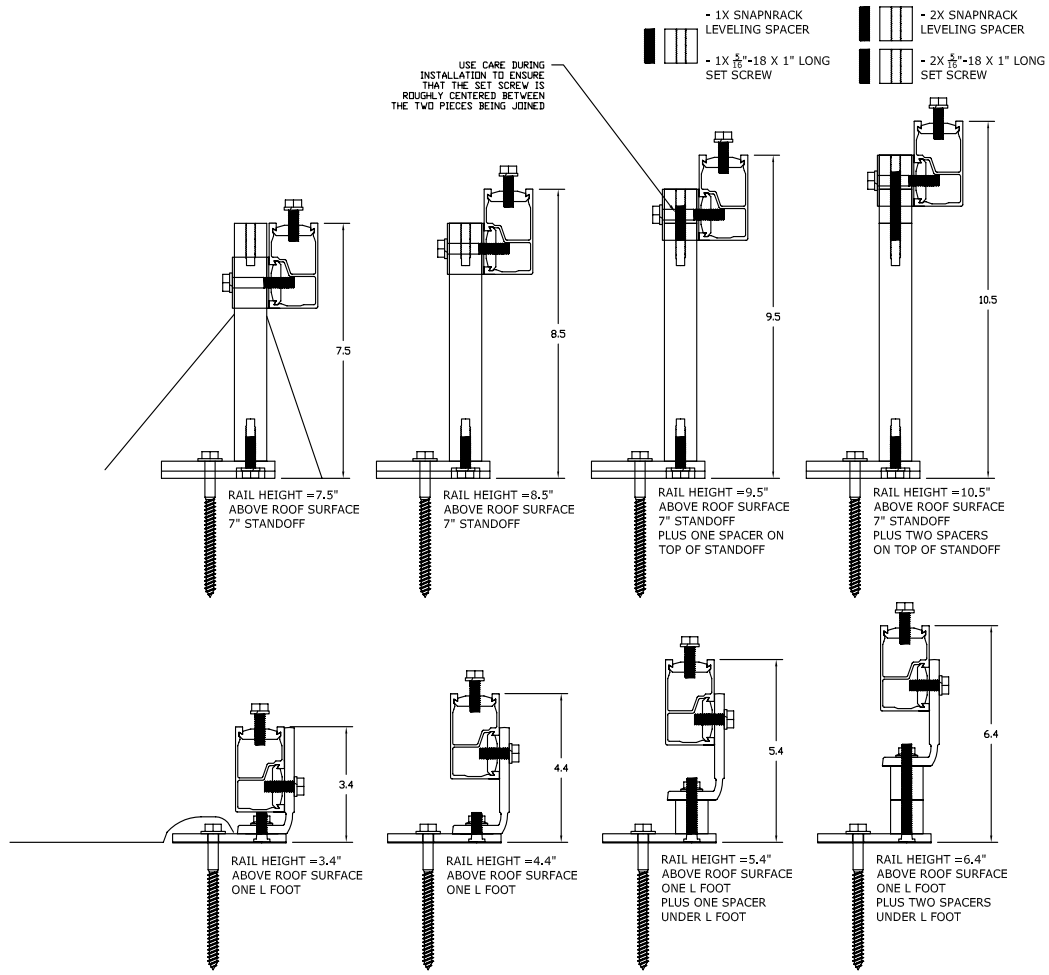
NOTES:
- STANDARD LAG BOLT SPEC ASSUMES 5/16" LAG BOLTS WITH 2.5" EMBEDMENT IN ROOF STRUCTURAL MEMBERS/RAFTERS
- TORQUE ALL $\frac{5}{16}$" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS

RAIL CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE vs. DOWNSLOPE)
- FOR UNEVEN ROOF SURFACES, USE UP TO TWO LEVELING SPACERS PER L FOOT OR STANDOFF. SEE DRAWING "STANDARD RAIL LEVELING" FOR DETAILS AND LIMITATIONS



SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	VARIES	PART # S100 D05	**SERIES 100 TYPICAL LAYOUT** REV E
		DRAFTER	G. McPHEETERS	DATE	120111		

REVISION:



STANDARD SERIES 100 ATTACHMENTS FEATURE 3" OF VERTICAL ADJUSTABILITY ON ALL MOUNTING POINTS WITH THE USE OF 1" LEVELING SPACERS

THE FIRST INCH OF ADJUSTABILITY IS ACCOMPLISHED WITH SLIDING FEATURES BUILT INTO BOTH L FOOT AND STANDOFF CLAMP COMPONENTS

FOR AN ADDITIONAL INCH OF HEIGHT ADJUSTMENT, ADD ONE LEVELING SPACER. USE OF SINGLE LEVELING SPACER NOT TO EXCEED 30% OF ATTACHMENT POINTS.

FOR A SECOND ADDITIONAL INCH OF HEIGHT ADJUSTMENT, ADD ANOTHER LEVELING SPACER. USE OF TWO LEVELING SPACERS NOT TO EXCEED 10% OF ATTACHMENT POINTS.

THE LIMITS ABOVE APPLY WHEN YOU ARE AT THE MAXIMUM STANDOFF HEIGHT DEPENDING ON THE STANDOFF BASE BEING USED. FOR STANDOFFS ON L FOOT BASES, THE MAXIMUM STANDOFF HEIGHT (BEFORE APPLYING THE LIMITATIONS ABOVE) IS 3". FOR STANDOFFS ON STANDOFF BASES, THE MAXIMUM HEIGHT BEFORE APPLYING THE LIMITATIONS ABOVE IS 10".

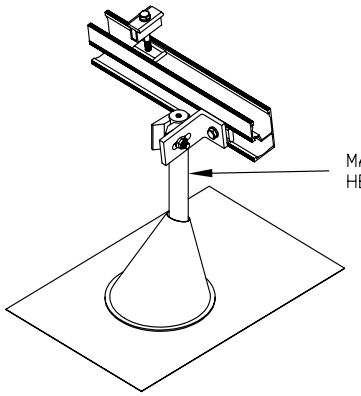
DESIGNER	G. McPHEETERS	SCALE	DNS	PART #	**SERIES 100 RAIL LEVELING**	REV
DRAFTER	G. McPHEETERS	DATE	120111	S100 D06		E

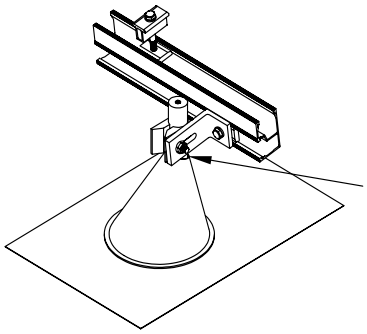
REVISION:

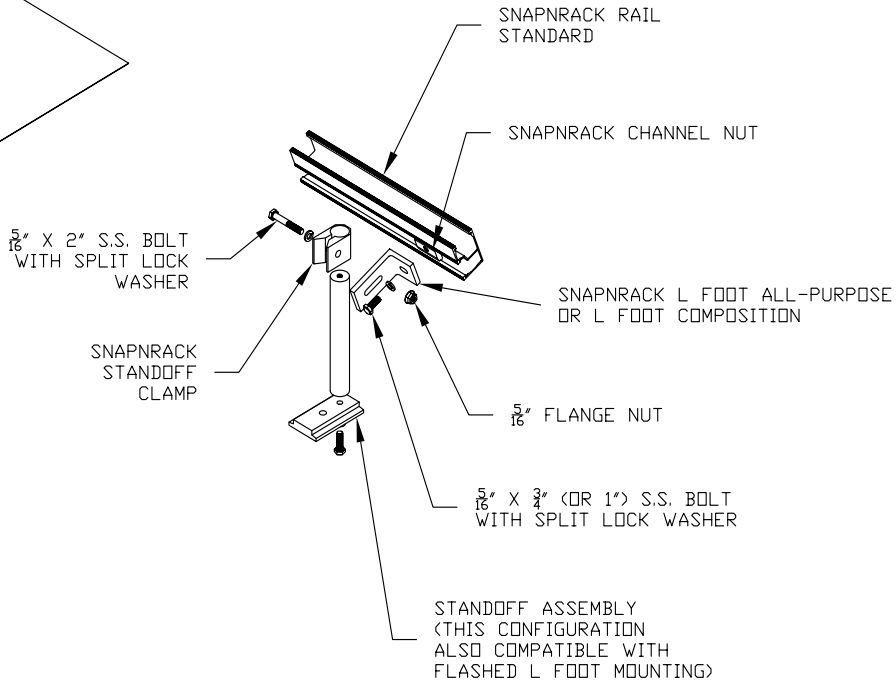
USE TILT KIT OPTION FOR INSTALLATIONS THAT REQUIRE MODULES TO BE TILTED ABOVE THE EXISTING ROOF SLOPE

LOW TILT SYSTEM SHOWN IS DESIGNED FOR TILT ANGLES FROM 0 TO 15 DEGREES ABOVE ROOF SURFACE

USE OF ANTI-SEIZE ON TILT HARDWARE IS RECOMMENDED (PARTICULARLY FOR STAINLESS TO STAINLESS HARDWARE)







NOTES:

- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS
- DO NOT EXCEED RAIL SPANS FOR LOCAL DESIGN WIND SPEED REQUIREMENTS
- FOR HIGHER TILT APPLICATIONS SEE "SERIES 100 TILT KITS 10-45 DEG"

SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	VARIES	PART # S100 D07	**SERIES 100 TILT KITS 0-15 DEG**	REV E
		DRAFTER	G. McPHEETERS	DATE	120111			

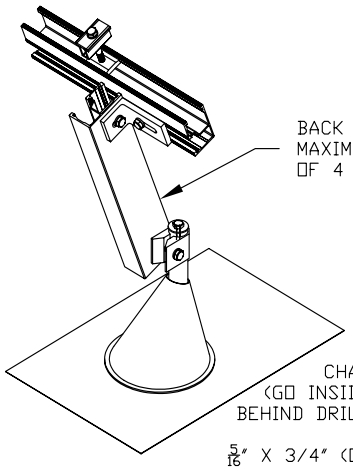
USE TILT KIT OPTION FOR INSTALLATIONS THAT REQUIRE MODULES TO BE TILTED ABOVE THE EXISTING ROOF SLOPE

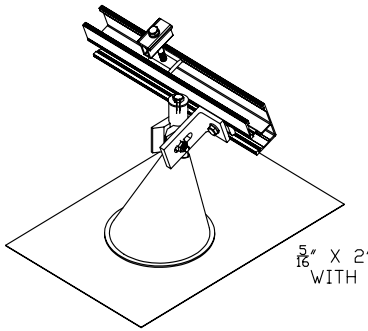
SYSTEM SHOWN IS DESIGNED FOR TILT ANGLES FROM 10 TO 45 DEGREES ABOVE ROOF SURFACE

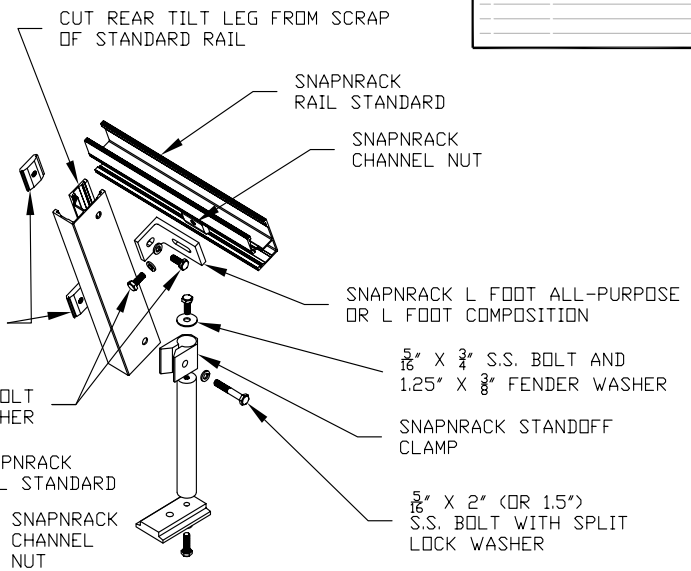
USE OF ANTI-SEIZE ON TILT HARDWARE IS RECOMMENDED (PARTICULARLY FOR STAINLESS TO STAINLESS HARDWARE)

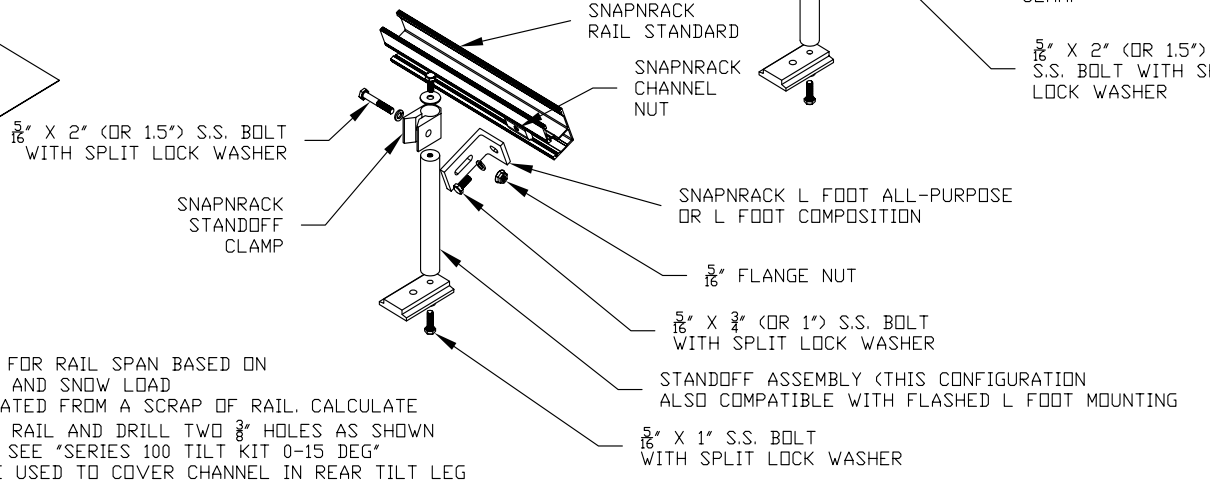
REFER TO S100 TKT SERIES 170 TILT KIT TOOL FOR A SIMPLE TOOL THAT DRAMATICALLY SIMPLIFIES TILT KIT INSTALLATION BY SUPPORTING THE UPPER RAIL AHEAD OF MODULE INSTALLATION

REVISION:









NOTES:

- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS
- REFER TO ENGINEERING CHARTS FOR RAIL SPAN BASED ON MODULE TILT ANGLE, WIND SPEED, AND SNOW LOAD
- BACK SUPPORT "LEG" IS FABRICATED FROM A SCRAP OF RAIL. CALCULATE REQUIRED TILT LEG LENGTH. CUT RAIL AND DRILL TWO 3/8" HOLES AS SHOWN
- FOR LOWER TILT APPLICATIONS SEE "SERIES 100 TILT KIT 0-15 DEG"
- SNAPNRACK RAIL COVER CAN BE USED TO COVER CHANNEL IN REAR TILT LEG

SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	VARIES	PART # S100 D08	**SERIES 100 TILT KITS 10-45 DEG DRILLED** REV E
		DRAFTER	G. McPHEETERS	DATE	120111		

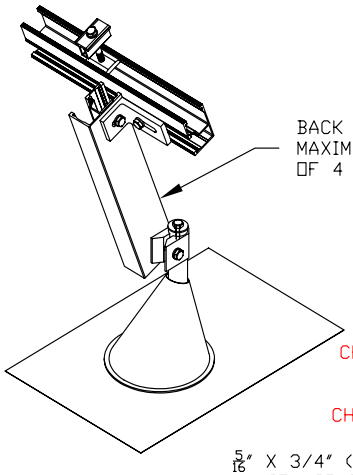
USE TILT KIT OPTION FOR INSTALLATIONS THAT REQUIRE MODULES TO BE TILTED ABOVE THE EXISTING ROOF SLOPE

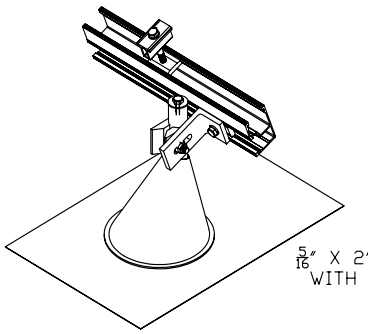
SYSTEM SHOWN IS DESIGNED FOR TILT ANGLES FROM 10 TO 45 DEGREES ABOVE ROOF SURFACE

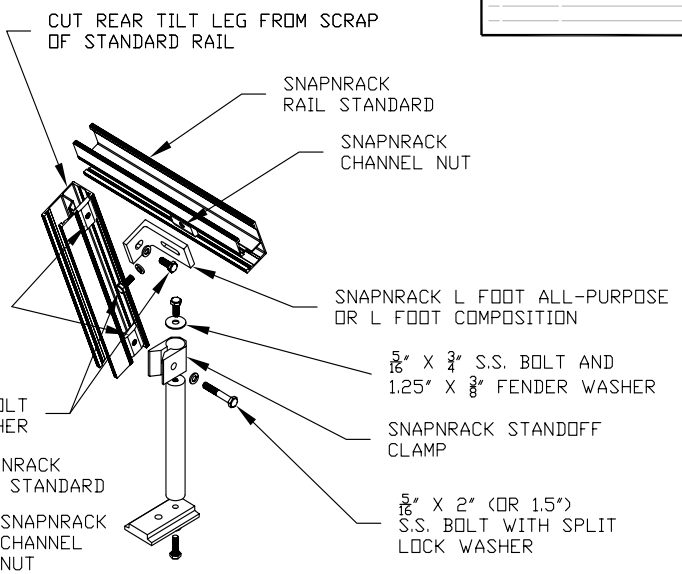
USE OF ANTI-SEIZE ON TILT HARDWARE IS RECOMMENDED (PARTICULARLY FOR STAINLESS TO STAINLESS HARDWARE)

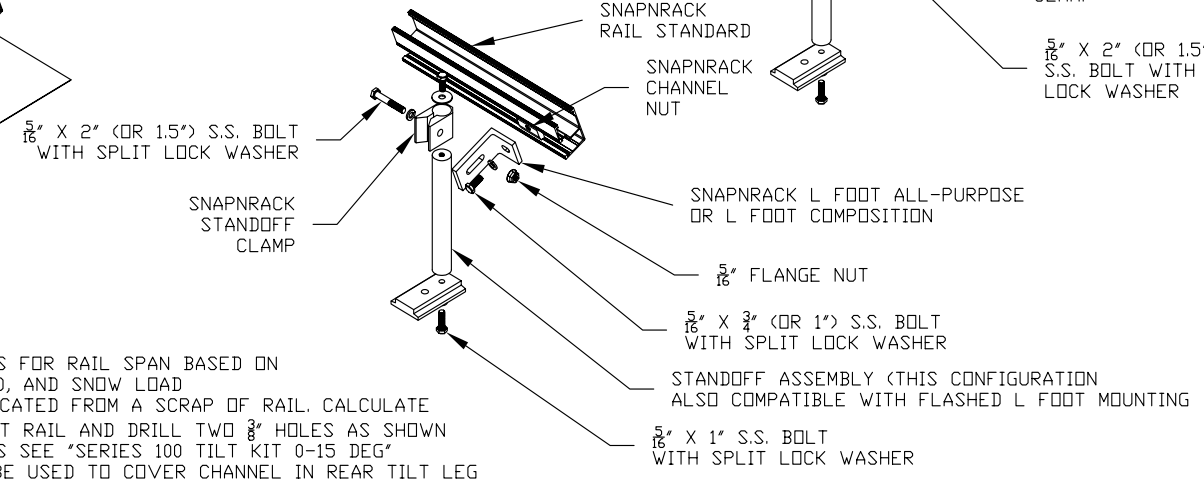
REFER TO S100 TKT SERIES 170 TILT KIT TOOL FOR A SIMPLE TOOL THAT DRAMATICALLY SIMPLIFIES TILT KIT INSTALLATION BY SUPPORTING THE UPPER RAIL AHEAD OF MODULE INSTALLATION

REVISION:









NOTES:

- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS
- REFER TO ENGINEERING CHARTS FOR RAIL SPAN BASED ON MODULE TILT ANGLE, WIND SPEED, AND SNOW LOAD
- BACK SUPPORT "LEG" IS FABRICATED FROM A SCRAP OF RAIL. CALCULATE REQUIRED TILT LEG LENGTH. CUT RAIL AND DRILL TWO 3/8" HOLES AS SHOWN
- FOR LOWER TILT APPLICATIONS SEE "SERIES 100 TILT KIT 0-15 DEG"
- SNAPNRACK RAIL COVER CAN BE USED TO COVER CHANNEL IN REAR TILT LEG

SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	VARIES	PART # S100 D09	**SERIES 100 TILT KITS 10-45 DEG GRIP NUT**	REV E
		DRAFTER	G. McPHEETERS	DATE	120111			

REVISION:

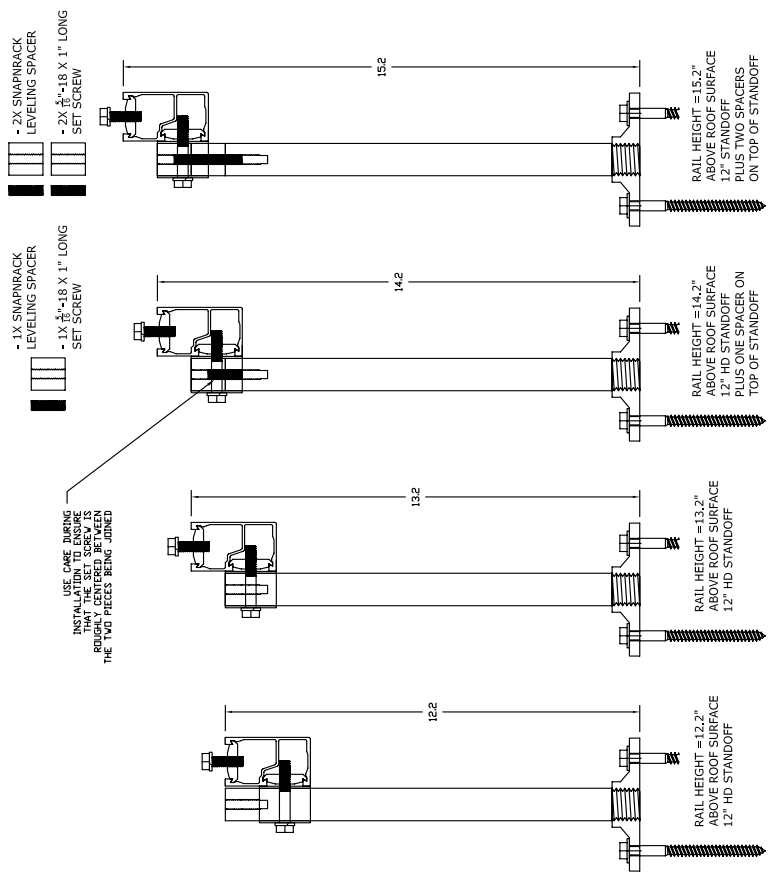
STANDARD SERIES 100 ATTACHMENTS FEATURE 3" OF VERTICAL ADJUSTABILITY ON ALL MOUNTING POINTS WITH THE USE OF 1" LEVELING SPACERS

THE FIRST INCH OF ADJUSTABILITY IS ACCOMPLISHED WITH SLIDING FEATURES BUILT INTO BOTH L FOOT AND STANDOFF CLAMP COMPONENTS

FOR AN ADDITIONAL INCH OF HEIGHT ADJUSTMENT, ADD ONE LEVELING SPACER. USE OF SINGLE LEVELING SPACER NOT TO EXCEED 30% OF ATTACHMENT POINTS.

FOR A SECOND ADDITIONAL INCH OF HEIGHT ADJUSTMENT, ADD ANOTHER LEVELING SPACER. USE OF TWO LEVELING SPACERS NOT TO EXCEED 10% OF ATTACHMENT POINTS.

THE LIMITS ABOVE APPLY WHEN YOU ARE AT THE MAXIMUM STANDOFF HEIGHT DEPENDING ON THE STANDOFF BASE BEING USED. FOR HD STANDOFFS ON HD STANDOFF BASES, THE MAXIMUM STANDOFF HEIGHT (BEFORE APPLYING THE LIMITATIONS ABOVE) IS 12".



SnapNrack PV Mounting System

DESIGNER	G. McPHEETERS	SCALE	
DRAFTER	G. McPHEETERS	DATE	

DNS	PART #
120111	S100 D10

SERIES 100 RAIL LEVELING HD STANDOFF

REV E

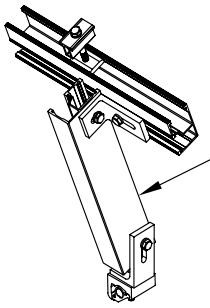
REVISION:

USE TILT KIT OPTION FOR INSTALLATIONS THAT REQUIRE MODULES TO BE TILTED ABOVE THE EXISTING ROOF SLOPE

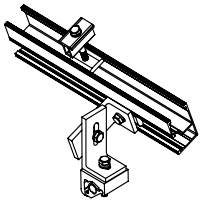
SYSTEM SHOWN IS DESIGNED FOR TILT ANGLES FROM 10 TO 45 DEGREES ABOVE ROOF SURFACE ON STANDING SEAM METAL ROOFS

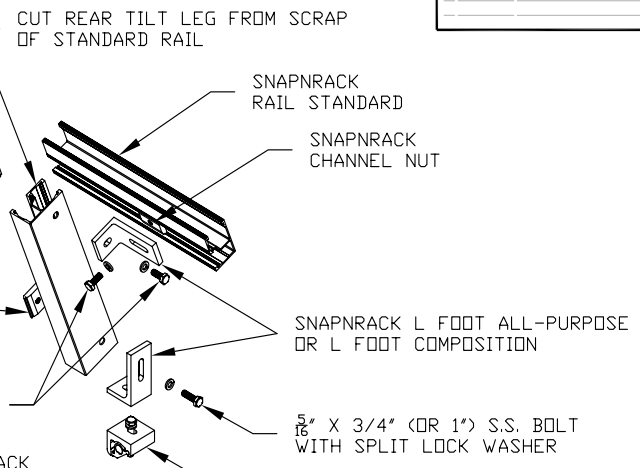
USE OF ANTI-SEIZE ON TILT HARDWARE IS RECOMMENDED (PARTICULARLY FOR STAINLESS TO STAINLESS HARDWARE)

REFER TO S100 TKT SERIES 170 TILT KIT TOOL FOR A SIMPLE TOOL THAT DRAMATICALLY SIMPLIFIES TILT KIT INSTALLATION BY SUPPORTING THE UPPER RAIL AHEAD OF MODULE INSTALLATION



BACK TILT LEG
MAXIMUM LENGTH
OF 4 FEET





CUT REAR TILT LEG FROM SCRAP OF STANDARD RAIL

SNAPNRACK
RAIL STANDARD

SNAPNRACK
CHANNEL NUT

SNAPNRACK
CHANNEL NUTS
(GO INSIDE CHANNEL
BEHIND DRILLED HOLES

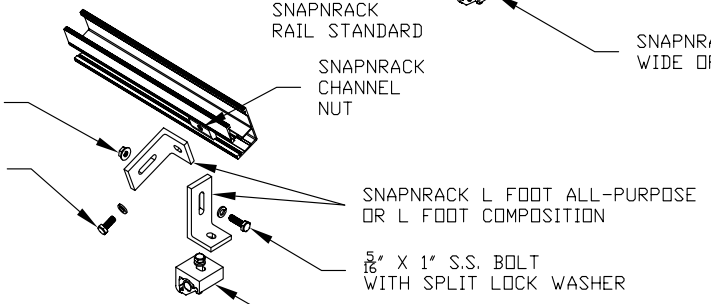
SNAPNRACK L FOOT ALL-PURPOSE
OR L FOOT COMPOSITION

5/16" X 3/4" (OR 1") S.S. BOLT
WITH SPLIT LOCK WASHER

5/16" X 3/4" (OR 1") S.S. BOLT
WITH SPLIT LOCK WASHER

SNAPNRACK
RAIL STANDARD

SNAPNRACK SEAM CLAMP
WIDE OR STANDARD BASE



5/16" FLANGE NUT

SNAPNRACK
CHANNEL
NUT

5/16" X 3/4" (OR 1") S.S. BOLT
WITH SPLIT LOCK WASHER

SNAPNRACK L FOOT ALL-PURPOSE
OR L FOOT COMPOSITION

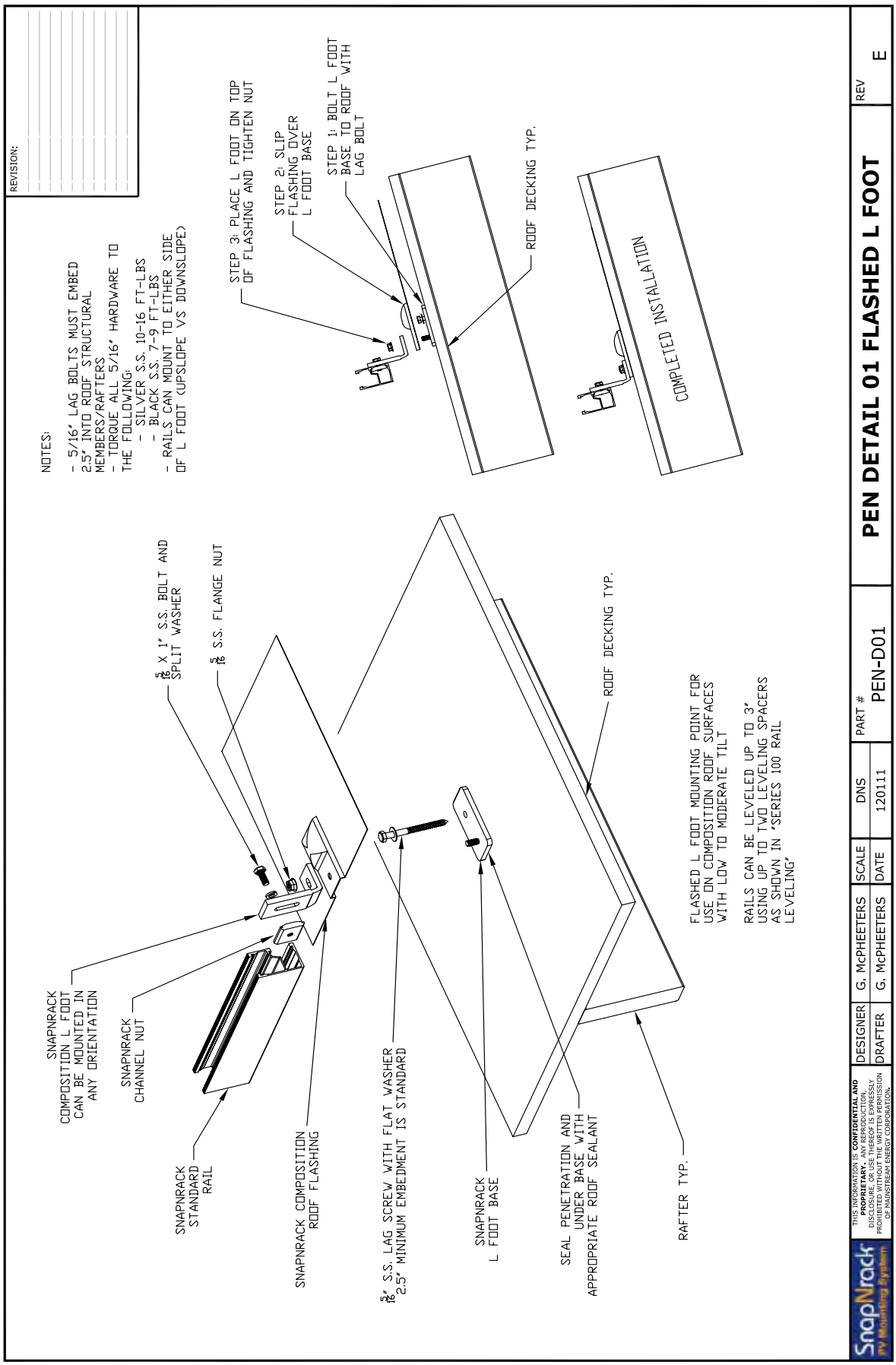
5/16" X 1" S.S. BOLT
WITH SPLIT LOCK WASHER

SNAPNRACK SEAM CLAMP
WIDE OR STANDARD BASE

NOTES:

- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS
- REFER TO ENGINEERING CHARTS FOR RAIL SPAN BASED ON MODULE TILT ANGLE, WIND SPEED, AND SNOW LOAD
- BACK SUPPORT "LEG" IS FABRICATED FROM A SCRAP OF RAIL. CALCULATE REQUIRED TILT LEG LENGTH. CUT RAIL AND DRILL TWO 3/8" HOLES AS SHOWN
- FOR LOWER TILT APPLICATIONS SEE "SERIES 100 TILT KIT 0-15 DEG"
- SNAPNRACK RAIL COVER CAN BE USED TO COVER CHANNEL IN REAR TILT LEG

SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	VARIES	PART # S100 D11	**SERIES 100 TILT KITS 10-45 DEG SEAM CLAMPS** REV E
		DRAFTER	G. McPHEETERS	DATE	120111		


REVISION:
NOTES:
- 5/16" LAG BOLTS MUST EMBED 2.5" INTO ROOF STRUCTURAL MEMBERS/RAFTERS
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
- SILVER S.S. 10-16 FT-LBS
- BLACK S.S. 7-9 FT-LBS
- RAILS CAN MOUNT TO EITHER SIDE OF L FOOT (UPSLOPE VS DOWNSLOPE)
STEP 3: PLACE L FOOT ON TOP OF FLASHING AND TIGHTEN NUT
STEP 2: SLIP FLASHING OVER L FOOT BASE
STEP 1: BOLT L FOOT BASE TO ROOF WITH LAG BOLT
ROOF DECKING TYP.
COMPLETED INSTALLATION
SNAPNRACK COMPOSITION L FOOT CAN BE MOUNTED IN ANY ORIENTATION
SNAPNRACK CHANNEL NUT
SNAPNRACK STANDARD RAIL
SNAPNRACK COMPOSITION ROOF FLASHING
5/16" S.S. LAG SCREW WITH FLAT WASHER 2.5" MINIMUM EMBEDMENT IS STANDARD
5/16" X 1" S.S. BOLT AND SPLIT WASHER
5/16" S.S. FLANGE NUT
SNAPNRACK L FOOT BASE
SEAL PENETRATION AND UNDER BASE WITH APPROPRIATE ROOF SEALANT
RAFTER TYP.
ROOF DECKING TYP.
FLASHED L FOOT MOUNTING POINT FOR USE ON COMPOSITION ROOF SURFACES WITH LOW TO MODERATE TILT
RAILS CAN BE LEVELED UP TO 3" USING UP TO TWO LEVELING SPACERS AS SHOWN IN "SERIES 100 RAIL LEVELING"
SnapNrack PV Mounting System
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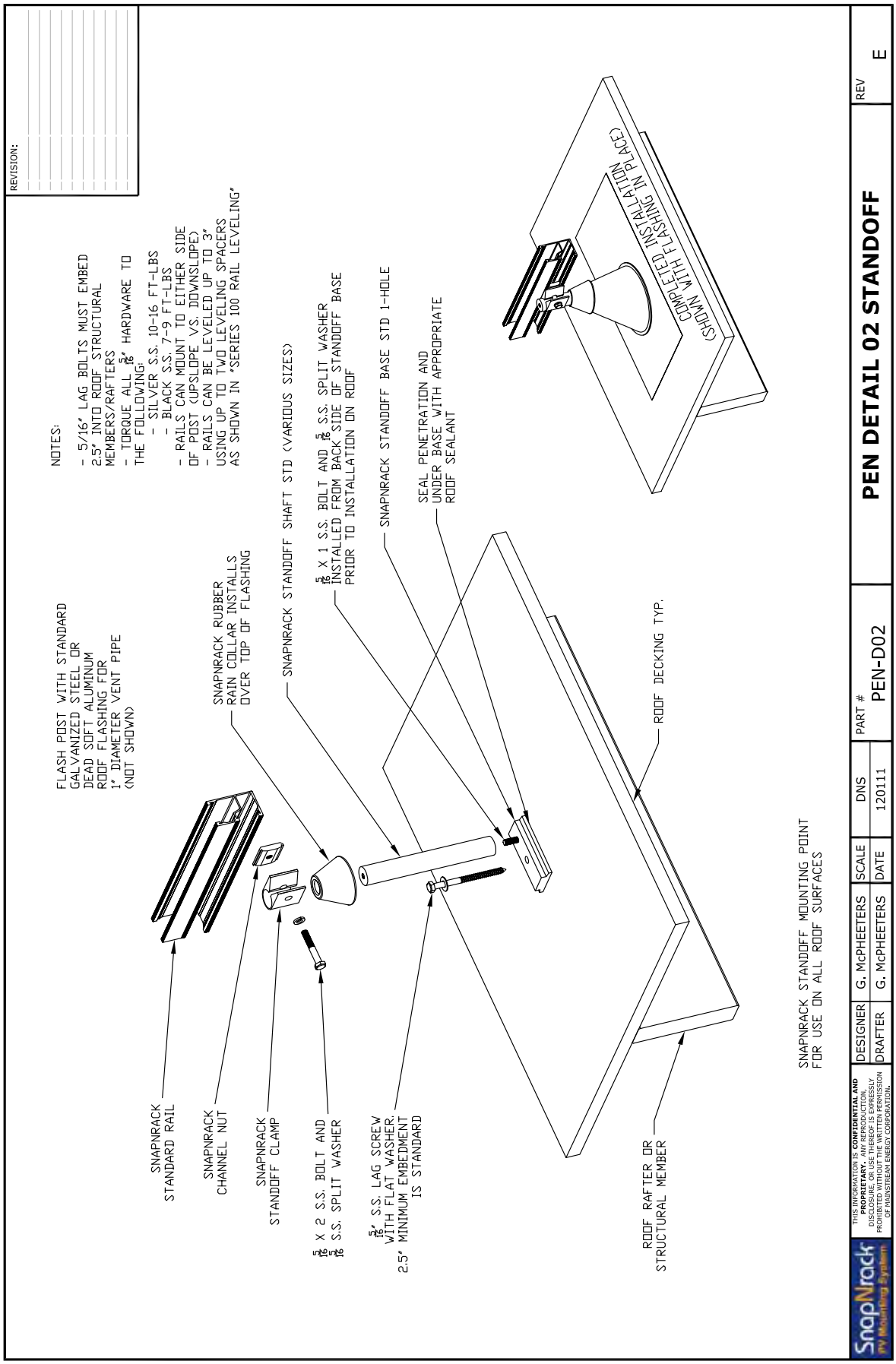
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE
DATE
DNS
120111
PART # PEN-D01
PEN DETAIL 01 FLASHED L FOOT
REV E


REVISION:
NOTES:
- 5/16" LAG BOLTS MUST EMBED 2.5" INTO ROOF STRUCTURAL MEMBERS
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
- SILVER S.S. 10-16 FT-LBS
- BLACK S.S. 7-9 FT-LBS
- RAILS CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE VS. DOWNSLOPE)
- RAILS CAN BE LEVELED UP TO 3" USING UP TO TWO LEVELING SPACERS AS SHOWN IN "SERIES 100 RAIL LEVELING"
FLASH POST WITH STANDARD GALVANIZED STEEL OR DEAD SOFT ALUMINUM ROOF FLASHING FOR 1" DIAMETER VENT PIPE (NOT SHOWN)
SNAPNRACK RUBBER RAIN COLLAR INSTALLS OVER TOP OF FLASHING
SNAPNRACK STANDOFF SHAFT STD (VARIOUS SIZES)
5/16 X 1 S.S. BOLT AND 5/16 S.S. SPLIT WASHER INSTALLED FROM BACK SIDE OF STANDOFF BASE PRIOR TO INSTALLATION ON ROOF
SNAPNRACK STANDOFF BASE STD 1-HOLE
SEAL PENETRATION AND UNDER BASE WITH APPROPRIATE ROOF SEALANT
ROOF DECKING TYP.
SNAPNRACK STANDOFF MOUNTING POINT FOR USE ON ALL ROOF SURFACES
COMPLETED INSTALLATION (SHOWN WITH FLASHING IN PLACE)
SNAPNRACK STANDARD RAIL
SNAPNRACK CHANNEL NUT
SNAPNRACK STANDOFF CLAMP
5/16 X 2 S.S. BOLT AND 5/16 S.S. SPLIT WASHER
5/16" S.S. LAG SCREW WITH FLAT WASHER. 2.5" MINIMUM EMBEDMENT IS STANDARD
ROOF RAFTER OR STRUCTURAL MEMBER
SnapNrack PV Mounting System
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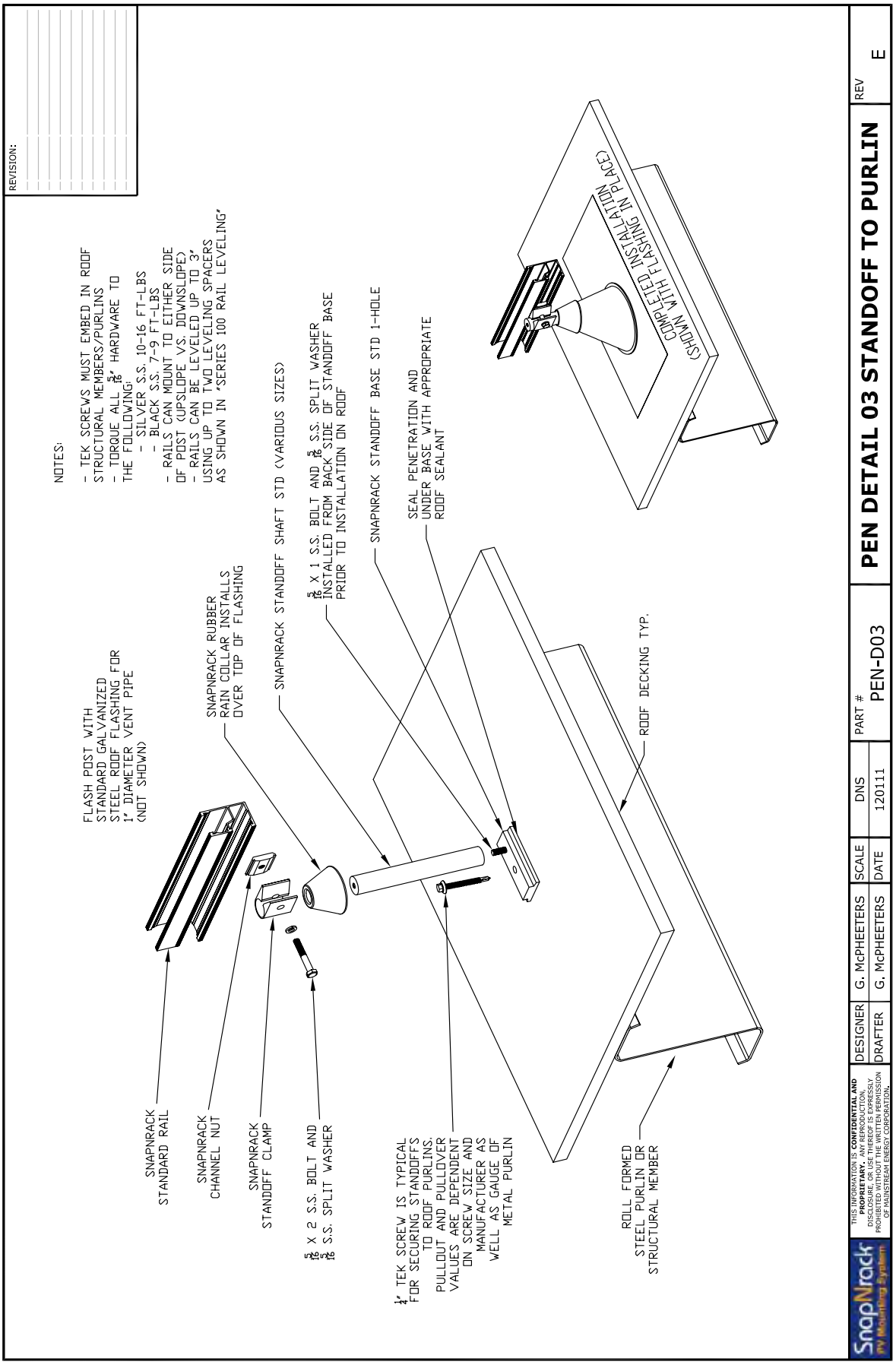
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE
DATE
DNS
120111
PART # PEN-D02
PEN DETAIL 02 STANDOFF
REV E


REVISION:
NOTES:
- TEK SCREWS MUST EMBED IN ROOF STRUCTURAL MEMBERS/PURLINS
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
- SILVER S.S. 10-16 FT-LBS
- BLACK S.S. 7-9 FT-LBS
- RAILS CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE VS. DOWNSLOPE)
- RAILS CAN BE LEVELED UP TO 3" USING UP TO TWO LEVELING SPACERS AS SHOWN IN "SERIES 100 RAIL LEVELING"
FLASH POST WITH STANDARD GALVANIZED STEEL ROOF FLASHING FOR 1" DIAMETER VENT PIPE (NOT SHOWN)
SNAPNRACK RUBBER RAIN COLLAR INSTALLS OVER TOP OF FLASHING
SNAPNRACK STANDOFF SHAFT STD (VARIOUS SIZES)
5/16" X 1 S.S. BOLT AND 5/16" S.S. SPLIT WASHER INSTALLED FROM BACK SIDE OF STANDOFF BASE PRIOR TO INSTALLATION ON ROOF
SNAPNRACK STANDOFF BASE STD 1-HOLE
SEAL PENETRATION AND UNDER BASE WITH APPROPRIATE ROOF SEALANT
ROOF DECKING TYP.
COMPLETED INSTALLATION WITH FLASHING IN PLACE
(SHOWN W/MTL)
SNAPNRACK STANDARD RAIL
SNAPNRACK CHANNEL NUT
SNAPNRACK STANDOFF CLAMP
5/16" X 2 S.S. BOLT AND 5/16" S.S. SPLIT WASHER
1" TEK SCREW IS TYPICAL FOR SECURING STANDOFFS TO ROOF PURLINS. PULLOUT AND PULLOVER VALUES ARE DEPENDENT ON SCREW SIZE AND MANUFACTURER AS WELL AS GAUGE OF METAL PURLIN
ROLL FORMED STEEL PURLIN OR STRUCTURAL MEMBER
SnapNrack
PV Mounting System
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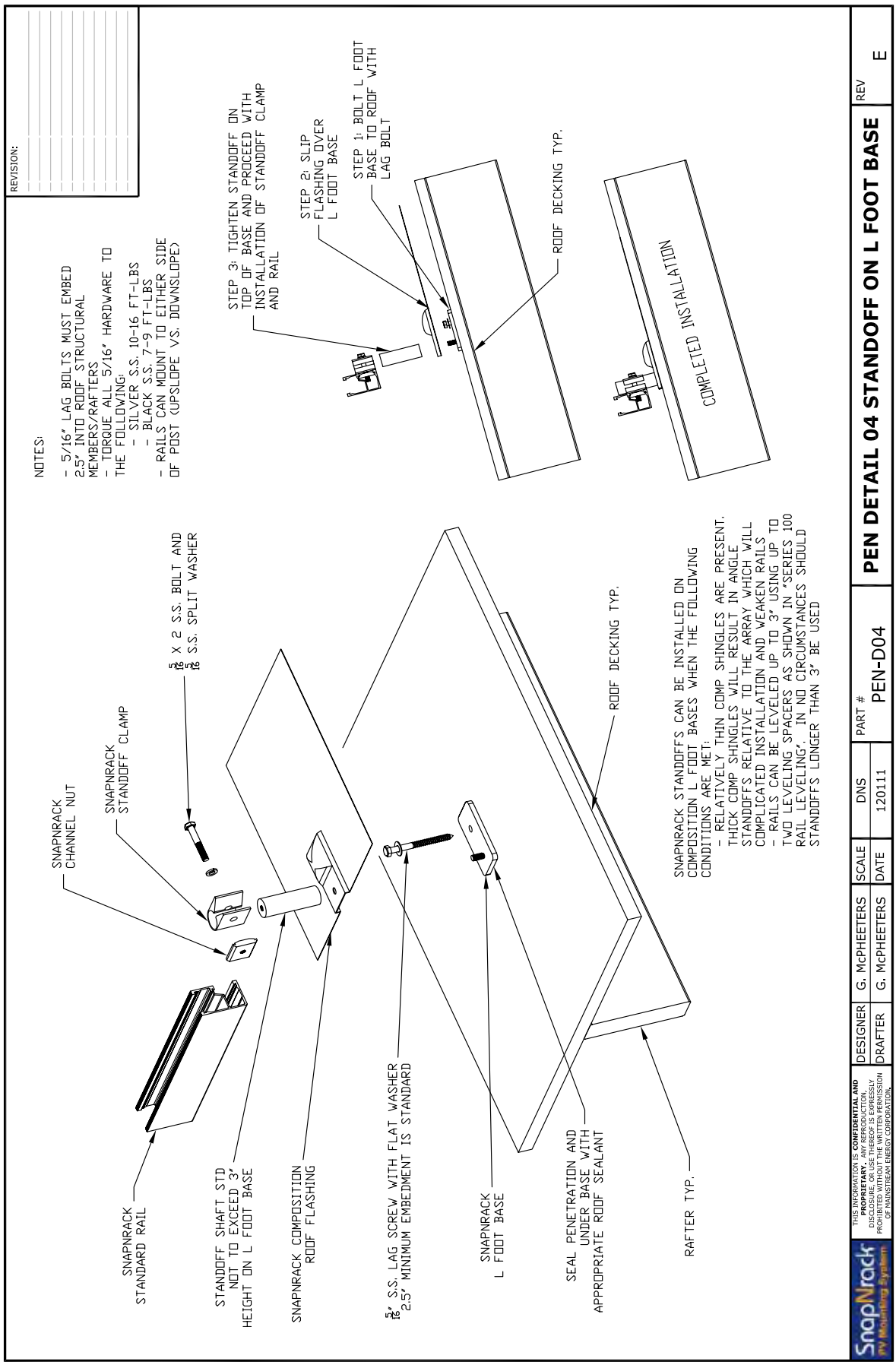
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE
DATE
DNS 120111
PART # PEN-D03
PEN DETAIL 03 STANDOFF TO PURLIN
REV E


REVISION:
NOTES:
- 5/16" LAG BOLTS MUST EMBED 2.5" INTO ROOF STRUCTURAL MEMBERS/RAFTERS
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
- SILVER S.S. 10-16 FT-LBS
- BLACK S.S. 7-9 FT-LBS
- RAILS CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE VS. DOWNSLOPE)
STEP 3: TIGHTEN STANDOFF ON TOP OF BASE AND PROCEED WITH INSTALLATION OF STANDOFF CLAMP AND RAIL
STEP 2: SLIP FLASHING OVER L FOOT BASE
STEP 1: BOLT L FOOT BASE TO ROOF WITH LAG BOLT
ROOF DECKING TYP.
COMPLETED INSTALLATION
SNAPNRACK CHANNEL NUT
SNAPNRACK STANDOFF CLAMP
5/16" X 2 S.S. BOLT AND 5/16" S.S. SPLIT WASHER
SNAPNRACK STANDARD RAIL
STANDOFF SHAFT STD NOT TO EXCEED 3" HEIGHT ON L FOOT BASE
SNAPNRACK COMPOSITION ROOF FLASHING
5/16" S.S. LAG SCREW WITH FLAT WASHER 2.5" MINIMUM EMBEDMENT IS STANDARD
SNAPNRACK L FOOT BASE
SEAL PENETRATION AND UNDER BASE WITH APPROPRIATE ROOF SEALANT
RAFTER TYP.
ROOF DECKING TYP.
SNAPNRACK STANDOFFS CAN BE INSTALLED ON COMPOSITION L FOOT BASES WHEN THE FOLLOWING CONDITIONS ARE MET:
- RELATIVELY THIN COMP SHINGLES ARE PRESENT.
THICK COMP SHINGLES WILL RESULT IN ANGLE STANDOFFS RELATIVE TO THE ARRAY WHICH WILL COMPLICATED INSTALLATION AND WEAKEN RAILS
- RAILS CAN BE LEVELED UP TO 3" USING UP TO TWO LEVELING SPACERS AS SHOWN IN "SERIES 100 RAIL LEVELING", IN NO CIRCUMSTANCES SHOULD STANDOFFS LONGER THAN 3" BE USED
SnapNrack PV Mounting System
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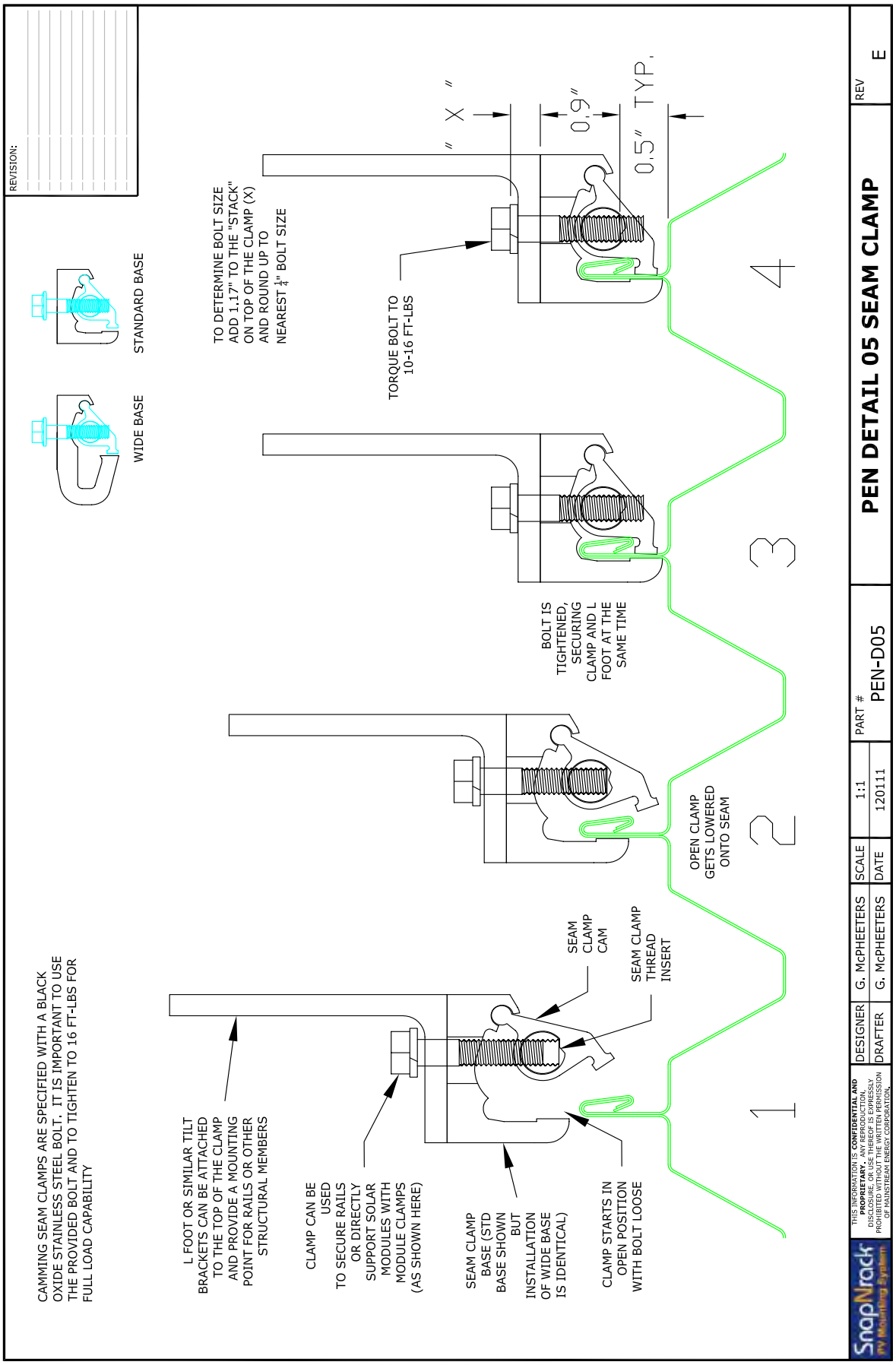
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE
DATE
DNS
120111
PART #
PEN-D04
PEN DETAIL 04 STANDOFF ON L FOOT BASE
REV E


REVISION:
STANDARD BASE
WIDE BASE
CAMMING SEAM CLAMPS ARE SPECIFIED WITH A BLACK OXIDE STAINLESS STEEL BOLT. IT IS IMPORTANT TO USE THE PROVIDED BOLT AND TO TIGHTEN TO 16 FT-LBS FOR FULL LOAD CAPABILITY
L FOOT OR SIMILAR TILT BRACKETS CAN BE ATTACHED TO THE TOP OF THE CLAMP AND PROVIDE A MOUNTING POINT FOR RAILS OR OTHER STRUCTURAL MEMBERS
CLAMP CAN BE USED TO SECURE RAILS OR DIRECTLY SUPPORT SOLAR MODULES WITH MODULE CLAMPS (AS SHOWN HERE)
SEAM CLAMP BASE (STD BASE SHOWN BUT INSTALLATION OF WIDE BASE IS IDENTICAL)
CLAMP STARTS IN OPEN POSITION WITH BOLT LOOSE
SEAM CLAMP CAM
SEAM CLAMP THREAD INSERT
OPEN CLAMP GETS LOWERED ONTO SEAM
BOLT IS TIGHTENED, SECURING CLAMP AND L FOOT AT THE SAME TIME
TORQUE BOLT TO 10-16 FT-LBS
TO DETERMINE BOLT SIZE ADD 1.17" TO THE "STACK" ON TOP OF THE CLAMP (X) AND ROUND UP TO NEAREST 1/4" BOLT SIZE
" X "
0.9"
0.5" TYP.
1
2
3
4
SnapNrack
PV Mounting System
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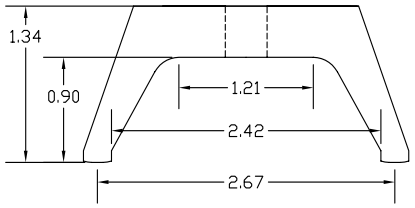
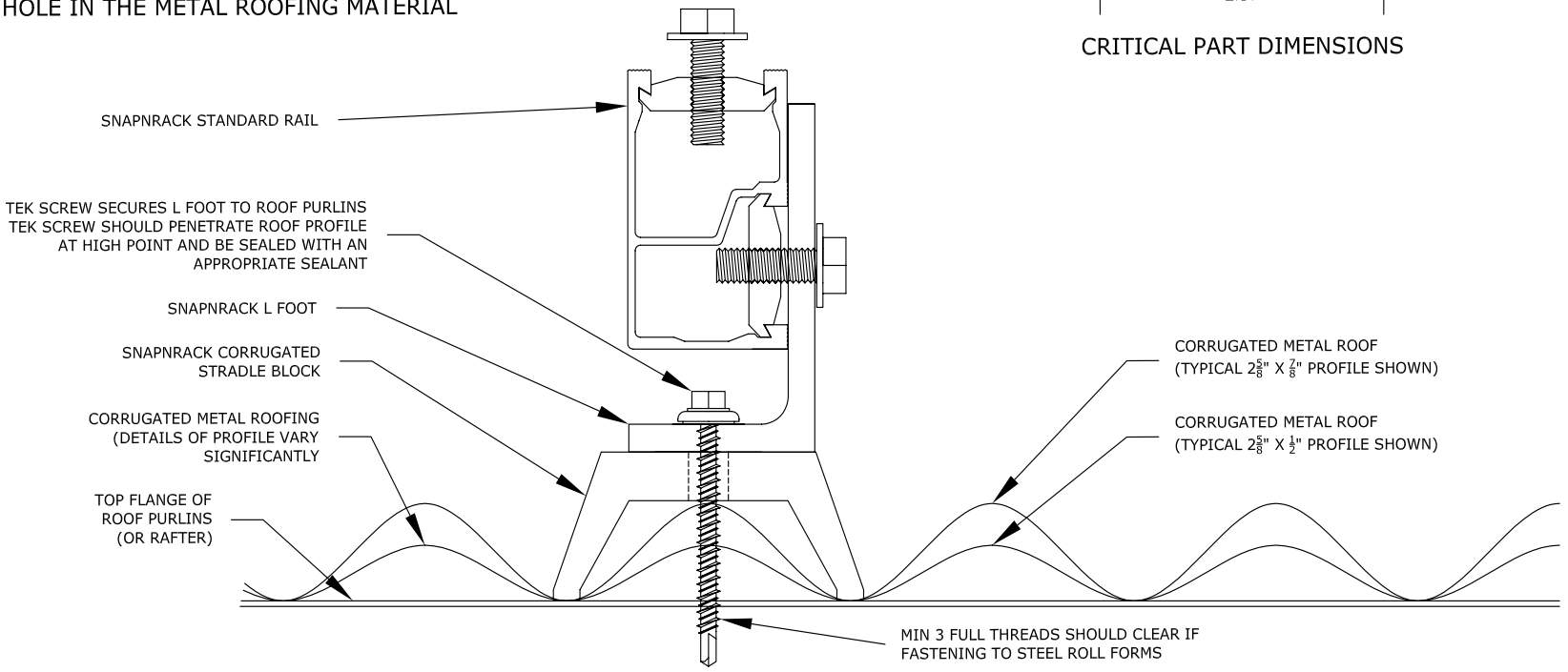
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE 1:1
DATE 120111
PART # PEN-D05
PEN DETAIL 05 SEAM CLAMP
REV E

REVISION:

USE THE SNAPNRACK CORRUGATED STRADDLE BLOCK TO STRADDLE THE RAISED PORTIONS OF CORRUGATED METAL ROOFING MATERIALS. THIS ALLOWS AN L FOOT TO BE MOUNTED WITH THE PENETRATION AT THE HIGH POINT OF THE ROOFING MATERIAL WITHOUT CRUSHING THE ROOF PROFILE. SHOWN WITH A TEK SCREW ATTACHMENT TYPICAL OF A METAL PURLIN STRUCTURE, BUT THE SYSTEM WORKS WELL WITH A LAG BOLT INTO A WOOD RAFTER AS WELL. BE SURE TO USE PROPER SEALANT TO SEAL UP THE HOLE IN THE METAL ROOFING MATERIAL



CRITICAL PART DIMENSIONS



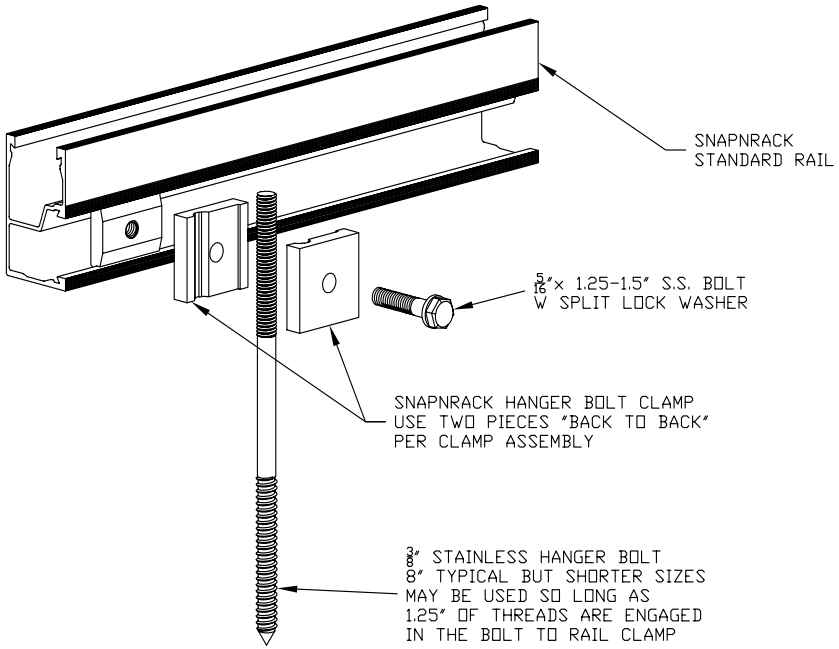
SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	1:1	PART # PEN-D06	**PEN DETAIL 06 CORRUGATED BLOCK** REV E
		DRAFTER	G. McPHEETERS	DATE	120111		

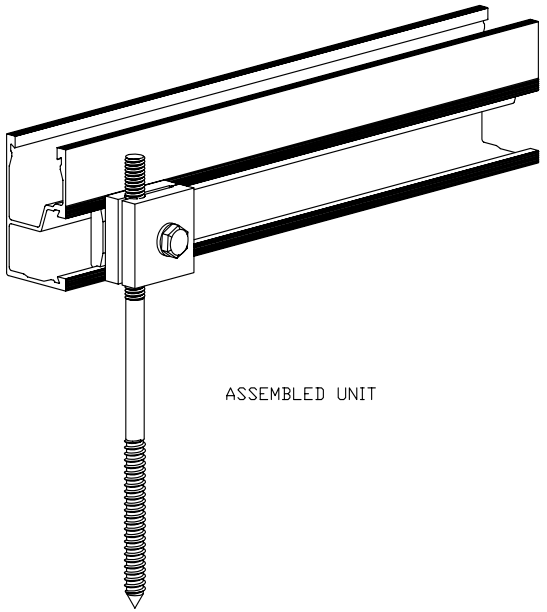
REVISION:

HANGER BOLT CLAMPS HAVE BEEN DESIGNED FOR USE WITH STANDARD 3/8" STAINLESS HANGER BOLTS. THEY ARE COMPATIBLE WITH ANY 3/8" STAINLESS BOLT OR THREADED ROD.

THE CLAMPS ARE 1.5" TALL AND ENGINEERED TO HAVE A MINIMUM OF 1.25" OF THREAD IN THE CLAMP AT ALL TIMES. MAXIMUM DESIGN LOAD IS 1,000 LBS (AXIAL) OR 250 LBS IF A FACTOR OF SAFETY OF 4 IS APPLIED.

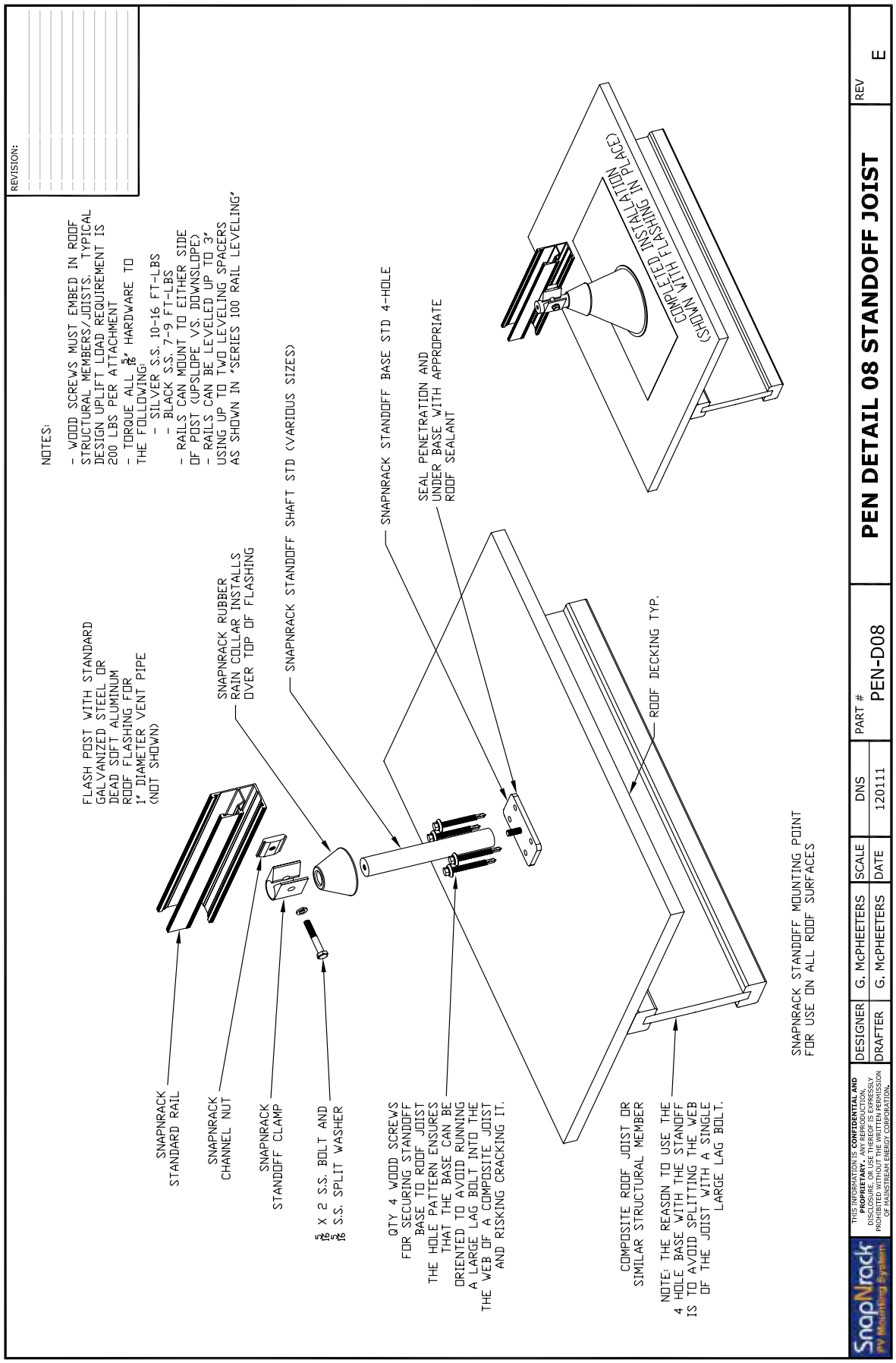
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS





ASSEMBLED UNIT

SnapNrack PV Mounting System	THIS INFORMATION IS **CONFIDENTIAL AND PROPRIETARY.** ANY REPRODUCTION, DISCLOSURE, OR USE THEREOF IS EXPRESSLY PROHIBITED WITHOUT THE WRITTEN PERMISSION OF MAINSTREAM ENERGY CORPORATION.	DESIGNER	G. McPHEETERS	SCALE	DNS	PART # PEN-D07	**PEN DETAIL 07 L HANGER BOLT**
		DRAFTER	G. McPHEETERS	DATE	120111		REV E


REVISION:
NOTES:
- WOOD SCREWS MUST EMBED IN ROOF STRUCTURAL MEMBERS/JOISTS. TYPICAL DESIGN UPLIFT LOAD REQUIREMENT IS 200 LBS PER ATTACHMENT
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
- SILVER S.S. 10-16 FT-LBS
- BLACK S.S. 7-9 FT-LBS
- RAILS CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE VS. DOWNSLOPE)
- RAILS CAN BE LEVELED UP TO 3" USING UP TO TWO LEVELING SPACERS AS SHOWN IN "SERIES 100 RAIL LEVELING"
FLASH POST WITH STANDARD GALVANIZED STEEL OR DEAD SOFT ALUMINUM ROOF FLASHING FOR 1" DIAMETER VENT PIPE (NOT SHOWN)
SNAPNRACK RUBBER RAIN COLLAR INSTALLS OVER TOP OF FLASHING
SNAPNRACK STANDOFF SHAFT STD (VARIOUS SIZES)
SNAPNRACK STANDOFF BASE STD 4-HOLE
SEAL PENETRATION AND UNDER BASE WITH APPROPRIATE ROOF SEALANT
(SHOWN WITH COMPLETED INSTALLATION WITH FLASHING IN PLACE)
ROOF DECKING TYP.
SNAPNRACK STANDOFF MOUNTING POINT FOR USE ON ALL ROOF SURFACES
SNAPNRACK STANDOFF
SNAPNRACK STANDARD RAIL
SNAPNRACK CHANNEL NUT
SNAPNRACK STANDOFF CLAMP
5/16" X 2 S.S. BOLT AND 5/16" S.S. SPLIT WASHER
QTY 4 WOOD SCREWS FOR SECURING STANDOFF BASE TO ROOF JOIST THE HOLE PATTERN ENSURES THAT THE BASE CAN BE ORIENTED TO AVOID RUNNING A LARGE LAG BOLT INTO THE WEB OF A COMPOSITE JOIST AND RISKING CRACKING IT.
COMPOSITE ROOF JOIST OR SIMILAR STRUCTURAL MEMBER
NOTE: THE REASON TO USE THE 4 HOLE BASE WITH THE STANDOFF IS TO AVOID SPLITTING THE WEB OF THE JOIST WITH A SINGLE LARGE LAG BOLT.
SnapNrack PV Mounting System
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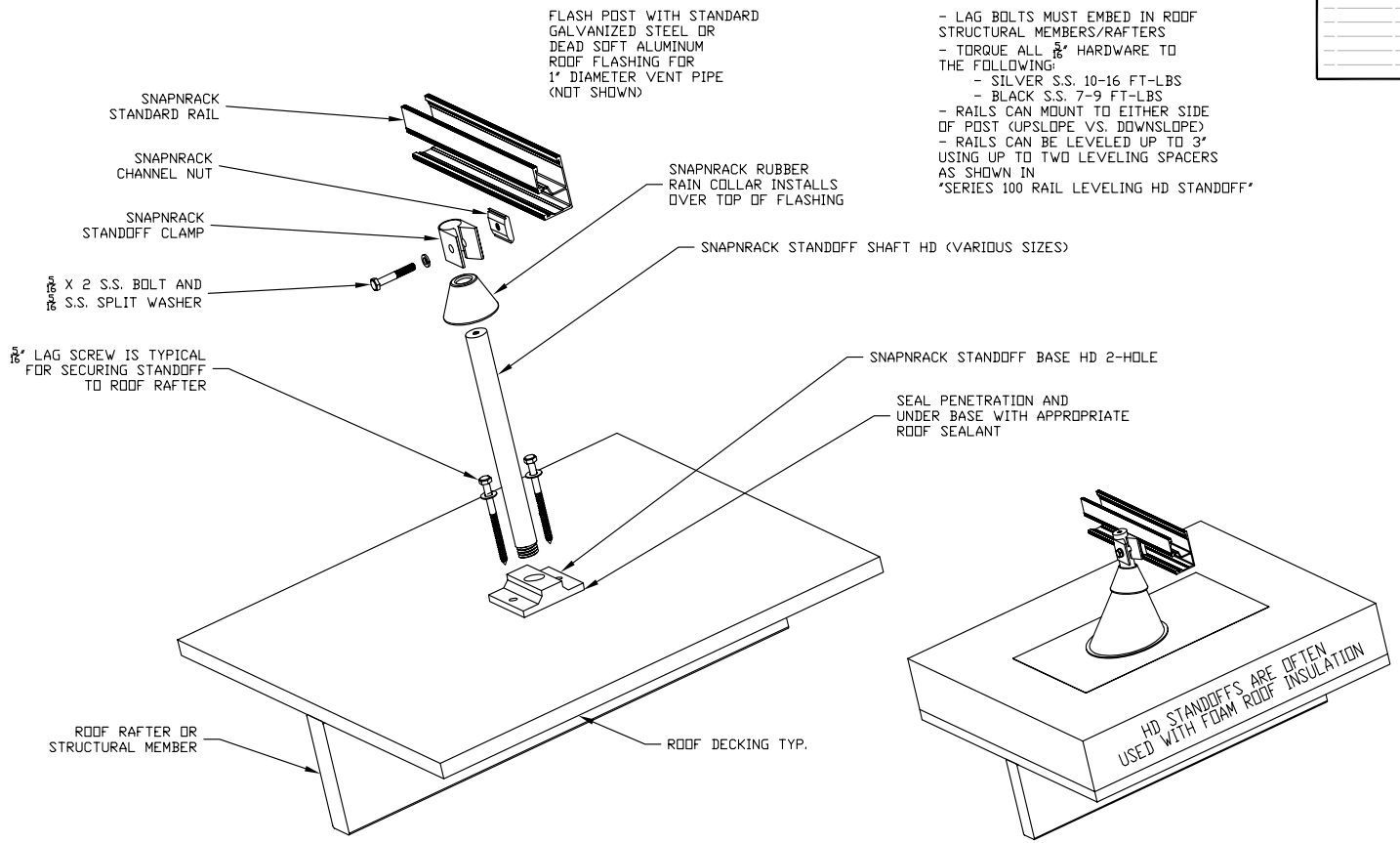
DESIGNER G. McPHEETERS
DRAFTER G. McPHEETERS
SCALE
DATE
DNS
120111
PART # PEN-D08
PEN DETAIL 08 STANDOFF JOIST
REV E

REVISION:

NOTES:

- LAG BOLTS MUST EMBED IN ROOF STRUCTURAL MEMBERS/RAFTERS
- TORQUE ALL 5/16" HARDWARE TO THE FOLLOWING:
  - SILVER S.S. 10-16 FT-LBS
  - BLACK S.S. 7-9 FT-LBS
- RAILS CAN MOUNT TO EITHER SIDE OF POST (UPSLOPE VS. DOWNSLOPE)
- RAILS CAN BE LEVELED UP TO 3" USING UP TO TWO LEVELING SPACERS AS SHOWN IN "SERIES 100 RAIL LEVELING HD STANDOFF"



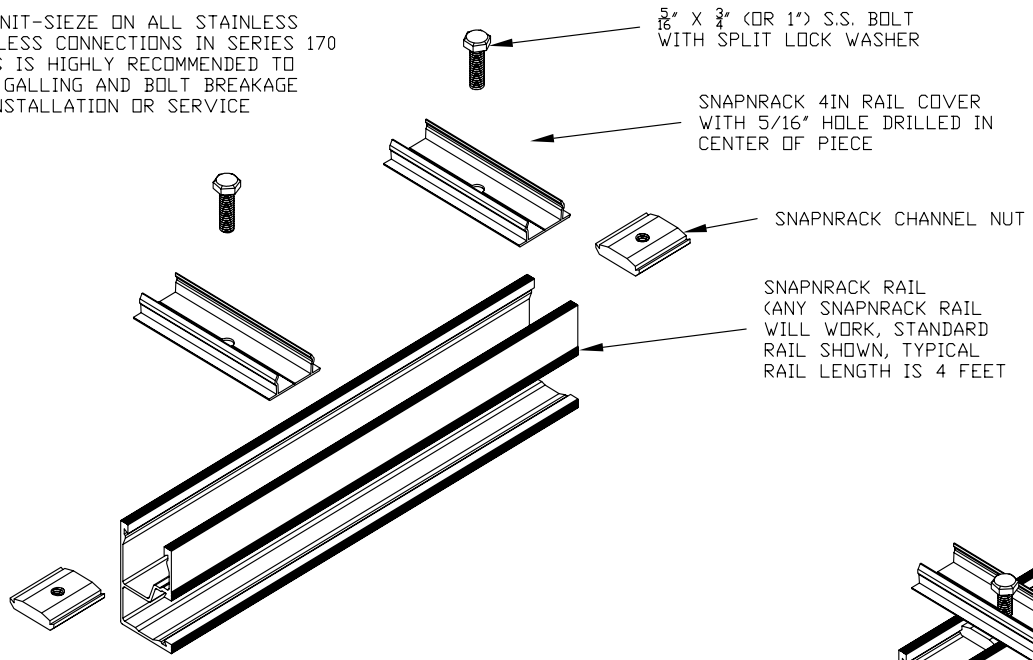
SNAPNRACK STANDOFF MOUNTING POINT
FOR USE ON ALL ROOF SURFACES

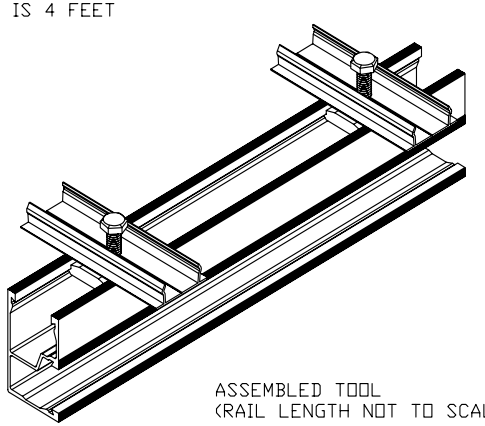
SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	DNS	PART # PEN-D09	**PEN DETAIL 09 HD STANDOFF** REV E
		DRAFTER	G. McPHEETERS	DATE	120111		

REVISION:

THE SERIES 170 TILT KIT TOOL IS A SIMPLE TOOL THAT CAN BE MADE FROM EXISTING SNAPNRACK COMPONENTS THAT DRAMATICALLY EASES THE INSTALLATION PROCESS FOR SERIES 170 TILT KITS BY SUPPORTING THE UPPER MODULE RAIL DURING INSTALLATION OF RACKING AND MODULES

USE OF ANIT-SIEZE ON ALL STAINLESS TO STAINLESS CONNECTIONS IN SERIES 170 TILT KITS IS HIGHLY RECOMMENDED TO PREVENT GALLING AND BOLT BREAKAGE DURING INSTALLATION OR SERVICE





ASSEMBLED TOOL
(RAIL LENGTH NOT TO SCALE)

SnapNrack PV Mounting System		DESIGNER	G. McPHEETERS	SCALE	VARIES	PART # S100 TKT	**SERIES 100 TILT KIT TOOL** REV E
		DRAFTER	G. McPHEETERS	DATE	120111		

13.23 SnapNrack Warranty

SNAPNRACK™ LIMITED WARRANTY

10 YEAR LIMITED PRODUCT WARRANTY | 5 YEAR LIMITED FINISH WARRANTY

Limited Warranties. SnapNrack, Inc. ("Manufacturer"), the manufacturer of the SnapNrack photovoltaic solar module racking product (the "Product"), warrants to the end-user of the Product ("you"), that while installed as part of the original solar electric system (the "System") at the original installation site, the Product shall be free from defects in materials and workmanship for a period of ten (10) years (the "Limited Product Warranty"), and the Product's anodized finish shall be free from visible peeling, cracking or chalking under normal atmospheric conditions for a period of five (5) years (the "Limited Finish Warranty") (collectively, the "Limited Warranties"). The Limited Warranties shall commence on the date of completion of the installation of the Product as a part of the System.

Warranty Service. If, within the applicable warranty period, the Product is determined by Manufacturer to be defective, based on reasonable evidence of a defect provided by you, Manufacturer will, at its sole option, (a) repair the Product or replace it with an equivalent product, or (b) take back the Product and refund to you the purchase price paid to Manufacturer by the original purchaser of the Product (the "Distributor"). Your sole and exclusive remedy under the Limited Warranties shall be limited to the repair, replacement or refund specified herein. For warranty claims, contact Manufacturer at the address below.

Warranty Conditions. THE FOREGOING WARRANTIES ARE CONTINGENT ON THE PROPER USE OF THE PRODUCT IN ACCORDANCE WITH THE INSTRUCTIONS AND SPECIFICATIONS PUBLISHED BY MANUFACTURER AND SHALL NOT APPLY TO ANY PRODUCT THAT HAS BEEN REPAIRED OR MODIFIED BY PERSONS OTHER THAN MANUFACTURER.

Warranty Disclaimer. THE EXPRESS WARRANTIES SET FORTH IN HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. MANUFACTURER HEREBY SPECIFICALLY DISCLAIMS ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF TITLE, NONINFRINGMENT, QUIET ENJOYMENT, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.

Damage Waiver. NOTWITHSTANDING ANY OTHER PROVISIONS HEREIN, IN NO EVENT WILL MANUFACTURER OR ITS SUPPLIERS BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES SUFFERED BY YOU, DISTRIBUTOR OR ANY THIRD PARTY WHICH MAY ARISE UNDER OR IN CONNECTION WITH THE PRODUCT OR THESE LIMITED WARRANTIES.

Limitation of Liability. DISTRIBUTOR AND MANUAFACTURER HAVE NEGOTIATED RISK ALLOCATION BETWEEN THEMSELVES AND AGREE THAT IN NO EVENT WILL MANUFACTURER'S LIABILITY FOR ANY CLAIM, WHETHER IN CONTRACT, TORT OR UNDER ANY OTHER THEORY OF LIABILITY, EXCEED THE CUMULATIVE AMOUNTS ACTUALLY RECEIVED BY MANUFACTURER FROM DISTRIBUTOR FOR THE PRODUCTS SOLD TO DISTRIBUTOR DURING THE 12 MONTH PERIOD IMMEDIATELY PRECEDING THE ACCRUAL OF THE CLAIM.

Address for Warranty Claims:

SnapNrack PV Mounting, 775 Fiero Lane Suite 200, San Luis Obispo CA 93401