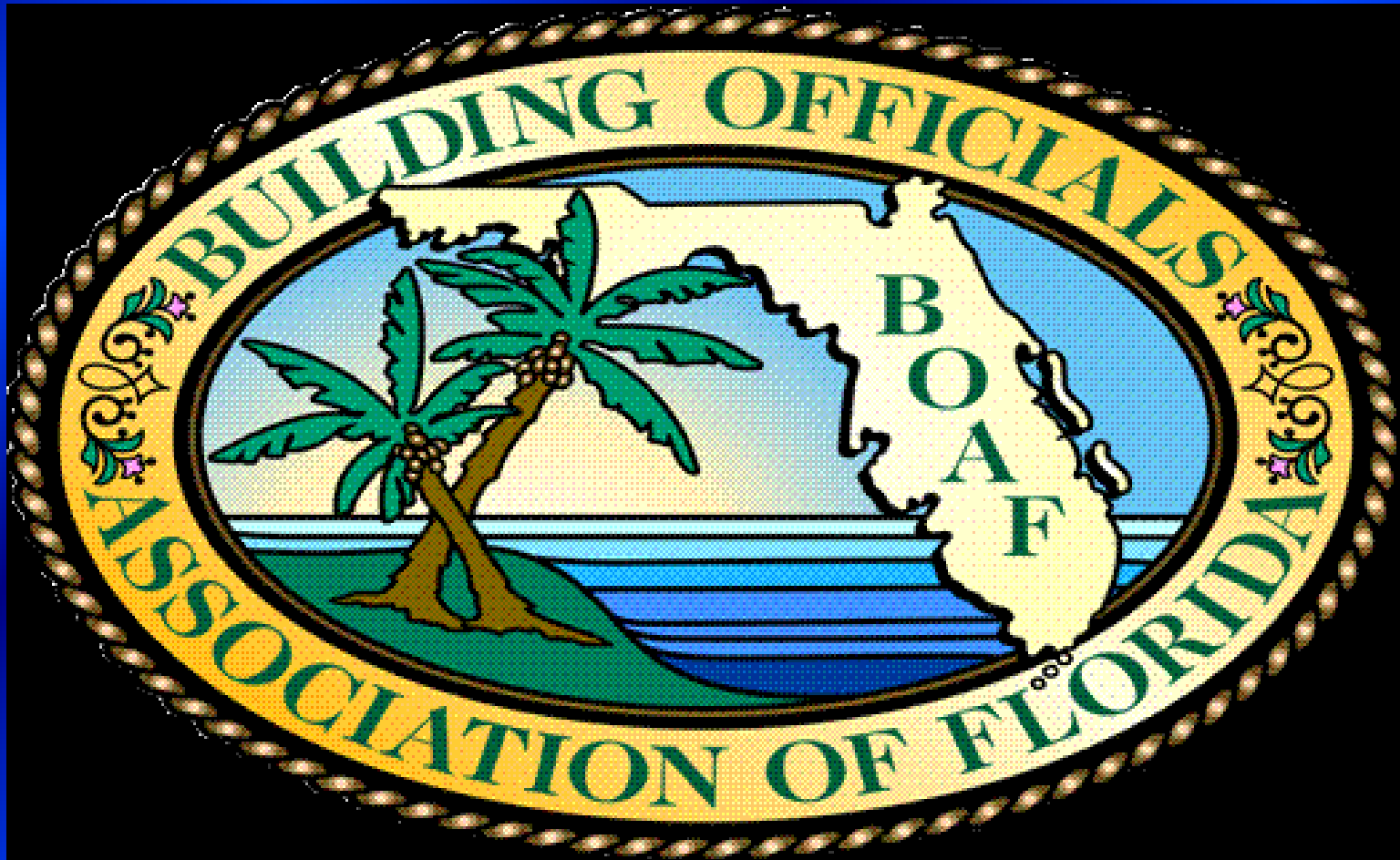


Solar Permitting & Inspection & the FBC



- COURSE INFORMATION
- Title: Solar Permitting & Inspection & the FBC
- Length: 1.0 hr.
- Location: Lake Mary
- Date: November 3rd, 2011
- Instructor: Neal Burdick

Approval Numbers:

- –BCAIB # 0007449
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- –FBPE # 544

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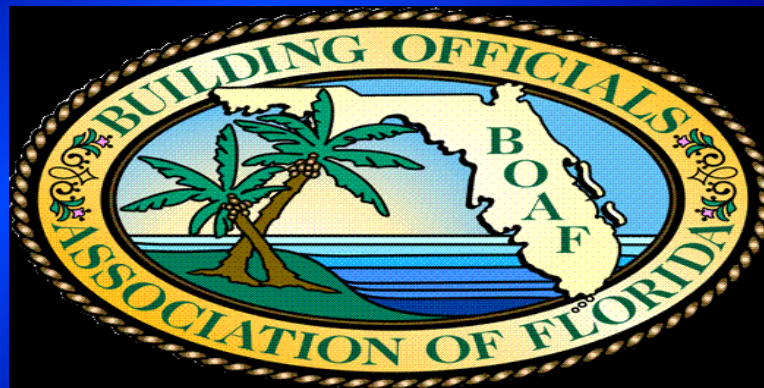
Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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All solar energy systems manufactured or sold in the State of Florida shall be listed or approved by the Florida Solar Energy Center.

This is in accordance with the Solar Energy Standards Act of 1976

(Section 377.705, Florida Statute)

Required Information for Permit:

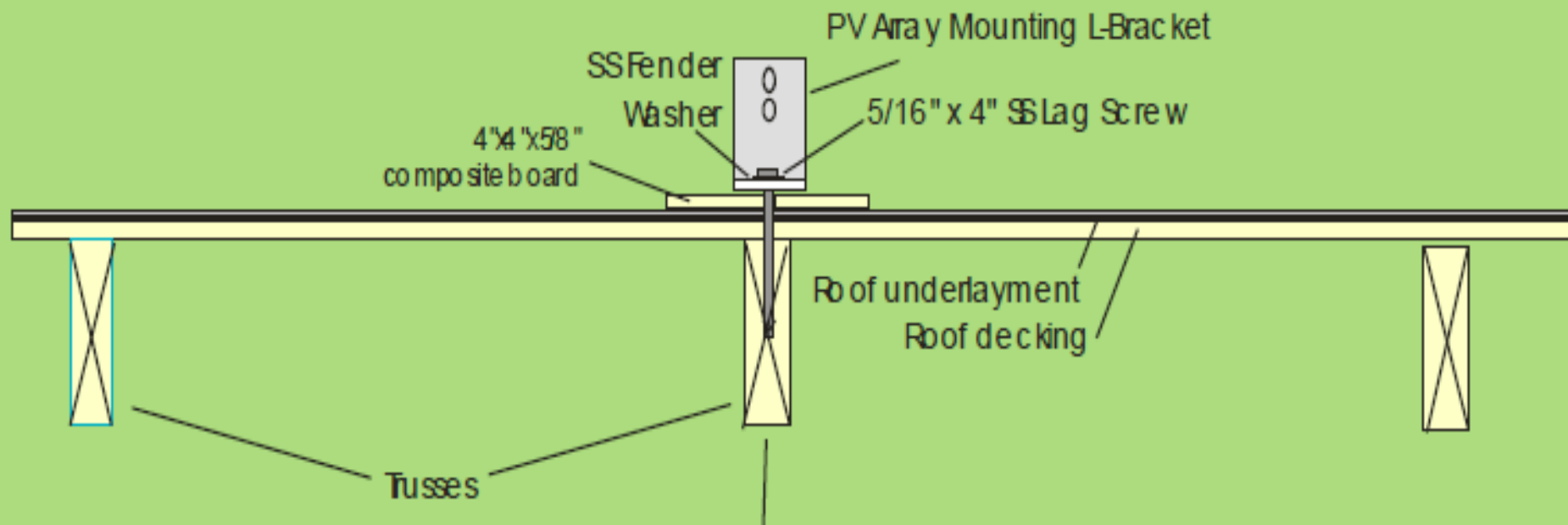
Solar system installations including solar domestic hot water systems, solar space heating systems, solar pool / spa heating systems, and solar photovoltaic systems should require the submission of two or more sets of plans for review.

The plans should illustrate, describe, and detail the following:

Required Information for Permit:

Solar Panel and Equipment attachment details for ground or building mounted systems are to be installed as per manufacturers instructions.

The drawings are to be site specific including design wind speed and exposure category, roofing material / resealing procedure, attachment details.



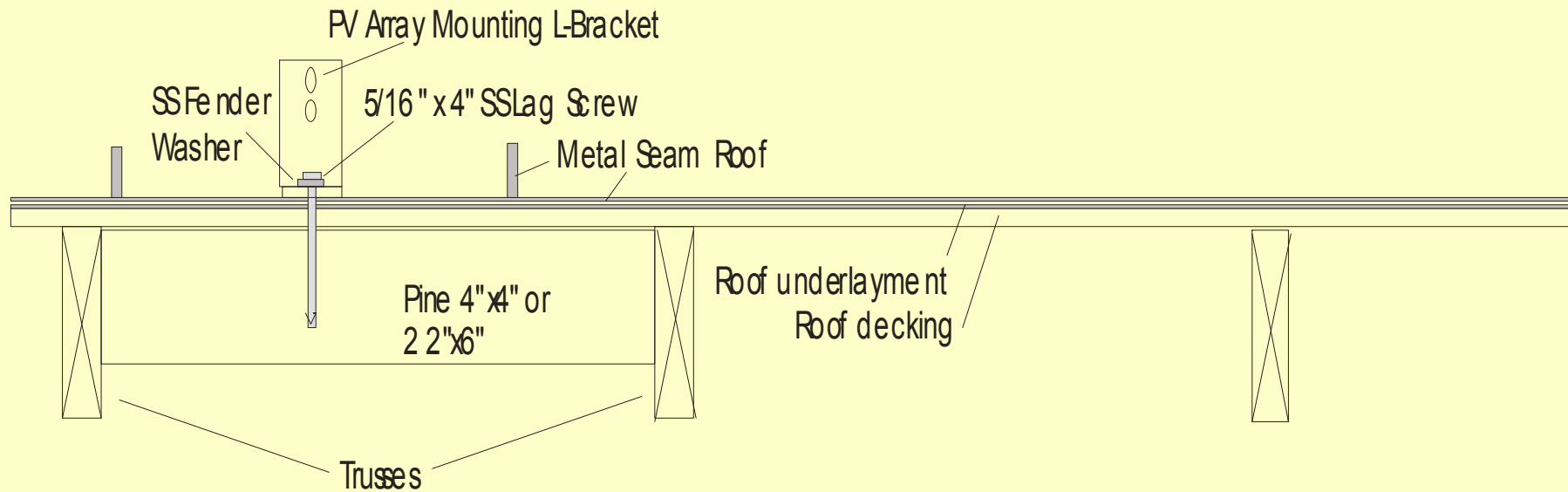
If attic is accessible, then drill 3/16" holes from bottom of truss through truss, decking and roof covering to locate center of truss from above. Then drill shaft and pilot holes for 4" SS lag screws from top of roof.

Before screwing down L-Bracket, spread generous amount of sealant on composite board, bottom of L-Bracket and on lag screw. After attaching L-Bracket, apply additional sealant over edges of bracket and top of lag screw-washer combination.

L-Bracket Attachment Detail

Shingle Roof

12/14/06



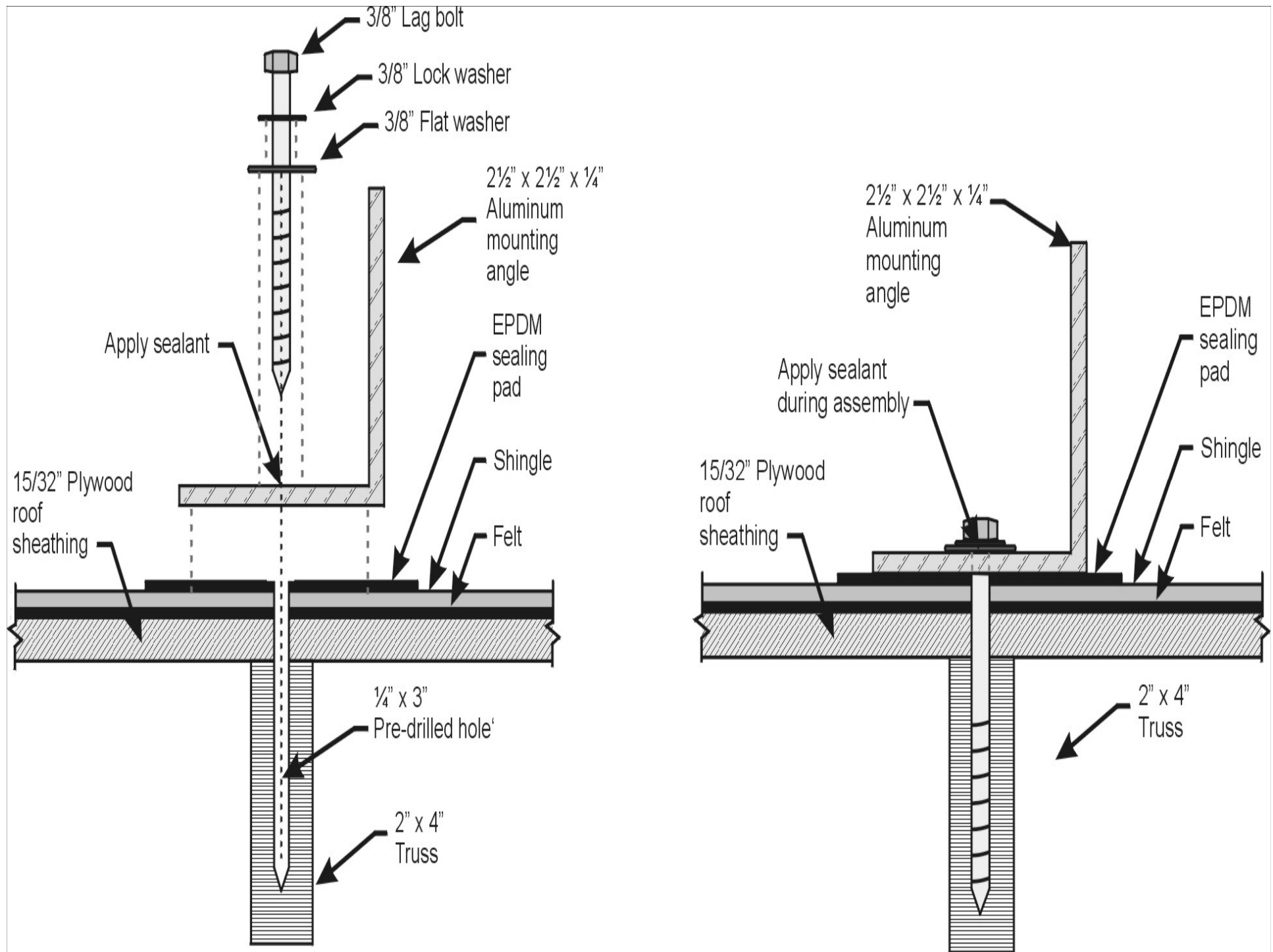
Before screwing down L-Bracket, spread generous amount of sealant on bottom of L-Bracket and on lag screw. After attaching L-Bracket, apply additional sealant over edges of bracket and top of lag screw-washer combination.

Attach 4 "x4" between trusses using either 4 - 16d nails or 4 deck screws on each end of 4"x4".

If 2 "x6"s are used, nail them on top of each other with top board flat against roof decking.

L-Bracket Attachment Detail
Metal Seam Roof with no Air Space

11/29/06

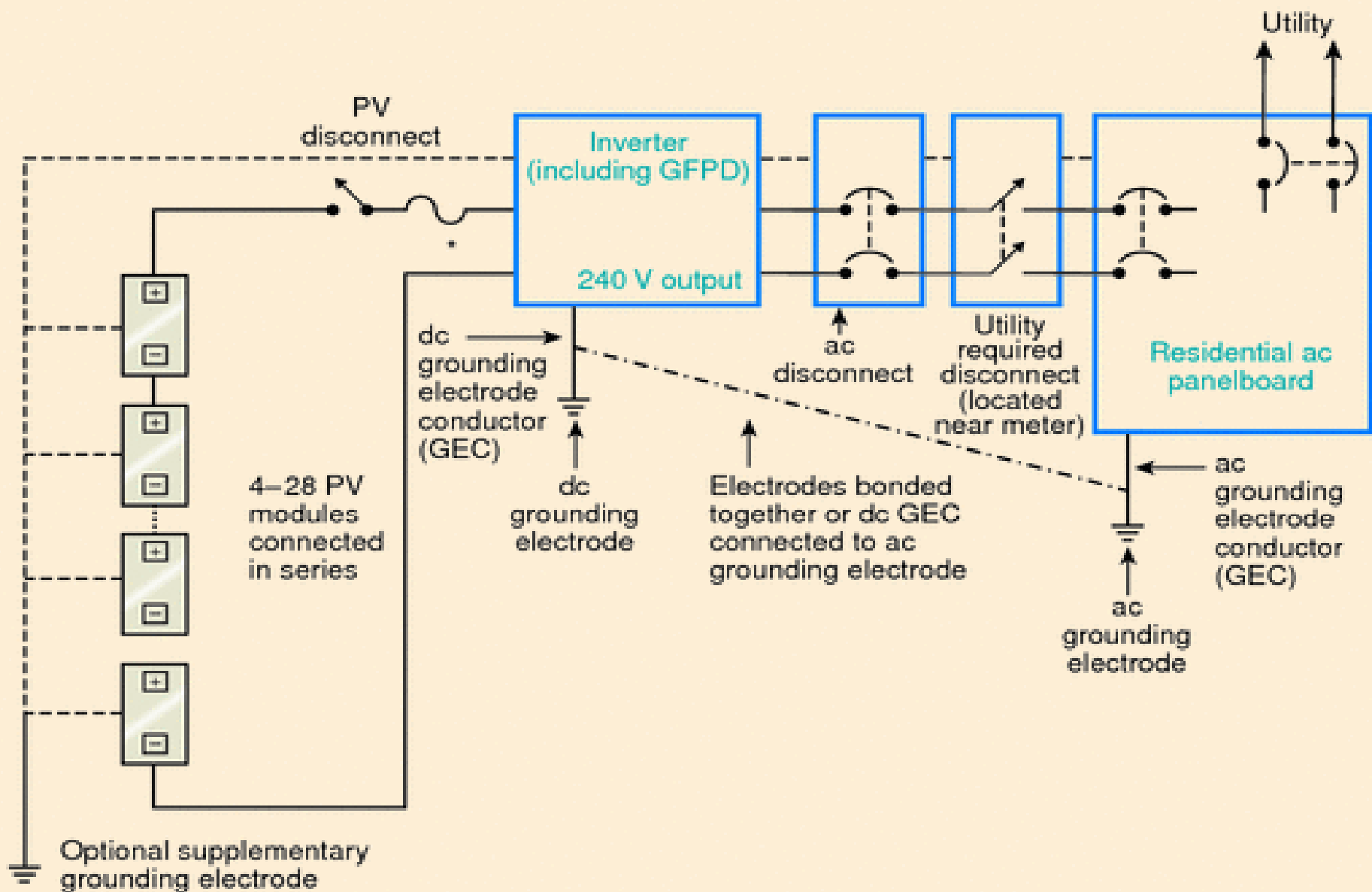


Required Information for Permit:

Photovoltaic systems must have electrical drawings illustrating a one line diagram (riser) showing routing of conductors with conductor / wire size, insulation type, volts, amps, load calculation, and signage.

PV systems may vary dramatically in PV array layout and inverter selection.

The majority of small-scale, residential- sized PV systems can be accurately represented by a one line diagram.



----- Equipment grounding conductor

- · - · - · - Bonding jumper

*No overcurrent protection required with certain inverters

Required Information for Permit:

Water heating systems must show the location and load for any added circuits / outlets to operate pumps.

Required Information for Permit:

Water heating systems drawings are to include location of water heating storage tanks with termination point of T & P relief valve discharge and safety pan drain lines illustrated or described. Collector loop piping diagram illustrating isolation valves, relief valves, check valves, and circulating pump.

Required Information for Permit:

Space heating systems drawings must include the water heating system details and details of coil installation and required duct work for coil installation.

Required Information for Permit:

Specifications for equipment including product approvals, NRTL approval, cut sheets, etc, must be provided.

Even for those jurisdictions that do not require plan submittals, this documentation can be supplied at the field inspection for reference.

Some detailed installation manuals can be several dozens or hundreds of pages.

If the local jurisdiction feels it is necessary to review these large documents, a good alternative would be for the documents to be supplied electronically, rather than in print.

Required Information for Permit:

Plot plan, survey, or diagram illustrating location of equipment when ground mounted or when building mounted with multiple buildings located on the parcel.

This is a simple diagram to show where the equipment is located on the property.

This can be a zone-clearance plot plan with the equipment clearly shown and identified on the plan.

If the solar PV array is ground-mounted, clearly show that system will be mounted within allowable zoned setbacks.

Structural Review of Solar PV Array Mounting System

Is the array to be mounted on a defined, permitted roof structure. (structure meets modern codes)

The reference to a defined, permitted roof structure refers to structures that have a clear inspection history so that verification of structural elements is unnecessary.

If structural modifications have been made due to remodeling, those changes should be documented through the permit and review process.

It also recognizes the fact that code enforcement for roof structural elements has been much more consistent across the United States in the last 35 years.

There may be many local jurisdictions who have been carefully reviewing roof structures for a much longer period of time.

The local jurisdiction should consider extending this limit based on the period that roofs have been consistently inspected.

In areas where jurisdictional reviews have not extended 35 years into the past, the jurisdiction may need to get the information from a roof worksheet to be sure whether or not the proposed Solar system is being installed on a typical roof structure or not.

Roof Information

Is the roofing type lightweight.

(Yes = composition, lightweight masonry, metal, wood shake, etc...)

If No, submit completed roof structure worksheet

(No = heavy masonry, slate, etc...)

There is a need to distinguish if a roof has a lightweight product.

Heavier roofing materials (e.g. slate, heavy masonry) may not have the assumed dead loading and live loading capacities that are found with lighter weight roofing materials.

These are much less common roof types and often justify a further review to clarify whether the roof structure is either in compliance or needs enhancement.

Does the roof have a single roof covering.
If No, submit completed roof structure worksheet.

Multiple composition roof layers may be taking a portion or all of the assumed additional weight allowance found in the 5 lbs/ft² allowance.

Provide method and type of weatherproofing roof penetrations (e.g. flashing, caulk).

The weatherproofing method needs to be specifically identified so that plan checkers and field inspectors are notified ahead of time of the method being used.

Some jurisdictions may constrain weatherproofing methods and materials.

Mounting System Information

Is the mounting structure an engineered product designed to mount PV modules.

If No, provide details of structural attachment certified by a design professional and approved by FSEC.

Non-engineered racking systems have undefined capabilities.

PV systems should only be mounted using systems that are engineered and designed for that purpose.

If an installer chooses to use a mounting system of unique design, then the system would require the design to be reviewed by FSEC.

For manufactured mounting systems, the following information should be provided:

Mounting System Manufacturer.

Product Name and Model #.

Total Weight of PV Modules and Rails _____ lbs.

(include total weight of all hardware used along with module weight)

Total Number of Attachment Points.

Weight per Attachment Point _____ lbs.

45 lbs has been used by some jurisdictions as a reasonable level below which point loading of roof joists and trusses can be ignored.

Most standard mounting systems have point loadings of 25-35 lbs per attachment.

Maximum Spacing Between Attachment Points
on a Rail ____ inches.

(see product manual for maximum spacing allowed
based on wind loading)

Depending on the wind loading requirements of a particular jurisdiction, the spacing or attachments may be dictated by the manufacturer's directions. For instance, a particular manufacturer may allow a 72" attachment spacing for a 90 MPH wind speed design, but the spacing reduces to a maximum of 48" when the design wind speed exceeds 100 MPH.

Total Surface Area of PV Modules _____ ft².

Take the surface area of a single module, and multiply it by the total number of modules in the roof-mounted system.

Distributed Weight of PV Module on Roof
_____ lbs/ft².

A 5 lbs/ft² limit is based on two things:

1) The roof is typical of standard code compliant roof structures so that the structure either has the proper spans and spacing, or proper use of engineered trusses and,

2) There is a single layer of roofing so that the normal weight allowance for additional roof layers is unused and available for the weight of the PV system.

Electrical Review of PV System (Calculations for Electrical Diagram)

In order for a PV system to be considered for an expedited permit process, the following must apply:

PV modules, utility-interactive inverters, and combiner boxes are identified for use in PV systems.

PV utility-interactive inverters must be specifically listed and labeled for this application (as required by NEC 690.60, 690.4 and Florida Statute Section 377.705).

Without this specific identification process an unacceptable amount of review would be necessary to approve an inverter.

Inverters that pass UL1741 and are listed as “utility-interactive” have met the requirement. Over 500 inverters currently meet this requirement.

PV modules must also be listed and identified for use in PV systems (as required by NEC 690.4).

PV modules that pass UL1703 and have a 600-Volt maximum voltage meet the requirement.

Source-combiners must be listed and labeled to meet the dc voltage requirements of the PV system or be specifically tested for PV systems and clearly state the allowable maximum current and voltage (as required by NEC 690.4).

The PV array is composed of 4 series strings or less, and 15 kW or less.

The purpose of this requirement is to limit the number of options of what can comply as a “simple” system so that a single electrical diagram can be used to describe a large percentage of the systems being installed.

The maximum of 15 kW refers to the array size based on the total installed nameplate capacity. The limit is set to stay generally within electrical interconnections that would be considered simple and possibly able to meet the 120% of busbar rating allowance in NEC 690.64(B) in a residence. (Minimum breaker for a 13.44 kW_{ac} PV system is 70 amps)

A 70-amp breaker is important since a 225-amp busbar in a 200-amp panel will allow a 70-amp PV breaker.

Since this does happen from time to time, or an installer can choose to install such a panelboard, it is considered the largest “simple” PV system.

Example

Residential application with:

200 Amp Bus, 40 position

120/240 Volt MDP

200 Amp Main Breaker

30 Amp PV Output Breaker

120% of 200 Amp = 240 Amps

So its OK to install a 30 Amp PV breaker in the
MDP

The ac interconnection point is on the load side of service disconnecting means (NEC 690.64(B)).

Load side interconnections are by far the most common, particularly in residential applications. Any line side connection is covered by NEC 690.64(A) and 230.82.

Although line side connections can be quite straightforward, they should require an additional step in the approval process and require a slightly different electrical drawing.

The basis for a simplified permit is the use of the standard electrical diagram.

PV systems can vary significantly in PV array layout and inverter selection.

However, the majority of small-scale, residential-sized PV systems can be accurately represented by a one line diagram.

For installations that do not meet the electrical installation criteria, detailed ampacity calculations, and other supporting documentation may be necessary to complete the review.

Additional components such as supply-side connections, modular inverter systems and battery-based systems may need to be added to the standard electrical diagrams to accommodate a variety of project types.

Basic inspection guidelines for Solar PV systems

Number of PV modules and PV model numbers match plans and spec sheets.

Array conductors are neatly and professionally held in place.

The PV array is properly grounded.

Electrical boxes are accessible and connections suitable for environment and system.

Array fastened and sealed according to attachment detail.

Conductors are properly rated and sized.

For Ground-Mounted Arrays

Foundation is installed as per approved drawings.

Structure mounted as per plans and manufactures instructions.

Structural elements are properly bonded.

Additional array electrode.

Attachment method according to plans.

Wiring not readily accessible.

Appropriate Signs Installed

Proper sign construction for environment installed.

Sign identifying PV power source system attributes at dc disconnect.

Sign for identifying ac point of connection.

Sign that identifies switch for alternative power system.

Equipment ratings must be consistent with application and signs

Inverter has a rating as high as max voltage on PV power source sign.

DC-side OCPDs are dc rated at least as high as max voltage on sign.

Switches and OCPDs are installed according to manufacturers specifications (i.e. many 600Vdc switches require passing through the switch poles twice in a specific way).

Inverter must be rated for the site ac voltage supplied and shown on the ac point of connection sign.

OCPD connected to the ac output of the inverter is rated at least 125% of maximum current on sign, and is no larger than the maximum OCPD on the inverter listing label.

The sum of the main OCPD and the backfed inverter OCPD is rated for not more than 120% of the busbar rating.

Basic inspection guidelines for solar domestic water heating systems

Collector must be listed or approved by FSEC.

Collector is installed in an unshaded location.

Orientation of collector must be within 45° (toward south) of west or east.

Collector Azimuth Angle (Include if compass reading is available).

Collector Tilt (from horizontal) (Must be mounted at an angle plus or minus 15° from latitude).

Check for clearances under collector (manufactures instructions).

Verify distance from collector to tank.

Collector properly attached to roof structure as per drawings.

All roof penetrations must be sealed.

Exterior pipe insulation is the proper thickness and is protected from UV degradation.

All piping insulation joints well sealed.

Air vent is installed in vertical position at highest point.

Temperature and Pressure (TP) Relief Valve or Pressure (P) Relief valve are installed.

Vacuum breaker installed (if required by system).

Solar storage tank properly installed.

Storage tank valves installed as per schematic.

Tank location, manufacturer, model, and capacity.

R-value of tank insulation.

Number of heating elements.

Upper and lower heating elements wattage and set point.

Pressure-Temperature Relief Valve installed.
Hot and cold service piping insulated.
Conventional tank properly converted to solar.
All components indicated on approved schematic
are installed in their proper locations.
Collector feed and return line piping is of proper
material and insulated.
Collector feed and return line piping is drainable.
Check valve installed.
Isolation valves in collector feed and return lines.
Drain valves in collector feed and return lines.

Insulation (Rated at R-2.4) or greater installed on all interconnecting hot and cold water piping installed in attics, unconditioned garages, other unconditioned indoor spaces, as well as all conditioned spaces.

Owner's manual provided.

System warranty provided.

It should be noted that an Expedited Permit Process solves only one of several challenges in the installation process of Solar PV systems.

Increasingly, local jurisdictions across the U.S. are placing less emphasis on the permit process and more emphasis on the field inspection process.

This is a positive trend for the Solar PV industry, as even the best permit package may do little to reduce challenges during a field inspection.

The field inspection will illustrate how well a contractor is able to install a code-compliant Solar PV system.

A well-organized permit package may simply make a poor-quality contractor look good initially, while the inspection process can more clearly identify competent installers.

Solar Contractor Licensing

Solar Contractor (CV) is an individual whose scope of work covers residential and commercial solar water heating, solar pool heating and photovoltaic (solar electric, or PV) systems.

This license was created in 1992 in conjunction with the ECLB, the solar electrical scope of the license is limited to the PV supply side "From the collector to the inverter on a *residential* project" -see minutes of the May 2008 combined ECLB/CILB meeting, FS 489.113(3)(f) & 61G4-15.021

The CV must hire an electrical contractor on all projects to install the inverter output circuit (ac circuit wiring) from the ac side of the inverter to the main supply panel or line side tap.

Based on this the CV is not allowed to install the ac circuit wiring on dc to ac micro-inverters (i.e. Enphase) since the inverters are individually connected to each other with ac circuit wiring (usually 120/240 or 208 Vac) under the PV collectors, and the ac circuit wiring must be connected from inverter to inverter before the PV collectors are installed.

Residential Solar Water Heating Specialty Contractor (CW) is an individual whose scope of work is limited to solar water heating and solar pool heating systems on residences only.

The CW license holder is not authorized to install PV systems and is not authorized to install solar water heating or pool heating systems on commercial buildings.

Since the CW license does not have these tasks included in its scope of work, a CW license holder may not subcontract the work to an authorized license holder (such as an electrical contractor or CV solar contractor).

Plumbing Contractor (PF) is an individual who is also authorized to install solar water heaters and pool heaters, but may be required to subcontract roofing and electrical work if the local building department so requires.

Plumbing contractors are not authorized to install PV systems.

Electrical Contractor (EC) is an individual who may install, maintain, repair, or alter any electrical service (including PV systems).

Electrical Contractors are not allowed to install residential or commercial solar hot water energy systems as it is not within the scope of their license.

From Executive Summary of the ECLB meeting
May 2004:

"After a review of F.S. 489 part I & II, The Board concluded that all components of photovoltaic systems are within the scope of, and can be completed by electrical contractors."

Roof attachments are considered to be components of a PV system and are within the scope of the EC.

Contrary to a report issued by FLASEIA / FLASEREF subcontracting for the roof attachments is not currently and has never been a requirement.

Solar pool heaters may be installed by a Certified Swimming Pool Contractors (CP, RP).

Local Licensing - Several local (city or county) licensing jurisdictions have established a solar contractor certificate of competency that is usually designated as an RX license.

These are limited to the installation of solar water or pool heaters only within the jurisdiction that has granted the license, and generally will not be authorized to install PV systems.

Florida Statute Section 163.04

Florida law forbids ordinances, deed restrictions, covenants, or similar binding agreements from prohibiting solar equipment use.

Under this law, a homeowner may not be denied by "any entity granted the power or right in any deed restriction, covenant or similar binding agreement to approve, forbid, control, or direct alteration of property..." permission to install a solar collector, clothesline, or other energy device using renewable resources.

It is important to seek the approval of a homeowners association prior to the installation of a solar system.

The law protecting the installation of solar does not waive the need for association approval if it is required by the governing documents.

The Legislature has made successive amendments to Section 163.04 to better state its intent and to protect the rights of all solar consumers.

This section applies to all actions taken with respect to approval or denial of a solar system, regardless of when the subdivision was instituted or when the association bylaws may have been adopted.

The following highlights were taken from a article posted on Mike Holts website titled “Solar Killers” made by Perry Vogler owner of Done Right Electric located at 4766 County Road 117A Wildwood, FL 34785.

I heard Mr. Harvey comment on some of these problems at the 2010 BOAF conference in Tampa. If Building Departments do not set specific guidelines when it comes to permitting, and inspections of PV systems they will loose this income and endanger public from unqualified installers not following code requirements.

Any Questions?

**BOAF would like to thank
you for attending**

