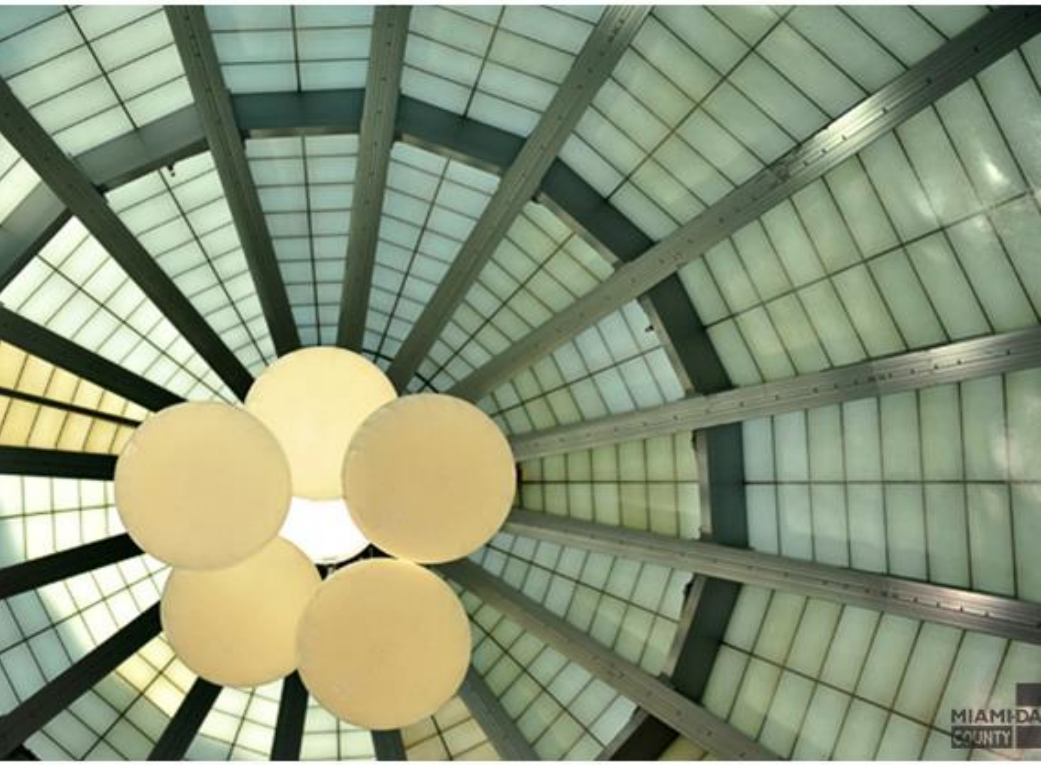
# SOLAR PHOTOVOLTAIC (PV) PERMITTING AND PLAN SUBMITTAL REQUIREMENTS

Presented by the Department of Regulatory an d Economic Resources (RER)

Construction, Permitting and Building Code Division

In Partnership with Florida Solar Energy Center (FSEC)

# AGENDA

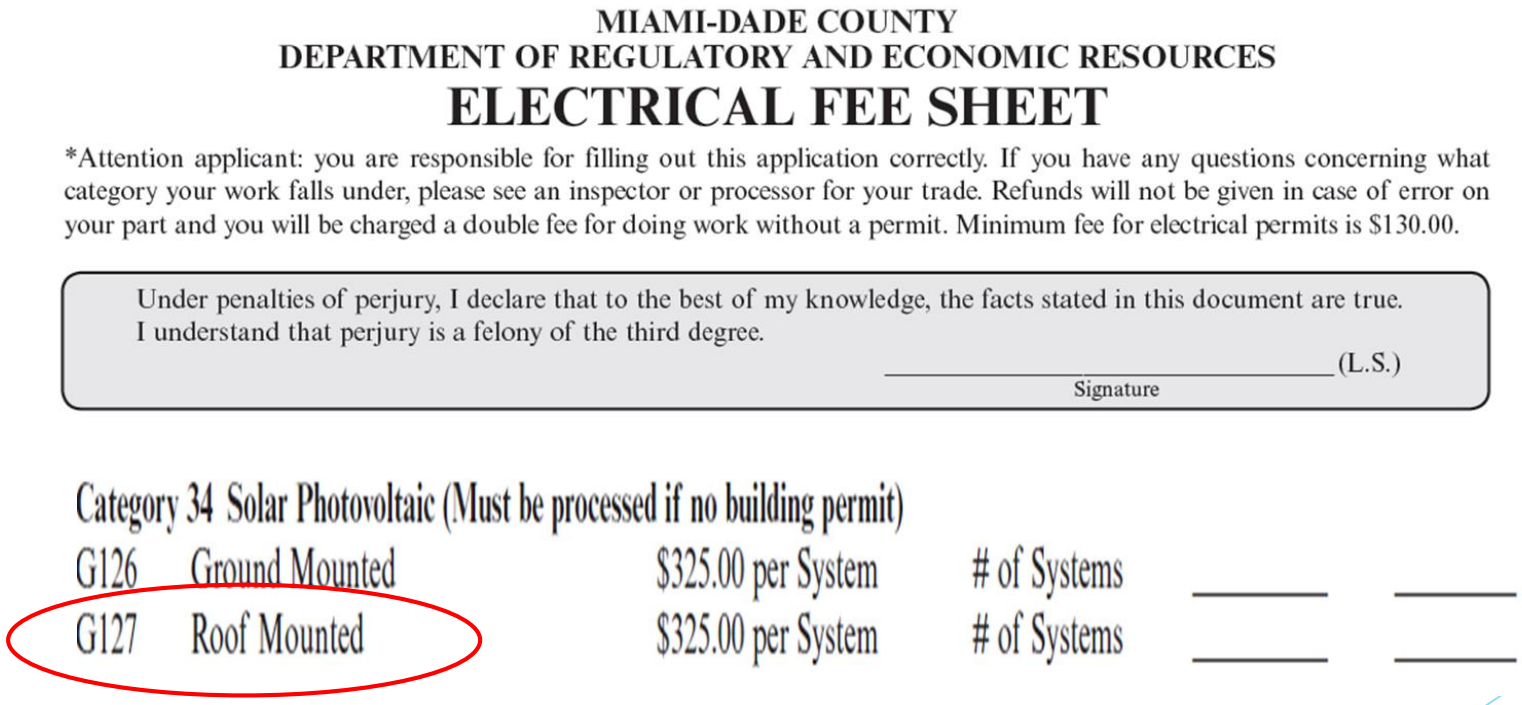


- Permit Application submittal and intake
- Plan review process and requirements
  - Structural/Roofing
  - Electrical
- Inspection Process and requirements
- Presentation by FSEC

# PERMIT APPLICATION SUBMITTAL

The following items are required at the time of permit application.

- A completed Building Permit Application (Yellow Form) signed and notarized by the property owner and contractor.
- An Electrical Fee sheet (Gold Form) signed by the contractor with the Electrical Category 34- Solar Photovoltaic information completed.



MIAMI-DADE COUNTY
DEPARTMENT OF REGULATORY AND ECONOMIC RESOURCES

**ELECTRICAL FEE SHEET**

*Attention applicant: you are responsible for filling out this application correctly. If you have any questions concerning what category your work falls under, please see an inspector or processor for your trade. Refunds will not be given in case of error on your part and you will be charged a double fee for doing work without a permit. Minimum fee for electrical permits is $130.00.

Under penalties of perjury, I declare that to the best of my knowledge, the facts stated in this document are true.
I understand that perjury is a felony of the third degree.

_____ (L.S.)
Signature

Category 34 Solar Photovoltaic (Must be processed if no building permit)

| | | | | | |
|---|---|---|---|---|---|
| G126 | Ground Mounted | $325.00 per System | # of Systems | _____ | _____ |
| G127 | Roof Mounted | $325.00 per System | # of Systems | _____ | _____ |

***Please select Roof Mounted system on the fee sheet, so that the required roof top in-progress inspection is generated as part of the job site inspections.***

# PERMIT APPLICATION SUBMITTAL Continued

- All Electrical Category 34 permits are routed via the Concurrent Plans Processing (CPP) system. This system allows the electronic submittal of plans and documentation and then send the plans to multiple trades for review and approval concurrently, thus expediting the permitting process.
- Submission of plans in the following format

PAPER:

- One (1) Set of sign and sealed plans by a design professional
- Plans will be converted to electronic format for a fee. An additional 24-48 hours must be allotted for this conversion.

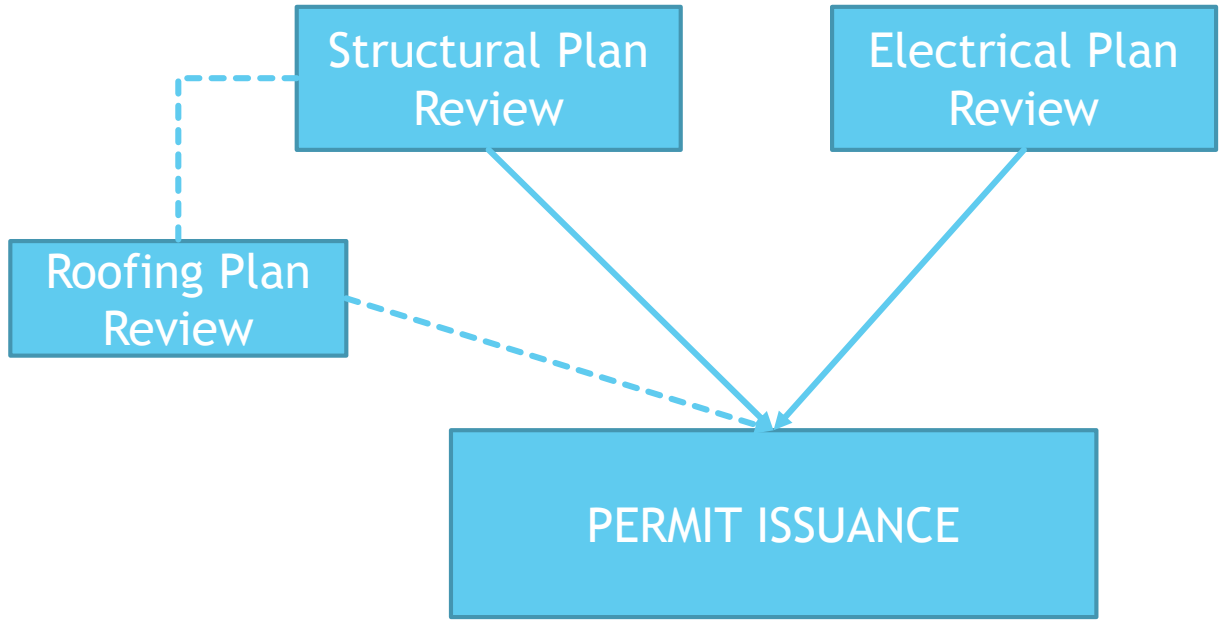
Or

ELECTRONIC:

- A CD ROM which contains all drawings and supporting documents in PDF file format based on the CPP guidelines established and available online at https://www.miamidade.gov/permits/library/guidelines/concurrent-plans-processing.pdf.
- Plans must comply with electronic signature requirements outline in Florida Statutes Chapters 471 and 481 and Florida Administrative Rules 61G15-23 and 61G1-16.

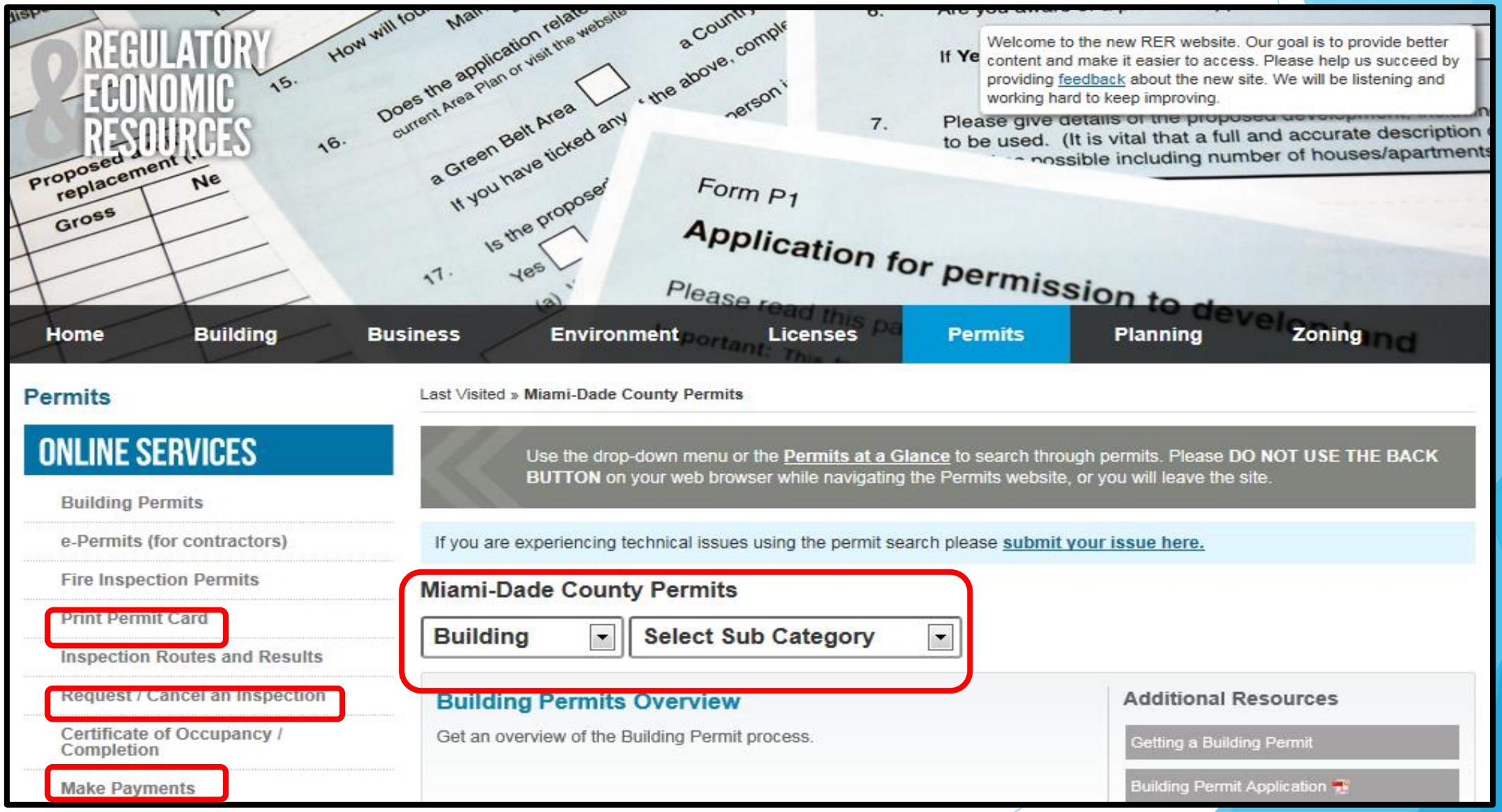
# PERMIT APPLICATION SUBMITTAL Continued

- Once the application, fee sheet and plans are submitted, a process number will be issued and upfront fees need to be paid in order for the Department to route your plans for review to the appropriate trades for approval and permit issuance.



# Structural and Roofing Plan Review

# ONLINE SERVICES - Miami-Dade County



Permits

Last Visited »

## ONLINE SERVICES

- Building Permits
- e-Permits (for contractors)
- Fire Inspection Permits
- Print Permit Card
- Inspection Routes and Results
- Request / Cancel an Inspection
- Certificate of Occupancy/Completion
- Make Payments

> View all Online Services

## PERMITS AT A GLANCE

- Building
- Business
- Electrical
- Environmental
- Film
- Mechanical

Use the drop-down menu or the **Permits at a Glance** to search through permits. Please **DO NOT USE THE BACK BUTTON** on your web browser while navigating the Permits website, or you will leave the site.

### Miami-Dade County Permits

Roofing | Solar

#### Solar Ridge Venting Calculations

This form enables the applicant to provide the necessary job site information, in order to comply with the requirements for balanced ridge venting.

#### Solar System Roof Permit

The Solar System Roof Permit is to be completed by the contractor.

#### Solar Systems Permit Document Guidelines

The Solar Systems Permit Document Guidelines provides building, equipment and roof plan information.

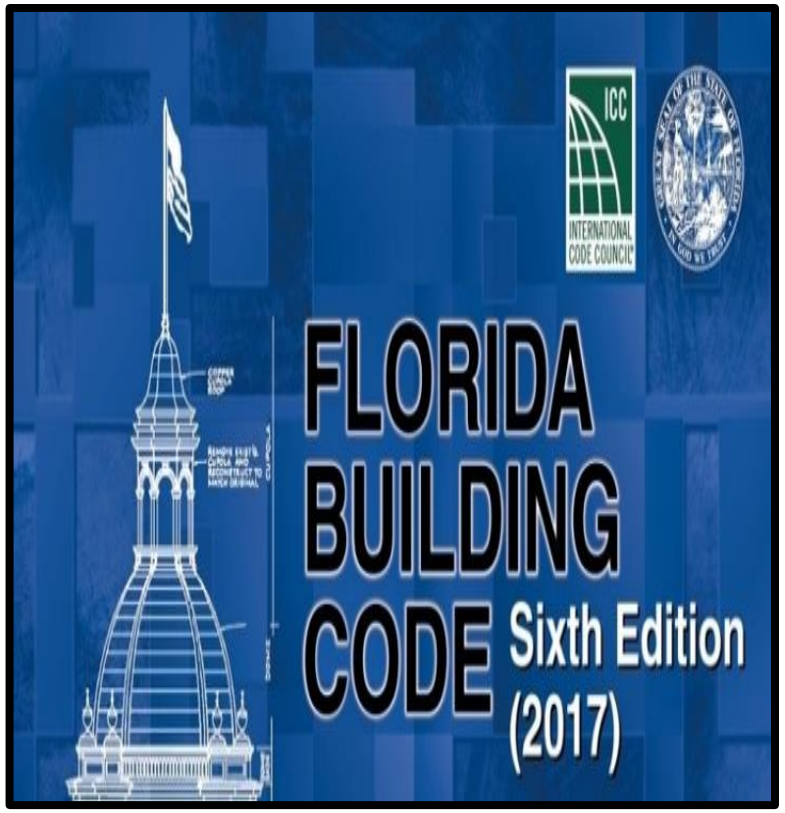
#### Solar System Permit Owner Disclosure

The property owner's signature in the Property Owner's Solar System Disclosure Form indicates that the information in this form has been explained to the property owner by the contractor.

# HIGH VELOCITY HURRICANE ZONE (HVHZ) PV REQUIREMENTS

- HVHZ Florida Building Code Requirements
- NEC-2014 VERSION
- Board of Rules and Appeals Interpretations
- UL 1703/2703 Listings

# HIGH VELOCITY HURRICANE ZONE (HVHZ) PV REQUIREMENTS




- Current version of the FBC
- Effective 12/31/2017

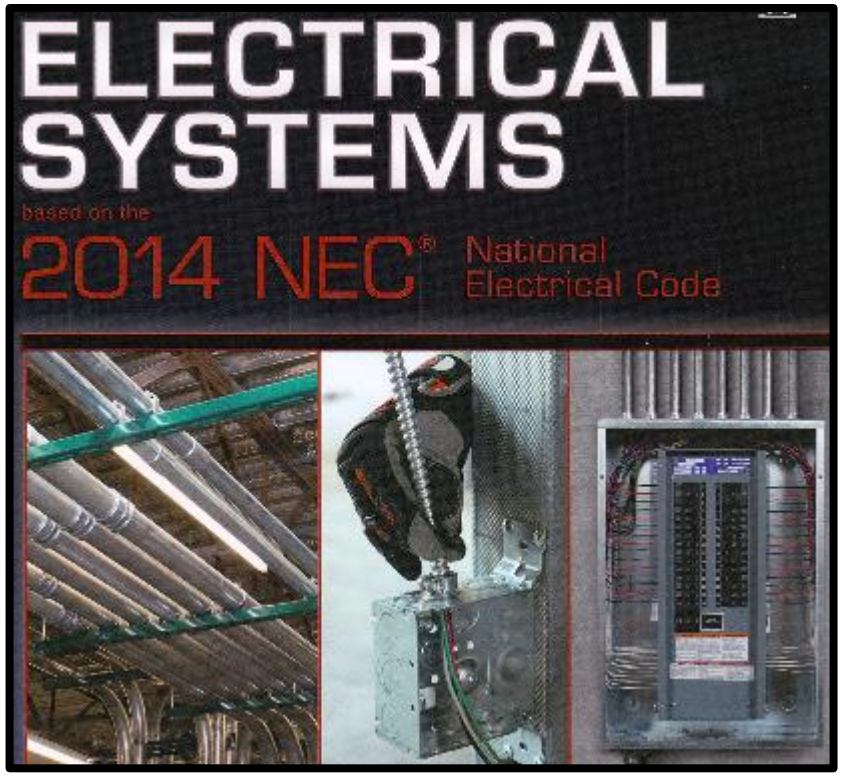
# CHAPTER 16 HVHZ STRUCTURAL DESIGN REQUIREMENTS

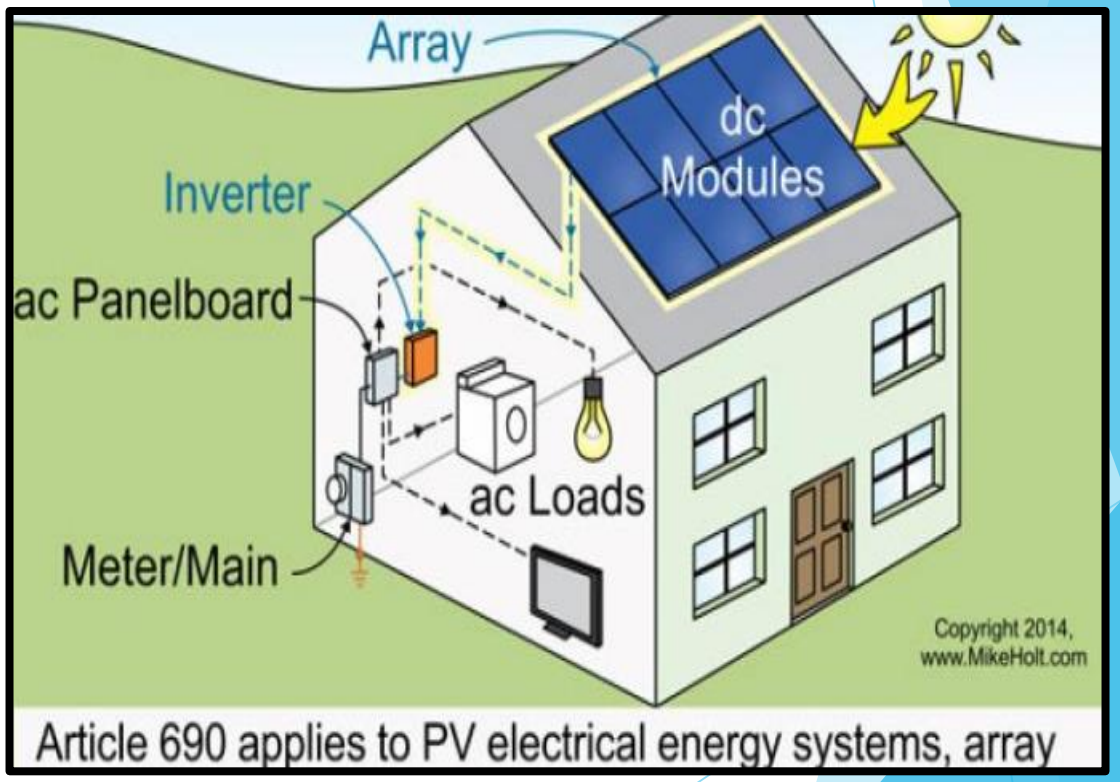
- Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 1605, 1607, 1611, 1616 through 1626

# CHAPTER 15 BUILDING CODE REQUIRERMENTS

- The High Velocity Hurricane Zone (HVHZ) consists of Miami-Dade and Broward Counties
- Sections 1512 through 1525 set forth the minimum requirements for the installation of roofing components, roofing systems and roofing assemblies and the ***waterproofing there of***.

# 2014 NEC IS NOW REQUIRED BY THE CURRENT VERSION OF THE FBC



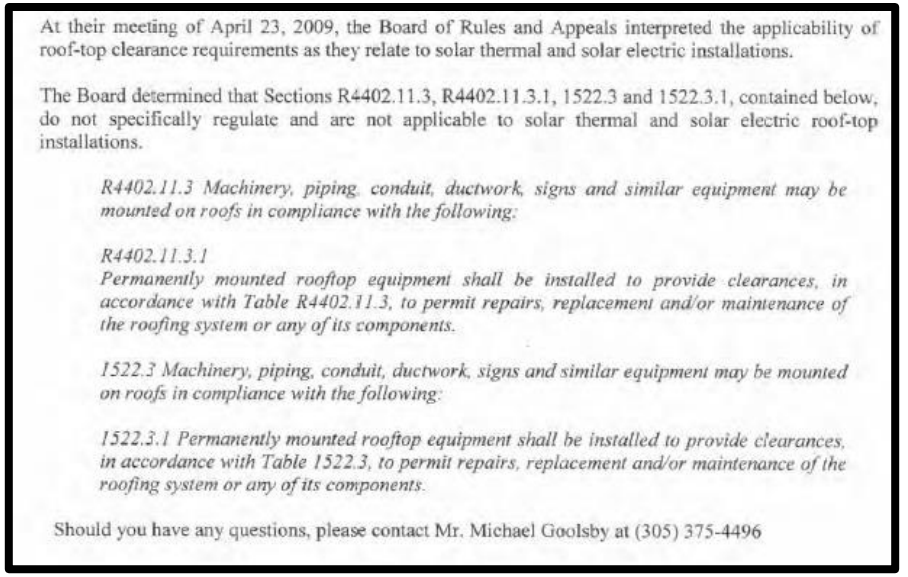



# The Board of Rules And Appeals & the Construction Trades Qualifying Board Interpretations

## Solar Rooftop Exemption to FBC Equipment Heights

# Solar Rooftop Exemption to FBC Equipment Heights

This interpretation exempts Rooftop PV and Solar Thermal equipment from the clearance requirements found in the HVHZ Chapter 15 Roofing requirements.



At their meeting of April 23, 2009, the Board of Rules and Appeals interpreted the applicability of roof-top clearance requirements as they relate to solar thermal and solar electric installations.

The Board determined that Sections R4402.11.3, R4402.11.3.1, 1522.3 and 1522.3.1, contained below, do not specifically regulate and are not applicable to solar thermal and solar electric roof-top installations.

*R4402.11.3 Machinery, piping, conduit, ductwork, signs and similar equipment may be mounted on roofs in compliance with the following:*

*R4402.11.3.1*
*Permanently mounted rooftop equipment shall be installed to provide clearances, in accordance with Table R4402.11.3, to permit repairs, replacement and/or maintenance of the roofing system or any of its components.*

*1522.3 Machinery, piping, conduit, ductwork, signs and similar equipment may be mounted on roofs in compliance with the following:*

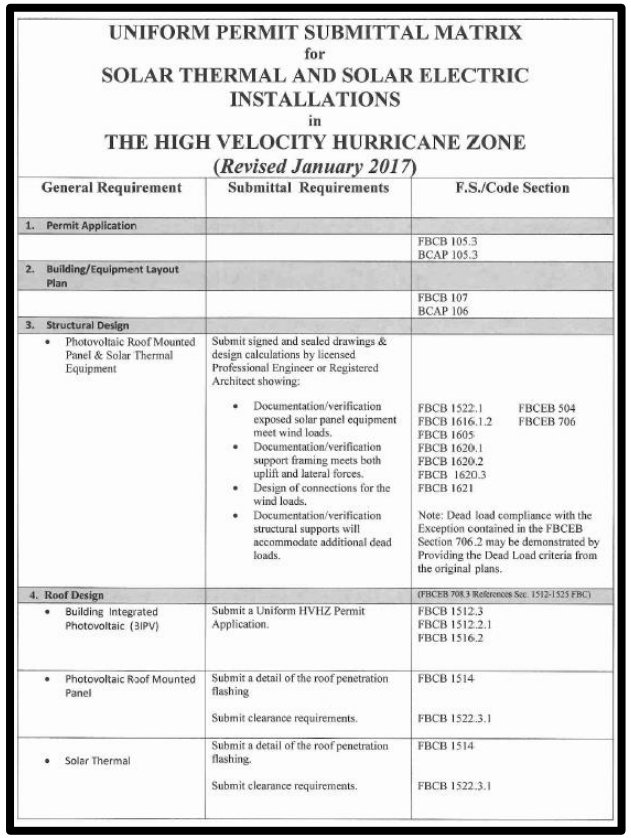
*1522.3.1 Permanently mounted rooftop equipment shall be installed to provide clearances, in accordance with Table 1522.3, to permit repairs, replacement and/or maintenance of the roofing system or any of its components.*

Should you have any questions, please contact Mr. Michael Goolsby at (305) 375-4496

# The Board of Rules And Appeals & the Construction Trades Qualifying Board Interpretations

## Solar Thermal and Solar Electric Guidelines

# Solar Thermal and Solar Electric Guidelines



**UNIFORM PERMIT SUBMITTAL MATRIX**
**for**
**SOLAR THERMAL AND SOLAR ELECTRIC INSTALLATIONS**
**in**
**THE HIGH VELOCITY HURRICANE ZONE**
***(Revised January 2017)***

| General Requirement | Submittal Requirements | F.S./Code Section |
|---|---|---|
| **1. Permit Application** | | |
| | | FBCB 105.3<br>BCAP 105.3 |
| **2. Building/Equipment Layout Plan** | | |
| | | FBCB 107<br>BCAP 106 |
| **3. Structural Design** | | |
| • Photovoltaic Roof Mounted Panel & Solar Thermal Equipment | Submit signed and sealed drawings & design calculations by licensed Professional Engineer or Registered Architect showing:<br>• Documentation/verification exposed solar panel equipment meet wind loads.<br>• Documentation/verification support framing meets both uplift and lateral forces.<br>• Design of connections for the wind loads.<br>• Documentation/verification structural supports will accommodate additional dead loads. | FBCB 1522.1 FBCEB 504<br>FBCB 1616.1.2 FBCEB 706<br>FBCB 1605<br>FBCB 1620.1<br>FBCB 1620.2<br>FBCB 1620.3<br>FBCB 1621<br>Note: Dead load compliance with the Exception contained in the FBCEB Section 706.2 may be demonstrated by Providing the Dead Load criteria from the original plans. |
| **4. Roof Design** | | (FBCEB 708.3 References Sec. 1512-1525 FBC) |
| • Building Integrated Photovoltaic (BIPV) | Submit a Uniform HVHZ Permit Application. | FBCB 1512.3<br>FBCB 1512.2.1<br>FBCB 1516.2 |
| • Photovoltaic Roof Mounted Panel | Submit a detail of the roof penetration flashing<br>Submit clearance requirements. | FBCB 1514<br>FBCB 1522.3.1 |
| • Solar Thermal | Submit a detail of the roof penetration flashing.<br>Submit clearance requirements. | FBCB 1514<br>FBCB 1522.3.1 |

# UL standards

- UL 1741 PV inverters
- UL 1703 PV modules
- UL 2703 PV racking systems
  - ANSI accredited in Jan 2015
  - Evaluates racking, modules, and grounding hardware
    - Fire classification (using UL 1703)
    - Bonding/grounding integrity
    - Corrosion
    - Mechanical loading

# PV-Permit Check List

# COMMON STRUCTURAL PV DISAPPROVAL ITEMS

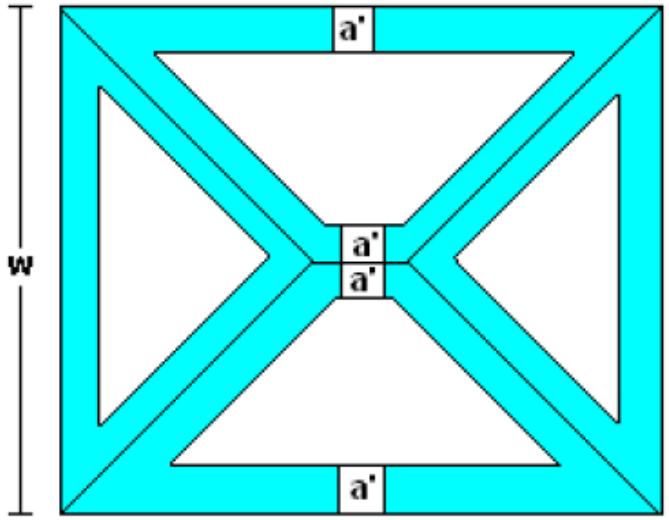
- Plans that do not address HVHZ wind pressures
- Plans that have incomplete or incorrect wind pressure calculations
- Roof plans that do not match the shape of roof; hipped versus gables and or flat

# COMMON STRUCTURAL PV DISAPPROVAL ITEMS

- Roof pressure zones are not calculated or presented correctly on plans
- PV modules are not rated for the wind pressure zones they are installed in

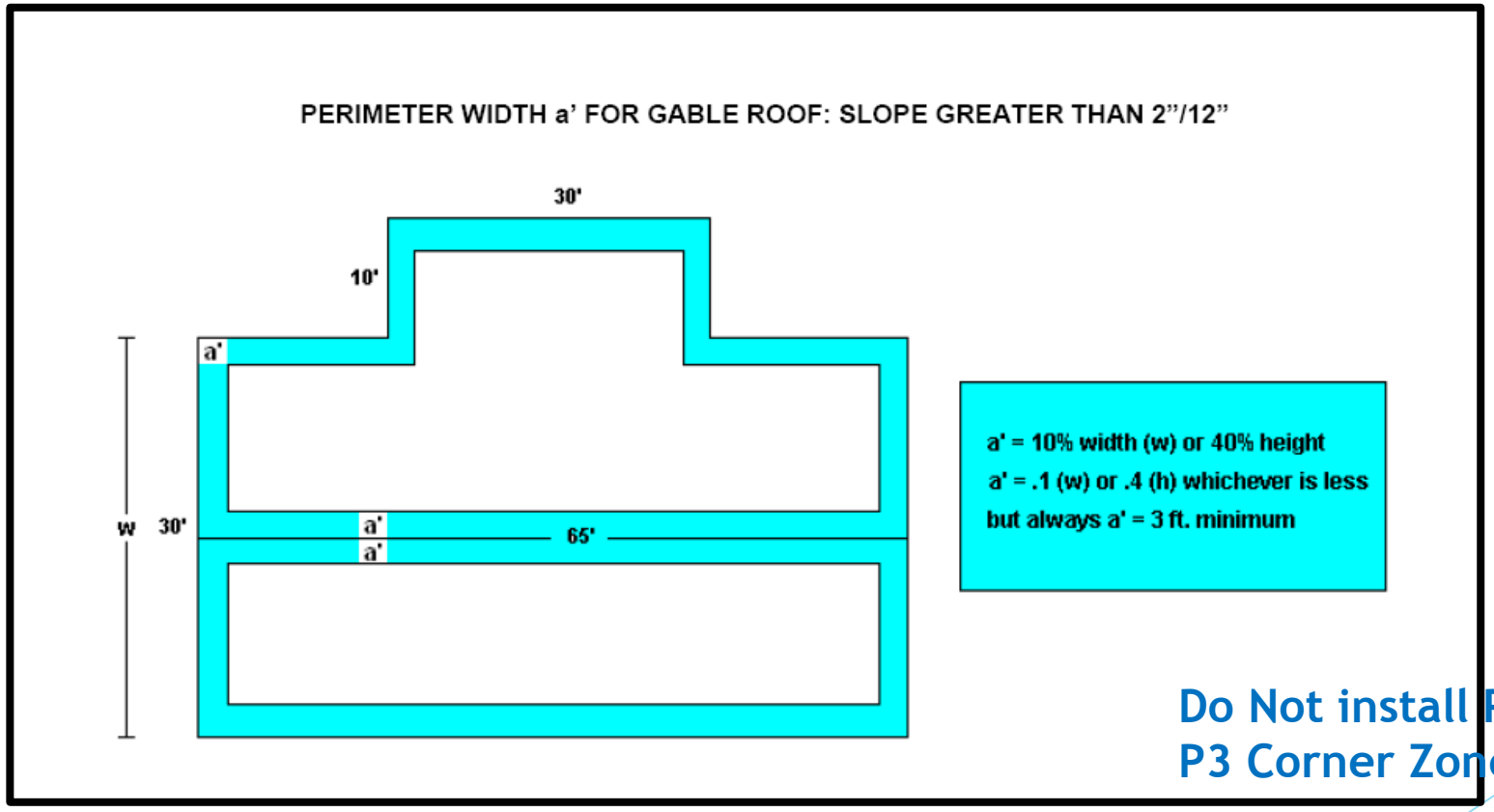
# HIP ROOF PERIMETER ZONES

PERIMETER WIDTH a' FOR HIP ROOF: SLOPE GREATER THAN 2"/12"



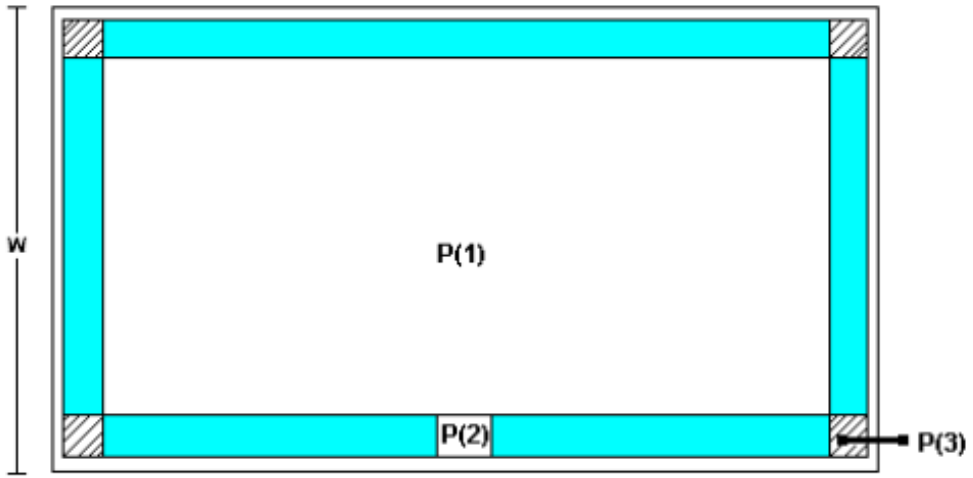

a' = 10% width (w) or 40% height (h)
a' = .1 (w) or .4 (h) whichever is less
but always a' = 3 ft. minimum

# GABLE ROOF PERIMETER ZONES




Do Not install PV modules in P3 Corner Zones

# LOW SLOPE PERIMETER ZONES




P(1): Field of the Roof

P(2): Perimeter of the Roof

P(3): Corner of the Roof

a' = P(2): Perimeter of the Roof

a' = 10% of width (w) or 40% of height (h)

a' = .1(w) or .4(h) whichever is less

a' always = 3 ft. minimun

*If a parapet equal to or higher than 3 ft. is provided around the entire perimeter of the roof then the uplift pressures of P(3) shall be equal to the uplift pressures of P(2).*

# COMMON STRUCTURAL PV DISAPPROVAL ITEMS

- Racking systems & stand-offs that are not rated for the wind pressure zones they are to be installed in.
- Connections are specified that do not meet the wind load requirements of Chapter 16 (Structural Design) HVHZ

# RAS-127 HVHV, EXPOSURE C
# PRESCRIPTIVE STEEP SLOPE UPLIFT PRESSURES

TABLE 1 - RISK CATEGORY II EXPOSURE CATEGORY "C"[1]
MINIMUM DESIGN WIND UPLIFT PRESSURES IN PSF
FOR FIELD [$P_{asd}$ $(1)^2$], PERIMETER [$P_{asd}$ $(2)^2$], AND CORNER [$P_{asd}$ $(3)^2$] AREAS OF
ROOFS FOR EXPOSURE C BUILDINGS WITH A ROOF MEAN HEIGHT AS SPECIFIED[3]

| ROOF SLOPE | > 2:12 to ≤ 6:12 | | | > 6:12 to ≤ 12:12 | |
|---|---|---|---|---|---|
| ROOF MEAN HEIGHT[3] | $P_{asd}$ (1) | $P_{asd}$ (2) | $P_{asd}$ (3) | $P_{asd}$ (1) | $P_{asd}$ (2) & $P_{asd}$ (3) |
| ≤ 20' | -39.1 | -68.1 | -100.7 | -42.8 | -50.0 |
| > 20' to ≤ 25' | -40.9 | -71.3 | -105.4 | -44.8 | -52.3 |
| > 25' to ≤ 30' | -42.4 | -73.9 | -109.3 | -46.4 | -54.3 |
| > 30' to ≤ 35' | -43.9 | -76.6 | -113.2 | -48.1 | -56.2 |
| > 35' to ≤ 40' | -45.1 | -78.7 | -116.3 | -49.4 | -57.8 |

[1] CALCULATED IN ACCORDANCE WITH ASCE.
[2] Pasd = 0.6 Pult
*asd: allowable stress design*
*ult: ultimate (calculated design pressure)*

**** Installing PV arrays in Zone 1 will help to minimize disapprovals.***

# RAS-128 HVHV, EXPOSURE C
# PRESCRIPTIVE LOW SLOPE UPLIFT PRESSURES

TABLE 1 - RISK CATEGORY II EXPOSURE CATEGORY "C" [1]
MINIMUM DESIGN WIND UPLIFT PRESSURES IN PSF
FOR FIELD [Pasd (1)[2]], PERIMETER [Pasd (2)[2]], AND CORNER [Pasd (3)[2]] AREAS OF
ROOFS FOR EXPOSURE C BUILDINGS WITH A ROOF MEAN HEIGHT AS SPECIFIED[3]

| ROOF MEAN HEIGHT[3] (BELOW) | Pasd (1) FIELD | Pasd (2) PERIMETER | Pasd (3) CORNERS |
|---|---|---|---|
| 20' | -42.8 | -71.7 | -108.0 |
| 25' | -44.8 | -75.1 | -113.0 |
| 30' | -46.4 | -77.8 | -117.2 |
| 35' | -48.1 | -80.6 | -121.3 |
| 40' | -49.4 | -82.9 | -124.7 |

[1] CALCULATED IN ACCORDANCE WITH ASCE.
[2] Pasd = 0.6 Pult
*asd: allowable stress design*
*ult: ultimate (calculated design pressure)*

# SAMPLE PV MODULE DESIGN LOADS

| SYSTEM INTEGRATION PARAMETERS | | |
|---|---|---|
| *Maximum system voltage SC II / NEC* | | 1000 V |
| *Maximum reverse current* | | 16 A |
| *Number of bypass diodes* | | 3 |
| *Design Loads** | *Two rail system* | 113 psf downward<br>64 psf upward |
| *Design Loads** | *Three rail system* | 170 psf downward<br>71 psf upward |
| *Design Loads** | *Edge mounting* | 30 psf downward<br>30 psf upward |

* Please refer to the Sunmodule installation instructions for the details associated with these load cases.

# COMMON STRUCTURAL PV DISAPPROVAL ITEMS

- Scanned documents that are not legible, and cannot be reviewed
- Building plans that include Manufacturer's data sheets that are not legible and cannot be reviewed
- Note:  Data sheets can be submitted as separate pdf files

# COMMON STRUCTURAL PV DISAPPROVAL ITEMS

- Construction plans provided by a Design Professional that are not signed and sealed correctly.
- Design Professionals seals that are not legible or not scanned by our vendor when construction documents are submitted at the Department's permit counter.

# COMMON STRUCTURAL PV DISAPPROVAL ITEMS

- Florida Licensed Professional Engineers can digitally sign and seal documents provided their digital seal is verified by an independent 3rd party verification service.

# COMMON BUILDING/ROOF TOP PV DISAPPROVAL ITEMS

- Roof penetration & flashing details that do not comply with the requirements of Chapter 15 (Roofing) HVHZ Section 1514.2.5
- Penetration flashings not performed in accordance with National Roofing Contractors Association (NRCA) roofing practices
- Flashing details that are not compatible with the type of roof system they are installed on.

# PV ROOF PLAN REQUIREMENTS

- On the Roof Plan show the location, nature, and extent of proposed work
- Show the size, shape, dimensions of roof and roof sections

# PV ROOF PLAN REQUIREMENTS

- Provide site exposure category & wind speed
- Provide roof pressure zones and sizes

# PV ROOF PLAN REQUIREMENTS

- Provide the layout of the racking and standoffs for the PV module attachment, including roof penetration flashing details

# PV ROOF PENETRATION FLASHING and WATERPROOFING REQUIREMENTS

# WATERPROOFING ROOF TOP PV PENETRATIONS

- The High Velocity Hurricane Zone (HVHZ) consists of Miami-Dade and Broward Counties
- Sections 1512 through 1525 set forth the minimum requirements for the installation of roofing components, roofing systems and roofing assemblies and the ***waterproofing there of***.

# WATERPROOFING PV ROOF PENETRATIONS

Prior to installing a PV system over an existing roof, consider whether the remaining roof service life is equivalent to the expected life to the PV system (typically greater than 20 plus years).

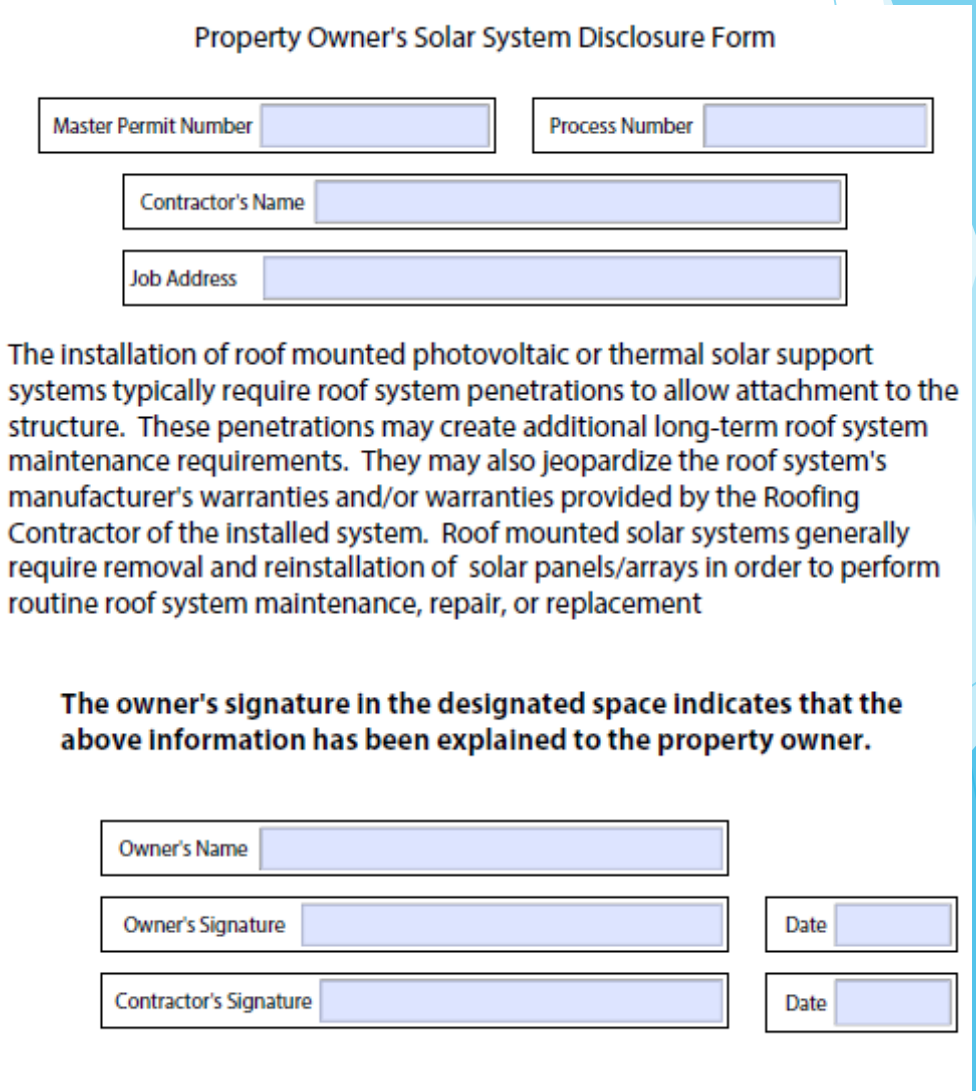
# WATERPROOFING PV ROOF PENETRATIONS

If it is expected that the PV installation will function longer than the existing roof system, then replacement of the existing roof is strongly recommended.

# PROPERTY OWNER'S SOLAR SYSTEM DISCLOSURE FORM

# PROPERTY OWNER'S SOLAR SYSTEM DISCLOSURE FORM

- Please ensure that this form is provided to the property owner.
- No power of Attorney Signatures are allowed on this form.
- This form should be regarded as "Informed Consent" prior to installing a PV array on an existing roof.



Property Owner's Solar System Disclosure Form

Master Permit Number

Process Number

Contractor's Name

Job Address

The installation of roof mounted photovoltaic or thermal solar support systems typically require roof system penetrations to allow attachment to the structure. These penetrations may create additional long-term roof system maintenance requirements. They may also jeopardize the roof system's manufacturer's warranties and/or warranties provided by the Roofing Contractor of the installed system. Roof mounted solar systems generally require removal and reinstallation of solar panels/arrays in order to perform routine roof system maintenance, repair, or replacement

**The owner's signature in the designated space indicates that the above information has been explained to the property owner.**

Owner's Name

Owner's Signature

Date

Contractor's Signature

Date

# BUILDING PERMIT SELECTION MENU
# SEARCH PERMIT HISTORY

# BUILDING PERMIT SEARCH

**Building Permit Selection Menu**

Effective July 22nd, 2004, the web application has been changed as follows:
The option to cancel inspections from **today's route** has been modified
to allow cancellation from **6:00 am to 8:00 am only**

Please make one selection, enter the required information (shown in **bold** lettering) and click the **Submit** button or press the **Tab** key and then press **Enter**.

- ○ Permit Inspection Request **(Permit Number)**
- ○ Cancel Inspections Requested Today **(Permit Number)**
- ○ Cancel Inspections from Today's Route **(Permit Number)**
- ○ Permit Inspection History **(Permit Number)**
- ○ Request Fire Inspection/History **(Permit or Fire Municipal Number)**
- ○ Permit History Inquiry **(Permit Number)**
- ○ Master Subsidiary Permit Cross-Reference **(Permit Number)**
- ○ Permit Fees **(Process Number)**
- ○ Permit Application History **(Process Number)**
- ◉ Process/Permit Number Cross-Reference **(Address)**
- ○ Open Master Permits **(Address)**
- ○ Contractor Permit Inquiry **(C** or **T** followed by **Contractor or Qualifier No.)**
- ○ Permit Inspection Holds **(Permit Number)**
- ○ Permit Outstanding Requirements **(Permit Number)**
- ○ Permit Project Status **(Permit Number)**
- ○ Open Permits by Folio **(Folio Number)**

Enter required information here:
ENTER ADDRESS ✕

Submit Reset

For Address Format click here

**Process/Permit Number Address Cross-Reference**

**Address:** 11805 SW 26 ST

| Process Number | Permit Number | Permit Type | Appl type | Appl Date |
|---|---|---|---|---|
| C2014080792 | 2014030359 | ELEC | NP | 03/25/2014 |
| C2014075156 | 2014029515 | MECH | NP | 03/13/2014 |
| C2014049432 | 2014019877 | ELEC | NP | 01/22/2014 |
| C2014045820 | 2014017598 | MECH | NP | 01/14/2014 |
| C2014042757 | 2014018284 | BLDG | NP | 01/07/2014 |
| C2014010782 | 2014004192 | ELEC | NP | 10/23/2013 |
| C2014003374 | 0 | BLDG | NP | 10/08/2013 |
| C2013168638 | 2013066313 | MECH | NP | 09/13/2013 |
| C2013150368 | 0 | BLDG | NP | 08/07/2013 |
| C2013014110 | 2013005912 | ELEC | NP | 10/30/2012 |
| C2012106531 | 2012044496 | ELEC | NP | 06/12/2012 |

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APPLICATION HISTORY INQUIRY SUCCESSFUL (MORE ENTRIES)

e-Permitting

Search: Go

miamidade.gov

Resident | Visitor | Business | Employee

MIAMI-DADE

# Permit History Inquiry

| | | | |
|---|---|---|---|
| Permit Number: | 2014018284 | Issue Date: | 01/17/2014 |
| Process Number: | C2014042757 | CO/CC Release Date: | |
| Permit Type: | BLDG | Master Permit Number: | 0 |
| Building Code: | FBC 2010 | Bldg CO Release Date: | |
| Categories: | GRAVEL, SBS, SINGLE PL | | |
| | | | |
| | | | |
| Address: | 11805 SW 26 ST | | |
| Owner's Name: | [redacted] | | |
| Folio Number: | | | |
| Proposed Use: | | | |
| Contractor: | [redacted] | [redacted] | |
| Tradesman: | | | |
| Permit expired (Y/N): | N | Expiration Date: | |
| New Issue Date: | 12/09/2016 | Revision Date: | |
| Extension Date: | | Last Inspection Date: | 12/21/2016 |
| Inspection Type: | FINAL | Inspection Disposition: | APPROVED |
| Request Date: | 12/20/2016 | Inspection Date: | 12/21/2016 |
| Last Approved Inspection Date: | 12/21/2016 | | |
| Inspection Comments: | COMPLIED PREVIOUS INSPECTOR COMMENT | | |

INQUIRY SUCCESSFUL

# Florida Administrative Code
## 61G4-15.021 Certification of Solar Contractors

(1) Scope of Rule. The purpose of this rule is to provide for the certification of solar contractors.

(f) Roofing. Solar contractors may perform roofing work directly related to the installation of a domestic solar water heating system, solar pool heating system, or photovoltaic system, including cutting roof openings and penetrations, installing flashings, attaching equipment mounting brackets and solar panels. **Such work shall be limited to an area within 18 inches of each roof penetration or attachment and shall be performed in accordance with National Roofing Contractors Association roofing practices.**

***State Licensed Electrical contractors do not have this authorization!***

# WATERPROOFING ROOF TOP PENETRATIONS

- 1512.2.1 ***All roofing components***, roofing systems, and roofing assemblies for construction regulated by code shall comply with this chapter.

# WATERPROOFING ROOF TOP PENETRATIONS

- **1513.1 Definitions ROOFING COMPONENT.** A roofing product that is incorporated into various roofing assemblies.

  ***Roofing components include roof coatings, adhesives, mastics, roof membranes, underlayments, etc…***

# WATERPROOFING PV ROOF PENETRATIONS

- 1514.2 Flashings – All roof flashings and terminations (*including **PV penetrations***) shall be designed and installed to meet the wind load requirements of Chapter 16 (High Velocity Hurricane Zone)
- 1514.2.5.2 Other roof penetrations shall be suitably flashed with curbs, collars, pitch pans in compliance with RAS-111 or an approved method.

# WATERPROOFING PV ROOF PENETRATIONS

- Use of proprietary flashing material and methods provided by the PV racking manufacturer.

  ***These methods shall comply with the requirements of***

  ***Chapter 15 of the Florida Building Code HVHZ***

- Compatible roofing methods and materials shall be used to flash/waterproof the PV array to the existing and/or new roof where the array is to be installed.

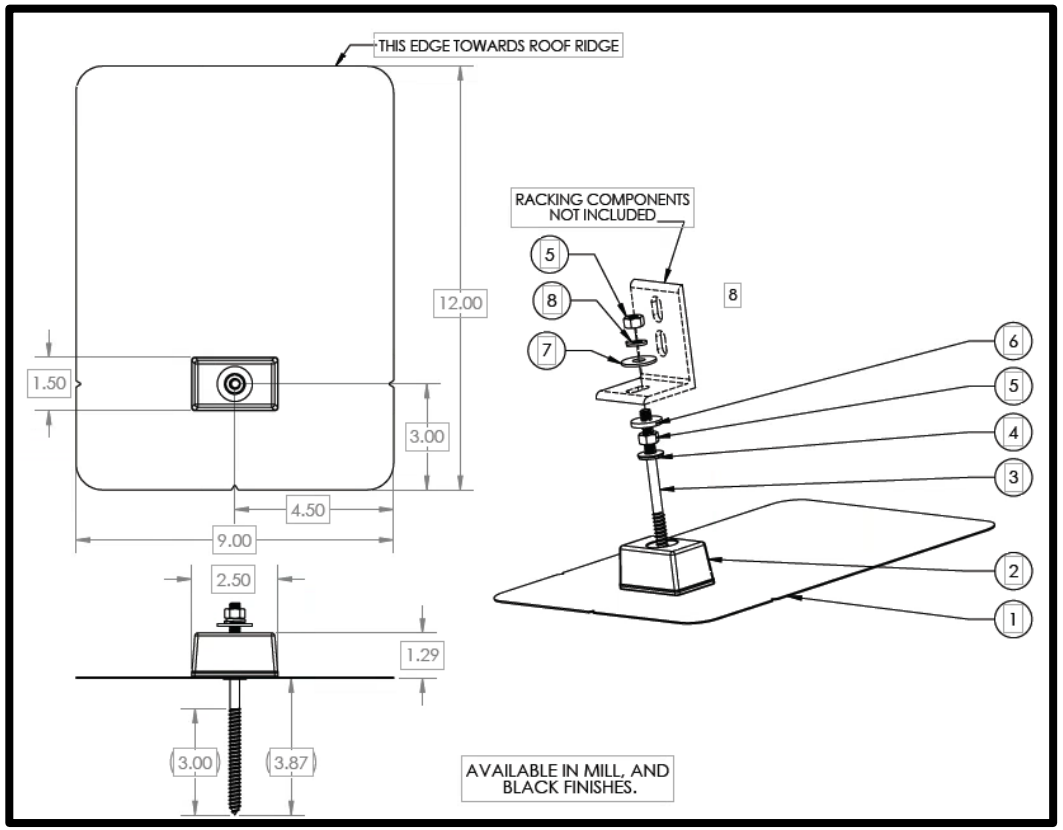
# SHINGLE ROOF SYSTEMS

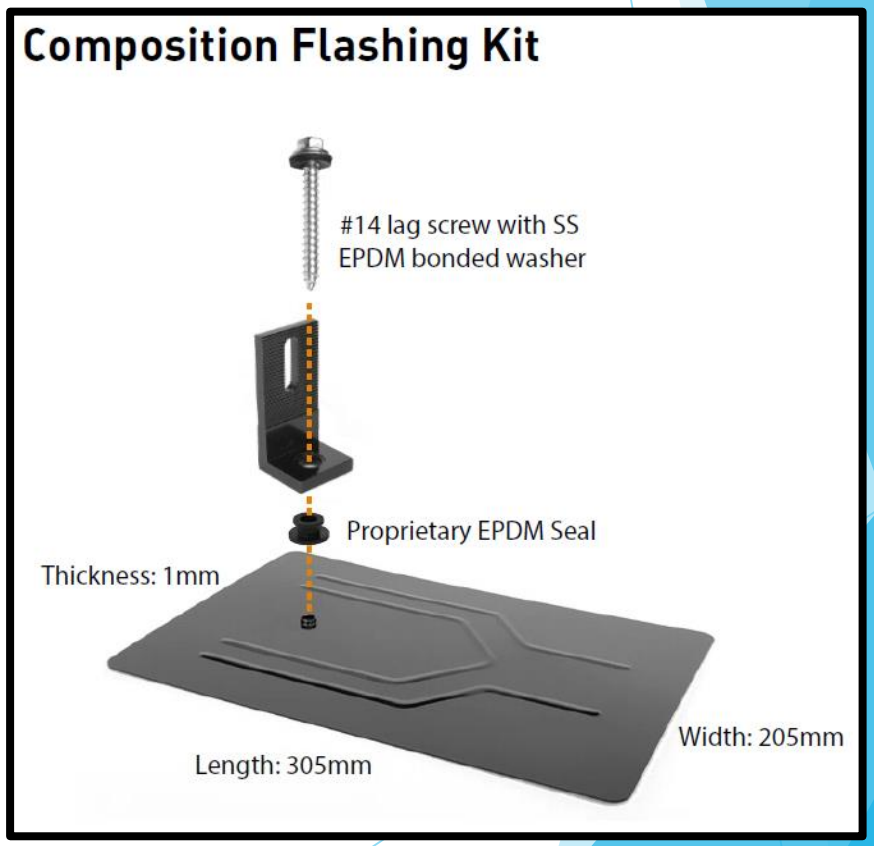
- Are classified as a water shedding (hydrokinetic) roof system
- Are considered to a “Class A” roof system
- Require a minimum of 2/12 roof slope
- Are limited to a roof mean height of less than 33 feet.
- PV shingle penetration flashings, shall be performed in accordance with National Roofing Contractors Association (NRCA) roofing practices.
- Typically a shingle flashing detail includes an aluminum skirt metal with the shingles woven around it to waterproof the penetration and to properly shed water off the roof
- Include details in drawings for approval and inspections

# ALUMINUM SKIRT FLASHINGS

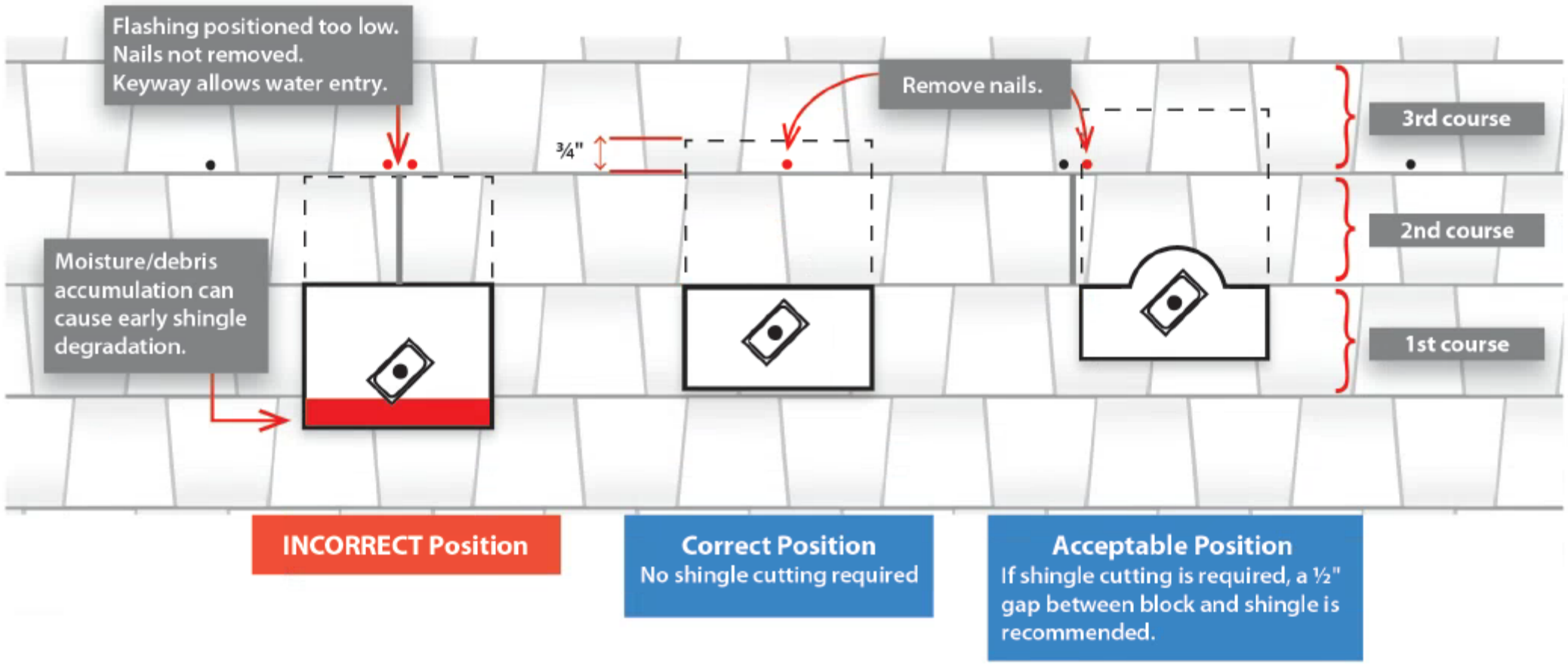
An acceptable permitting submittal option, would be to submit the manufacturer's shingle skirt flashing details and installation instructions as pdf file for ease of Permit reviews and inspections.

# TYPICAL PROPRIETARY ALUMINUM SKIRT FLASHINGS



# Proper Flashing Placement



# TILE ROOF SYSTEMS

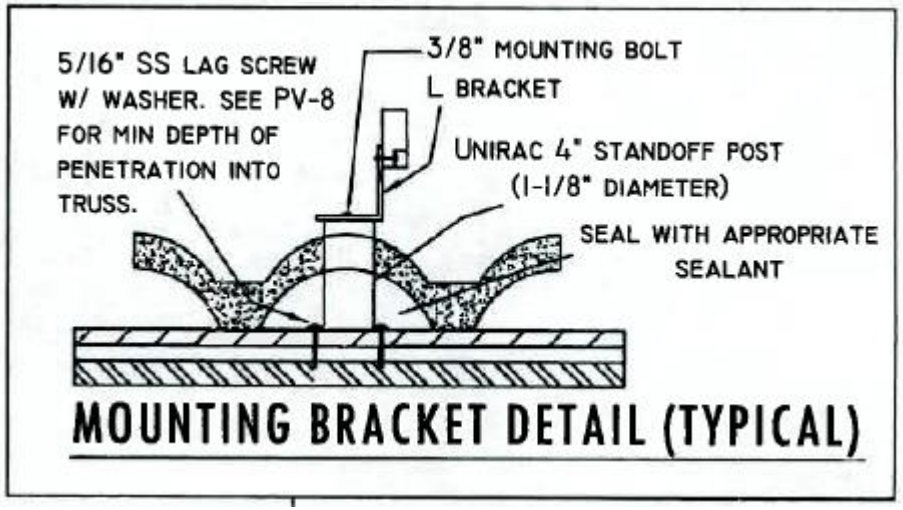
- Tile roofs are considered to be discontinuous roof systems, with the tile underlayment acting as the waterproofing element.
- 61G4-15.021 Penetration flashings shall be performed in accordance with National Roofing Contractors Association (NRCA) roofing practices.
- 1514.2.5.2 Other roof penetrations shall be suitably flashed with curbs, collars, pitch pans in compliance with RAS-111 or an approved method compatible with a tile roof assembly
- ***However, typically pitch pans are used on flat roofs and are not good roofing practice for multiple penetrations on a tile roof assembly.***

# TILE ROOF SYSTEMS

- ***A fasteners penetrating a roof system and only sealed with mastic or sealant is not an approvable PV flashing detail.***
- No roof penetration shall be located in roof valleys, it is recommended by the NRCA, that all penetrations be a lest 18” away from a valley.

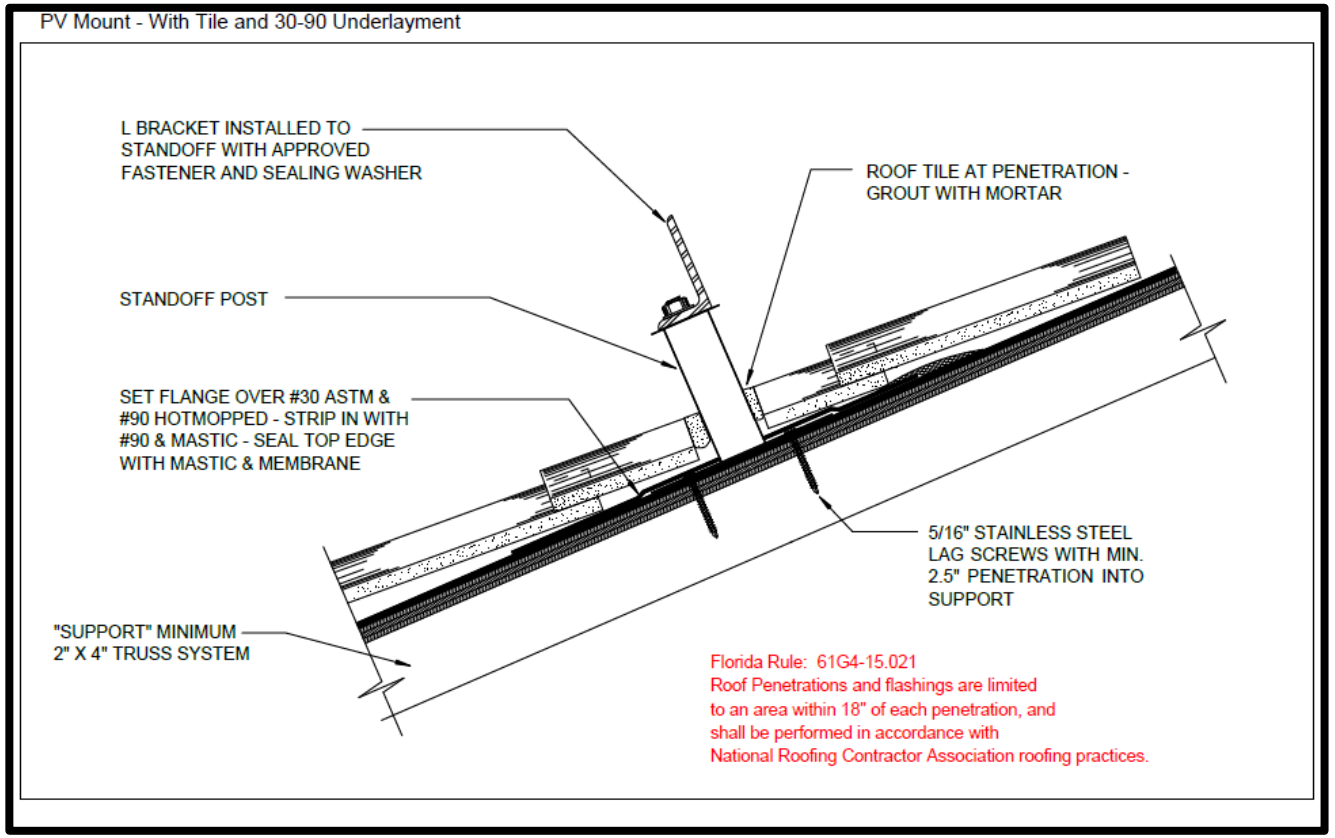
# TILE ROOF SYSTEMS

# EXAMPLE OF UNACCEPTABLE PENETRATON DETAIL

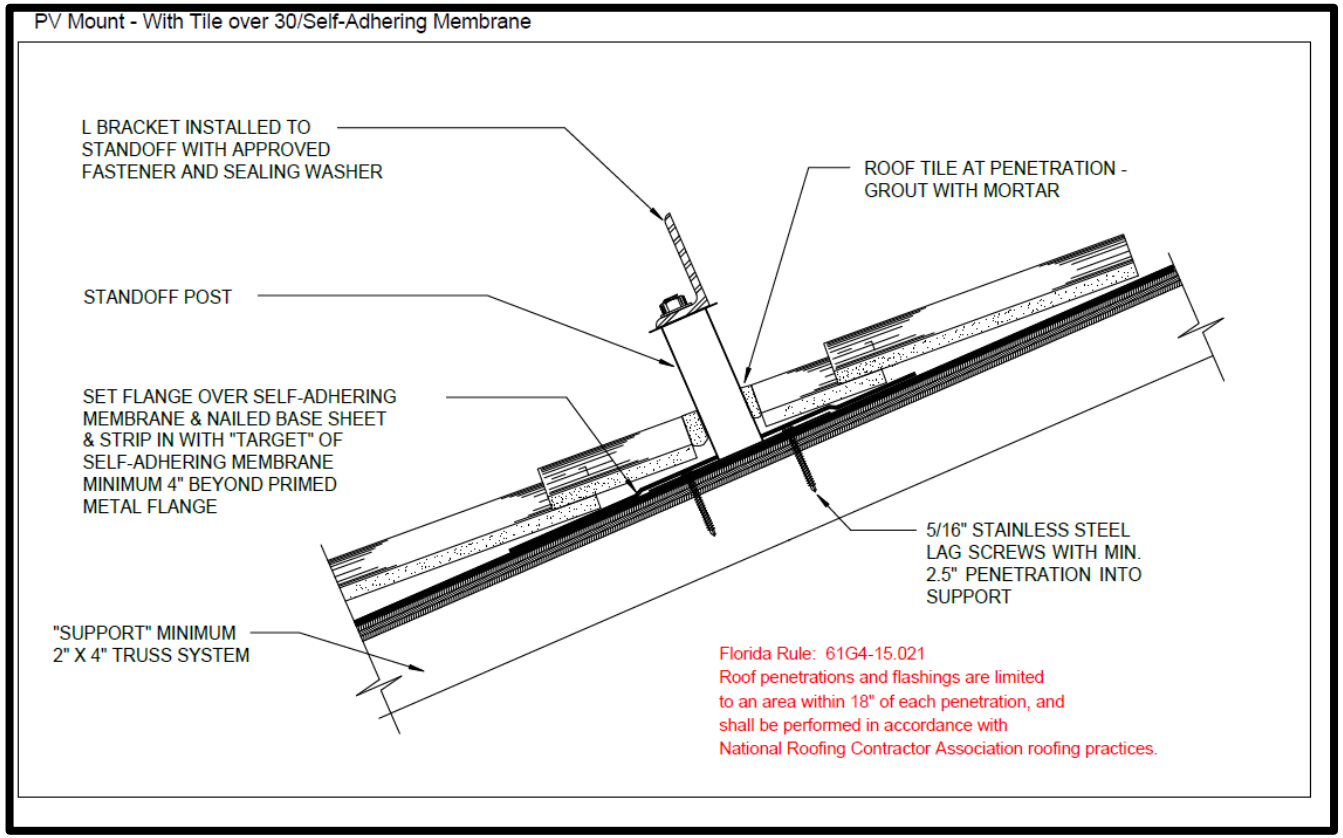


# Improper penetration flashing details

# MDC PRESCRIPTIVE TILE FLASHING DETAIL

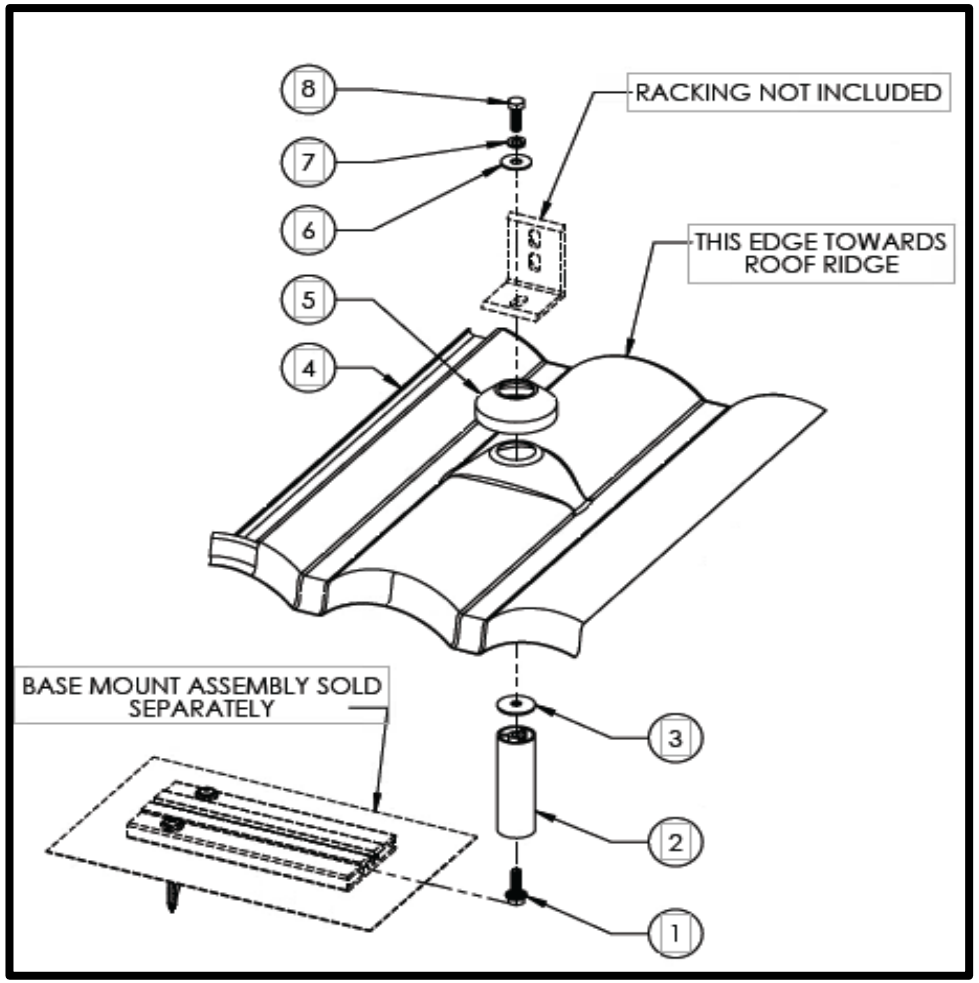


# MDC PRESCRIPTIVE TILE FLASHING DETAIL



# EXAMPLE OF PROPRIETARY PV STAND-OFF & FLASHING DETAIL

**It is required to seal the base mount and/or the skirt flashing to the roofing underlayment.**



# Liquid Applied Penetration Flashings

- Liquid applied elastomeric sealants are compatible with asphaltic roof systems (refer to manufacturer's data sheets)
- Most major roofing component manufactures have these products
- Can be installed on low and steep slope roofs
- Durable and UV resistant
- Available in caulk and regular grade
- Used with flashing fabric on penetrations
- Applied with trowels or stiff brushes

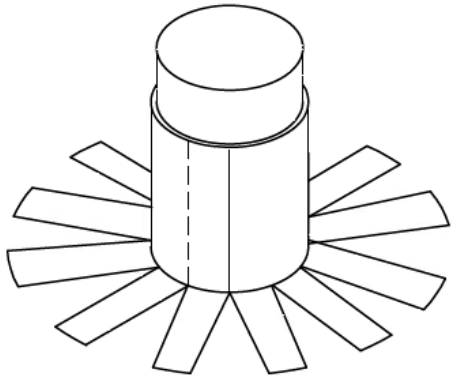
# Liquid Applied Penetration Flashings

**** Liquid Applied PV Standoff and Penetration Flashing Detail for Field Fabricated Installations***

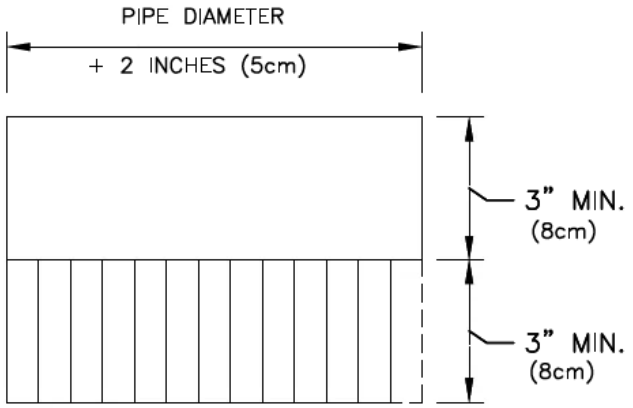
MIAMI-DADE COUNTY

STEP 1:

Cut & apply polyester fabric finger flashing in an approved liquid flashing grade coating.



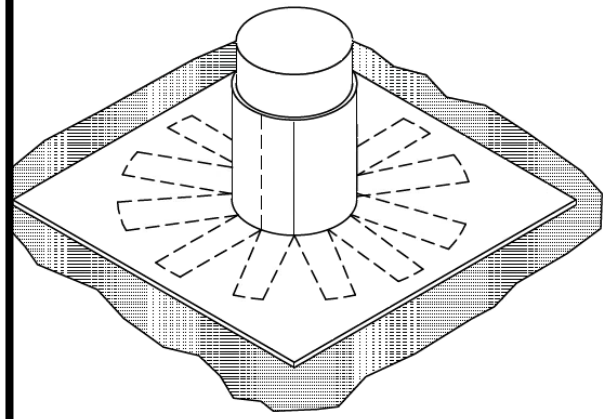
Fabricate polyester fabric finger flashing.



# Liquid Applied Penetration Flashings

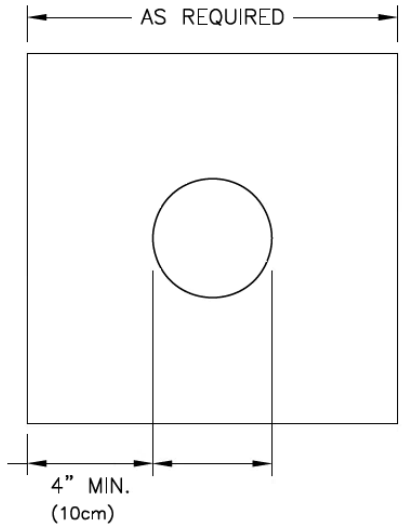
STEP 2:

Cut and apply a "target" in a full bed of liquid flashing grade coating, ensure that all edges of the finger flashings are embeded in the flashing coating & covered by the target

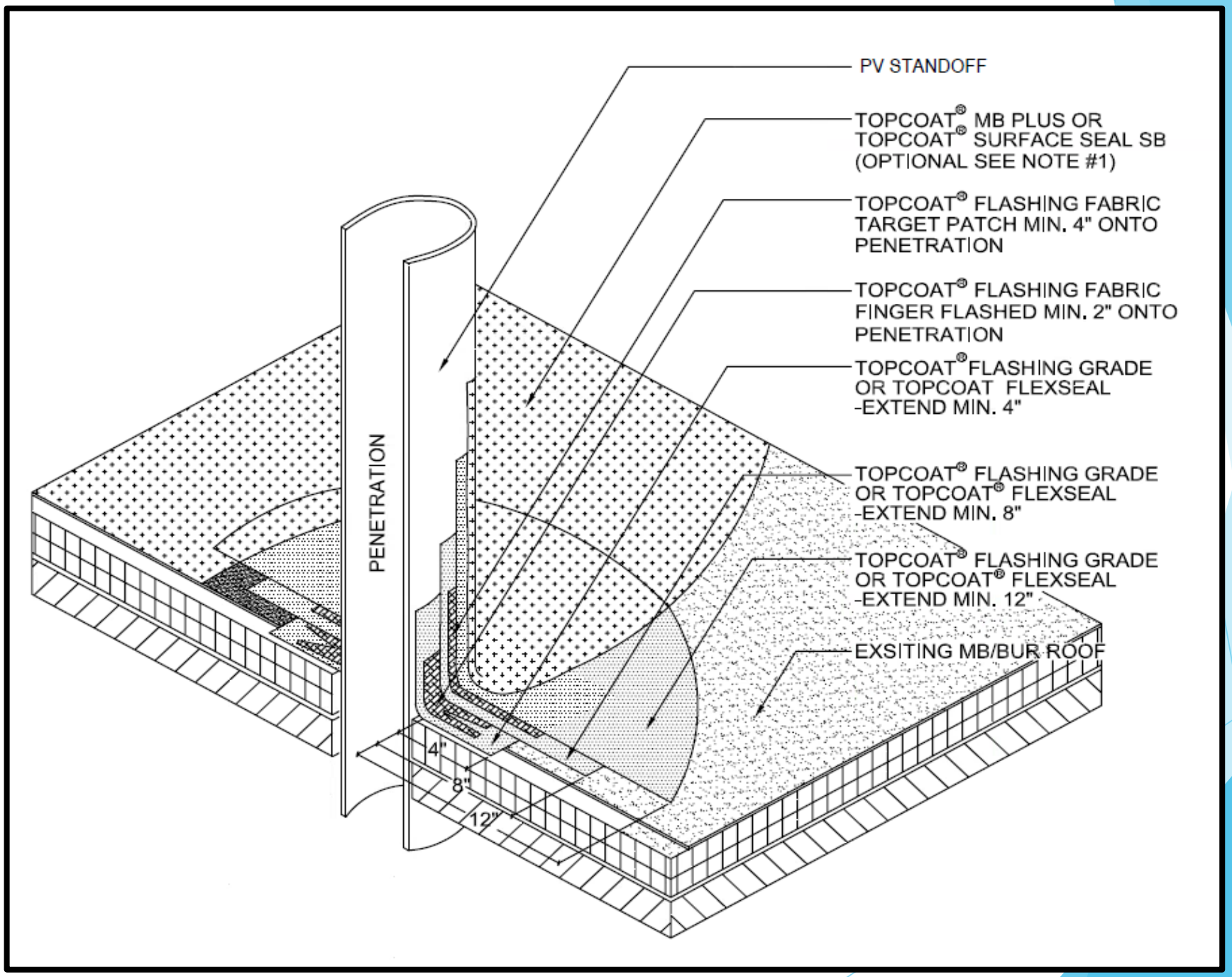


Apply final top coat of the liquid applied flashing , ensure that all of the polyester fabric is throughly coated.

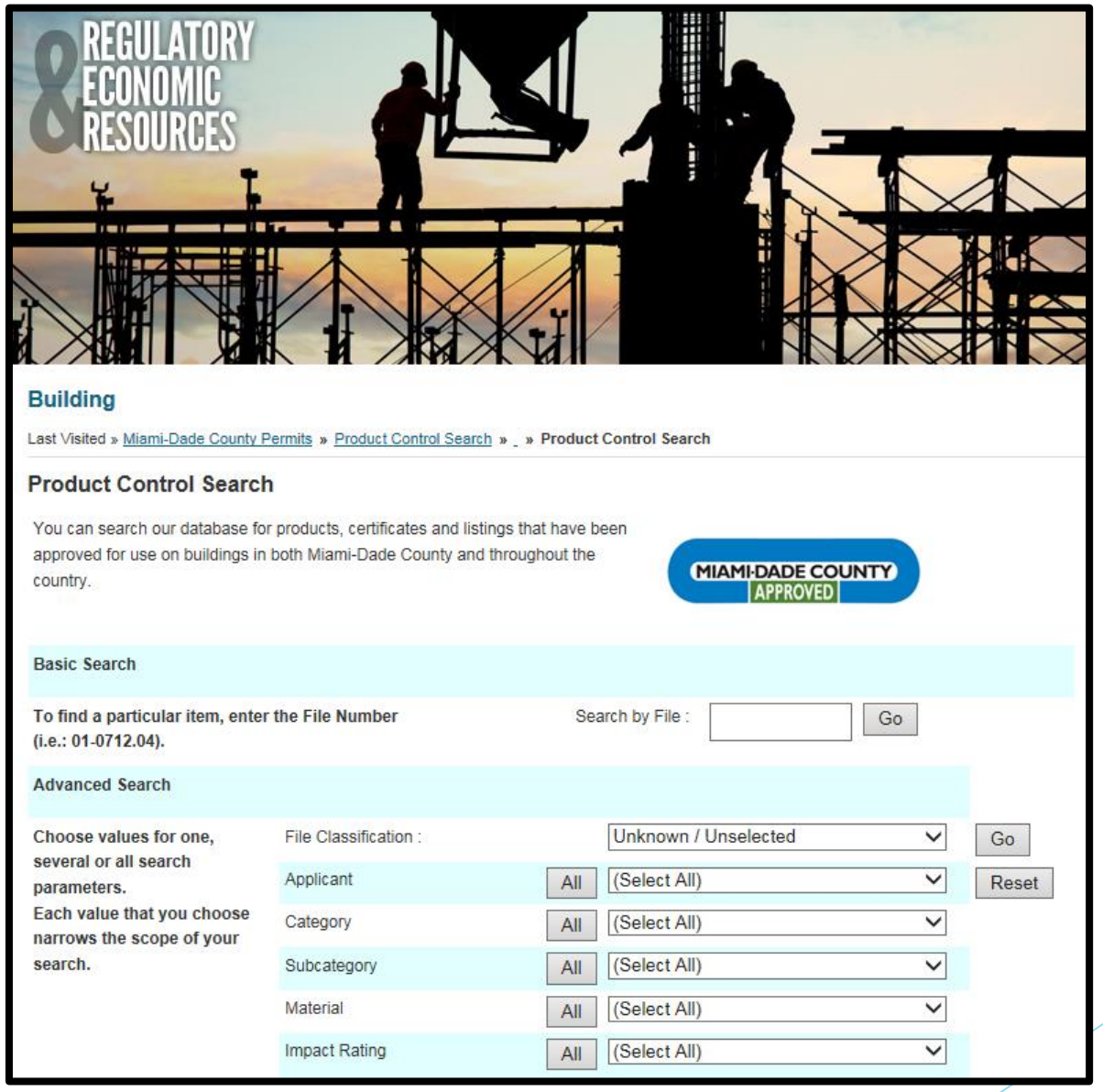
Fabricate polyester fabric target.



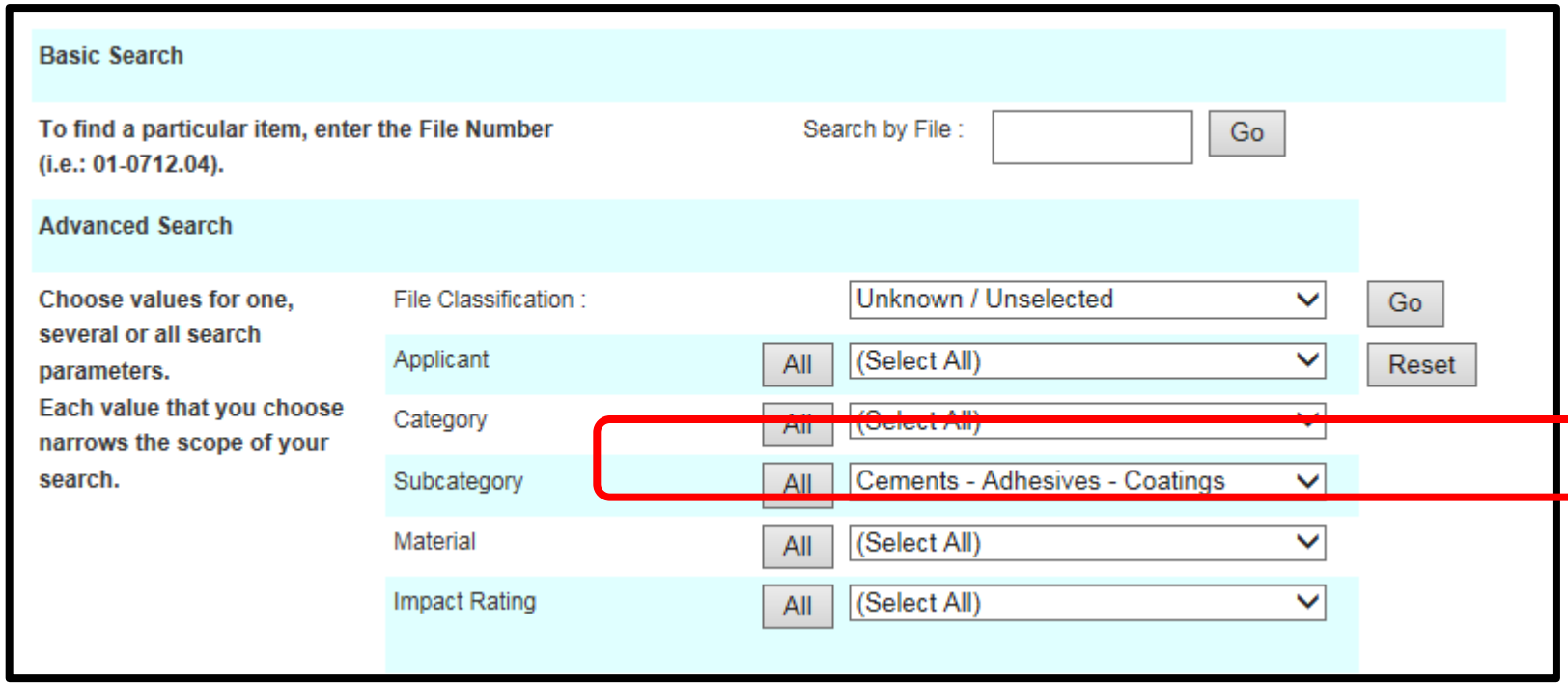

* See the MDC's Product Approval Website for approved coatings & adhesives


PV STANDOFF
TOPCOAT® MB PLUS OR
TOPCOAT® SURFACE SEAL SB
(OPTIONAL SEE NOTE #1)
TOPCOAT® FLASHING FABRIC
TARGET PATCH MIN. 4" ONTO
PENETRATION
TOPCOAT® FLASHING FABRIC
FINGER FLASHED MIN. 2" ONTO
PENETRATION
TOPCOAT® FLASHING GRADE
OR TOPCOAT FLEXSEAL
-EXTEND MIN. 4"
TOPCOAT® FLASHING GRADE
OR TOPCOAT® FLEXSEAL
-EXTEND MIN. 8"
TOPCOAT® FLASHING GRADE
OR TOPCOAT® FLEXSEAL
-EXTEND MIN. 12"
EXSITING MB/BUR ROOF
PENETRATION
4"
8"
12"

# MDC PRODUCT CONTROL SEARCH



# MDC PRODUCT CONTROL SEARCH BY SUBCATEGORY



**Subcategory:** Cements - Adhesives - Coatings

**Material:** None

**Impact Rate:** None

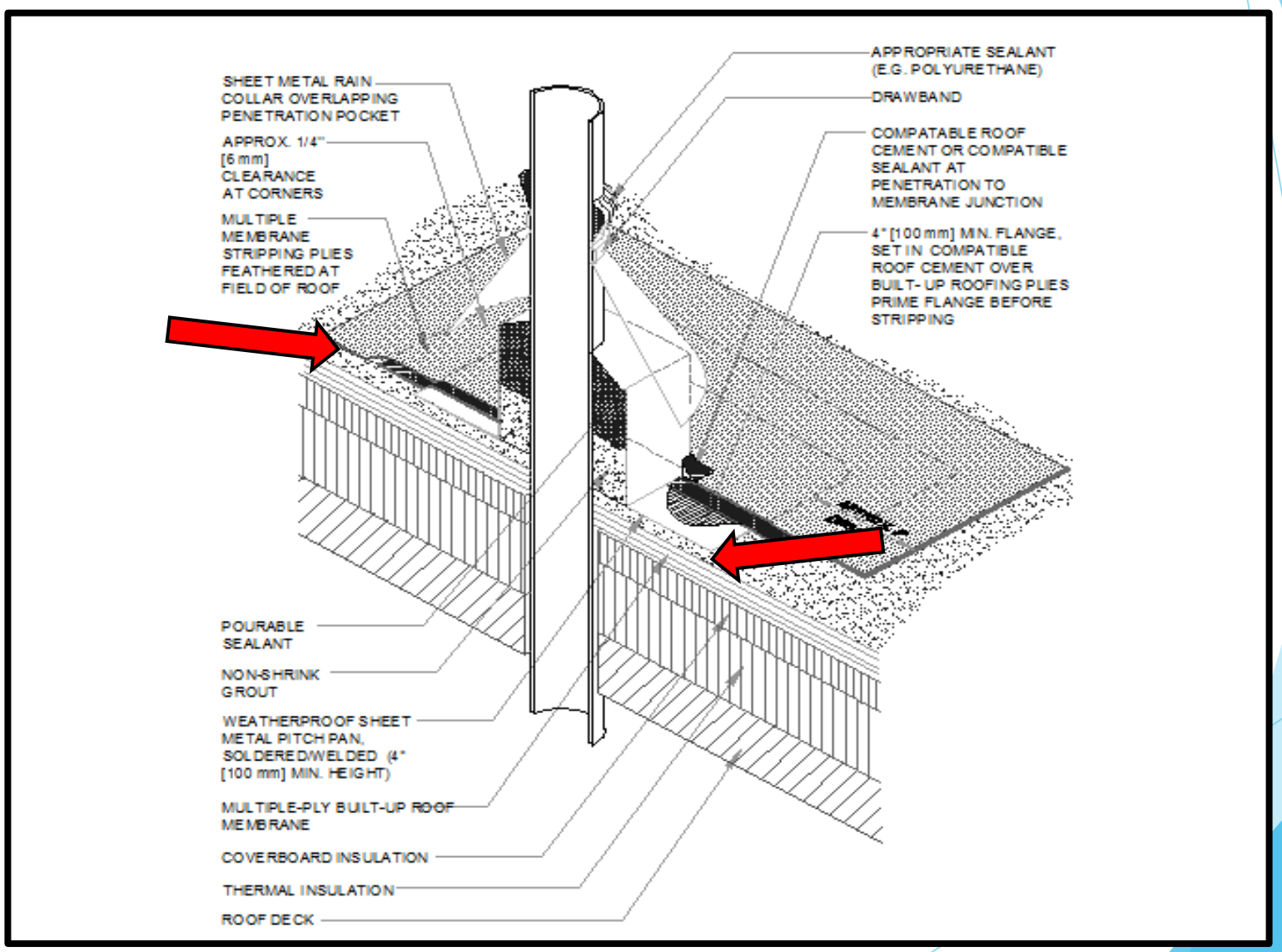
**Maximum Design Pressure(+):** 0.00

**Maximum Design Pressure(-):** 0.00

| NOA | APPLICANT | CATEGORY | SUBCATEGORY | MATERIAL | DESCRIPTION | IMPACT | MDP+ | MDP- | CLASS_DESC | EXPIRES |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-0621.01 | Tremco, Inc. | Roofing | Cements - Adhesives - Coatings | Unknown / Unselected | Cements Adhesives and Coatings | Unselected / Unknown | 0 | 0 | High velocity hurricane zone | June 27 2018 |
| 12-0921.10 | Pinturas Thermicas del Norte SA de CV | Roofing | Cements - Adhesives - Coatings | Elastomeric | Thermotek Silver Plus, Thermotek Gold Plus and Thermotek Platinum Plus | Unselected / Unknown | 0 | 0 | High velocity hurricane zone | July 11 2018 |
| 12-1220.13 | Lanco & Harris Corp. | Roofing | Cements - Adhesives - Coatings | Elastomeric | Lanco Ultra Siliconizer (Premium) Elastomeric White Roof Coating & Lanco Urethanizer (Ultra Premium) Elastomeric White Roof Coating | Unselected / Unknown | 0 | 0 | High velocity hurricane zone | February 28 2018 |
| 13-0108.01 | Commercial Innovations, Inc. | Roofing | Cements - Adhesives - Coatings | Asphalt | Commercial Innovations Cements, Coatings & Adhesives | Unselected / Unknown | 0 | 0 | High velocity hurricane zone | April 17 2018 |
| 13-0212.01 | Topps Products Inc. | Roofing | Cements - Adhesives - Coatings | SEBS | Topps System 1000 | Unselected / Unknown | 0 | 0 | High velocity hurricane zone | May 1 2018 |
| 13-0219.26 | The Garland Company, Inc. | Roofing | Cements - Adhesives - Coatings | Urethane | Garland's White-Knight Plus | Unselected / Unknown | 0 | 0 | High velocity hurricane zone | September 19 2018 |
| 13-0307.01 | Tamko Building Products, Inc. | Roofing | Cements - Adhesives - Coatings | Unknown / Unselected | Tamko Coatings and Cements | Unselected / Unknown | 0 | 0 | High velocity hurricane zone | July 24 2018 |
| 13-0321.03 | Firestone Building | Roofing | Cements - | Urethane | Firestone ISO Twin Pack | Unselected / | 0 | 0 | High velocity | July 24 |

# LOW SLOPE (2/12 ≤)
# PENETRATION FLASHING DETAILS

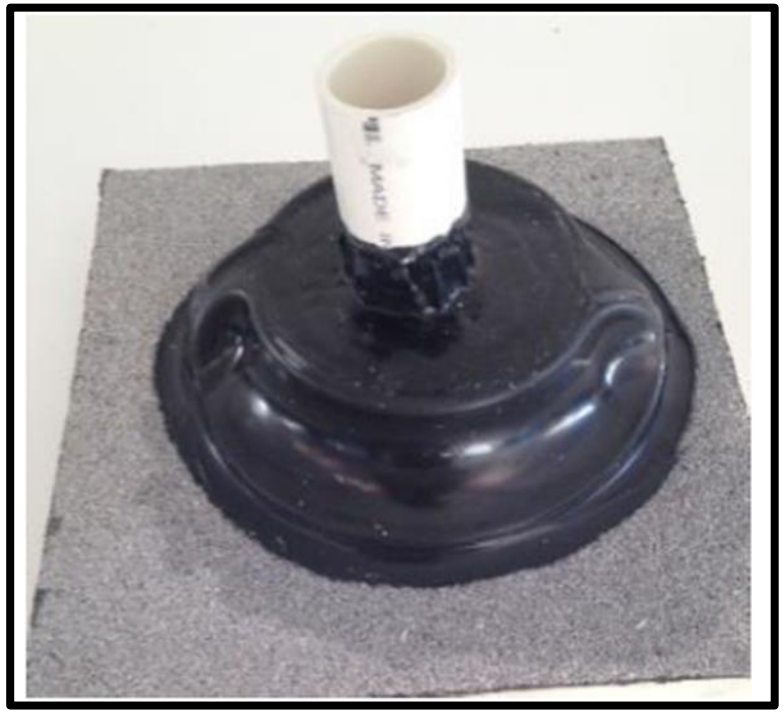
# LOW SLOPE “PITCH PAN” FLASHING DETAIL



# Pitch pans filled with roof cement are a poor choice for long term flashing penetrations, the roof cement will

# Modern penetration flashing methods for Low Sloped Granular Surfaced Roofs

M Curb used on granular surfaced roof, with pourable urethane sealer



E Curb installation

# ROOFTOP PV FIRE CLASSIFICATIONS

# HVHZ FBC PV REQUIREMENTS

- CHAPTER 15 ROOF ASSEMBLIES AND ROOFTOP STRUCTURES
- **1516.2 -** Fire-Resistant roofing assemblies and coverings shall be provided on all structures.
- In the HVHZ ***Class A or Class B*** fire rated roof assemblies shall be provided

# FBC 1510.7.2 Fire Classification

- Rooftop mounted Photovoltaic systems shall have the same fire classification as the roof assembly required by **Section 1505 FBC.**

# FIRE RESISTANCE FOR PV PANELS & MODULES

**FBC 1510.7.4-**Rooftop mounted PV panels and modules shall be listed and labeled in accordance with UL 1703.

# FIRE RATINGS

- UL 1703 REQUIREMENTS
- UL 2703 REQUIREMENTS

# UL 1703 Fire Tests

**31 Fire Tests**

Revised 31 effective October 25, 2016

**31.1 Type tests for fire performance characterization of modules and panels independent of roof coverings**

31.1.1 General

31.1.1.1 To label a module or panel as a specific "Type" as defined in 16.4.1 so that it may be labeled in accordance with 47.11.1, it shall be subjected to a spread-of-flame test and a burning brand test as described in the Standard Test Methods for Fire Tests of Roof Coverings, UL 790, as modified in accordance with Sections 31.1.2 and 31.1.3. The specific tests to be conducted for new "Types" are outlined in Table 31.1.

# UL 1703

- A PV module or panel intended to be installed on a roof shall be evaluated for fire performance in accordance with **UL 1703** section 16.3.
- System Fire Class Ratings A, or B are only relevant for PV modules or panels with mounting systems in combination with a fire rated roof system

# UL 1703

The specimens selected for testing are to be representative of the construction series being investigated with regard to components and design.  A module or panel intended for mounting on a roof may be represented by type in accordance with UL 1703 section 16.4.1.

See table 16.1

## Table 16.1
## Construction and fire performance for PV module types

Added Table 16.1 effective October 25, 2016

| Type | Superstrate Material/ Thickness | Encapsulant (Super/Cell) Material/ Thickness | Encapsulant (Cell/Sub) Material/ Thickness | Substrate Material/ Thickness | Spread of Flame | Burning Brand |
|---|---|---|---|---|---|---|
| 1 | Glass / 0.14 ± 0.03 inch (3.6 ±0.76 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.012 inch (0.30 mm) ≤ thickness ≤ 0.025 inch (0.64 mm) | 6 feet (1.82 m) or less in 10 minutes | C Brand |
| 2 | Glass / 0.14 ± 0.03 inch (3.6 ±0.76 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.001 inch (0.025 mm) ≤ thickness < 0.012 in (0.30 mm) | Same as Type 1 | Same as Type 1 |
| 3 | Glass / 0.105 ± 0.030 inch (2.67 ±0.76 mm) | N/A | Polymer / 0.035 ± 0.02 inch (0.9 ±0.5 mm) | Glass / 0.105 ± 0.030 inch (2.67 ±0.76 mm) | Same as Type 1 | Same as Type 1 |
| 4 | Same as Type 1 | Same as Type 1 | Same as Type 1 | Same as Type 1 | 13 feet (1.82 m) or less in 4 minutes | Same as Type 1 |
| 5 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 4 | Same as Type 1 |
| 6 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 4 | Same as Type 1 |
| 7 | Same as Type 1 | Same as Type 1 | Same as Type 1 | Same as Type 1 | 8 feet (2.4 m) or less in 10 minutes | Same as Type 1 |
| 8 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 7 | Same as Type 1 |
| 9 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 7 | Same as Type 1 |
| 10 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 1 | B Brand |
| 11 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 4 | Same as Type 10 |
| 12 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 7 | Same as Type 10 |
| 13 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 1 | A Brand |
| 14 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 4 | Same as Type 13 |
| 15 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 7 | Same as Type 13 |

# Required Fire Test Standard UL 790

- Certification from a Nationally Recognized Test Laboratory (NRTL) showing compliance with the **UL 1703** standard for module and racking systems is required to be considered in the design of PV arrays.

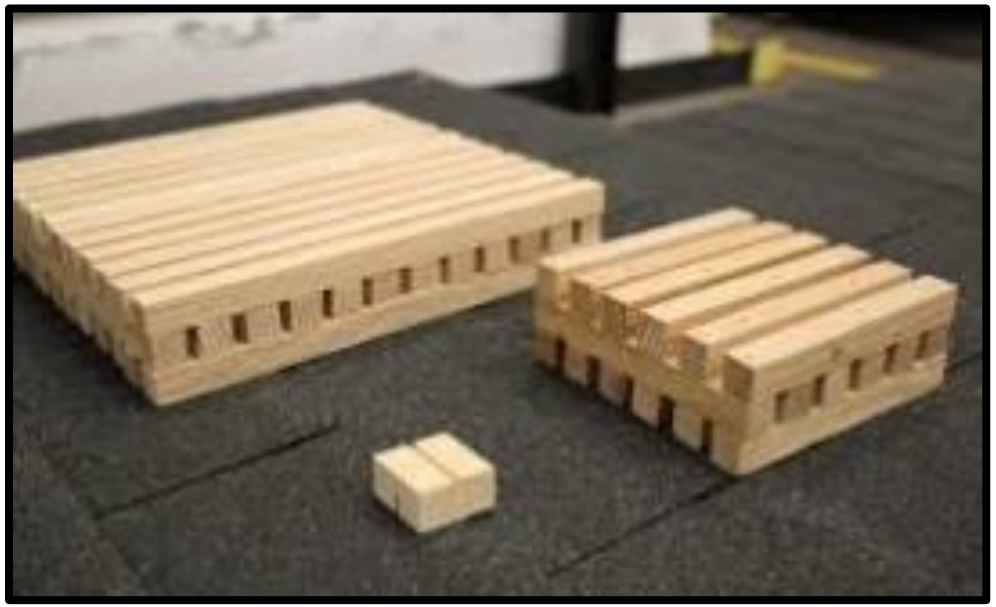
# UL 790 Spread of Flame Test



**Table 31.1**
**Required tests for fire performance of PV modules or panels independent of mounting system and roof covering**

| Test | Fire Performance Characteristics | | |
|---|---|---|---|
| Spread of Flame On Top Surface of Module or Panel (Section 31.1.2) | Flame Spread less than 6 ft. in 10 minutes | Flame spread less than 8 ft. in 10 minutes | Flame spread less than 13 ft. in 4 minutes |
| Burning Brand on Surface of Module or Panel (Section 31.1.3) | A Brand | B Brand | C Brand |
| One test is required for each of the above required tests | | | |

# UL 790 Spread of Flame Test



# UL 2703 PV Racking Systems

- **UL 2703 was ANSI** accredited in Jan 2015
- Is now required in conjunction with **UL 1703**
- Evaluates racking, modules, grounding hardware, corrosion & mechanical loading
- Includes Fire classification using **UL 1703** requirements

# UL 2703 PV Racking Systems

- **UL 2703 revised fire classification** of a "PV" system now includes the PV module, roof rack, and the roof system.
- Effective October 25, 2016 PV Modules and Rack Mounting Systems are required to match fire rating of the roof systems per the fire requirements of **UL 1703**.

# UL 2703 PV Racking Systems

- If your roof pitch is 2:12 or greater, you must use a **steep slope** racking system.
- If your roof pitch is 2:12 or lower, you must use a **low slope** racking system.

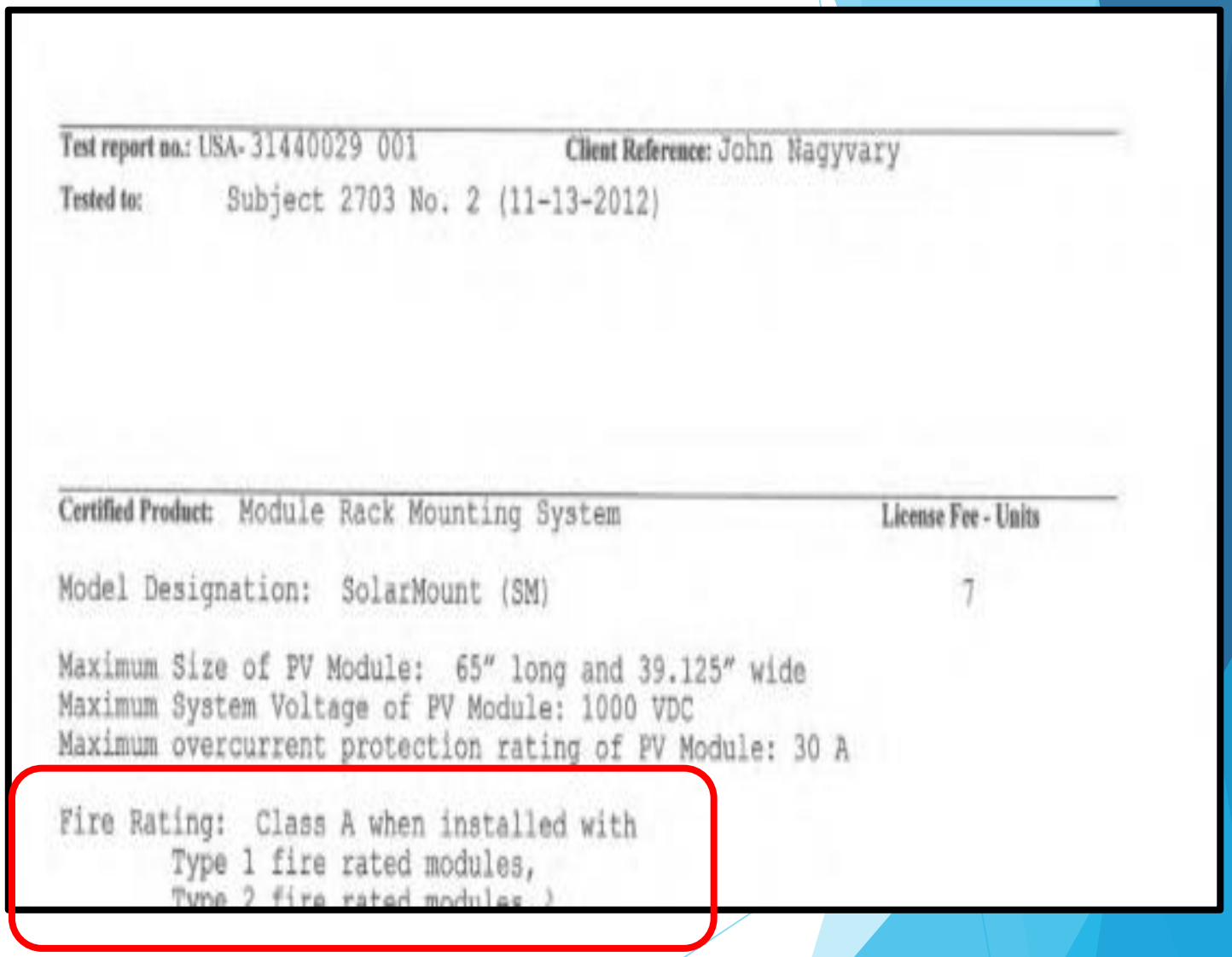

# ROOF MOUNTED PV SYSTEMS LISTING RESOURCE

# SAMPLE UL 2703 LISTING

## UNIRAC 2703 CERTIFICATE MODULE RACK MOUNTING SYSTEM

# UNIRAC 2703 LISTING

- Lists Certified Module racking system
- Provides maximum size of module
- Lists type of Fire Rating
- Lists Types of Fire Rated module



Test report no.: USA-31440029 001 Client Reference: John Nagyvary

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System License Fee - Units

Model Designation: SolarMount (SM) 7

Maximum Size of PV Module: 65" long and 39.125" wide
Maximum System Voltage of PV Module: 1000 VDC
Maximum overcurrent protection rating of PV Module: 30 A

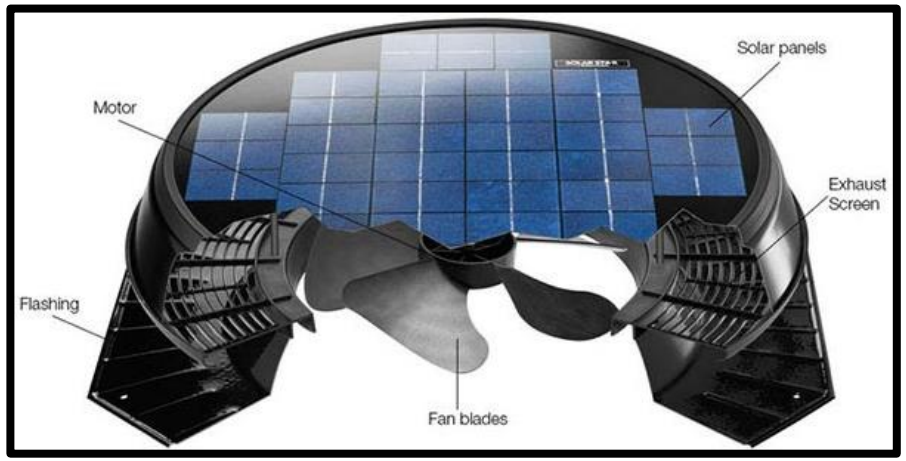
Fire Rating: Class A when installed with
Type 1 fire rated modules,
Type 2 fire rated modules )

## Table 16.1
## Construction and fire performance for PV module types

Added Table 16.1 effective October 25, 2016

| Type | Superstrate Material/ Thickness | Encapsulant (Super/Cell) Material/ Thickness | Encapsulant (Cell/Sub) Material/ Thickness | Substrate Material/ Thickness | Spread of Flame | Burning Brand |
|---|---|---|---|---|---|---|
| 1 | Glass / 0.14 ± 0.03 inch (3.6 ±0.76 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.012 inch (0.30 mm) ≤ thickness ≤ 0.025 inch (0.64 mm) | 6 feet (1.82 m) or less in 10 minutes | C Brand |
| 2 | Glass / 0.14 ± 0.03 inch (3.6 ±0.76 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.018 ± 0.008 inch (0.45 ±0.2 mm) | Polymer / 0.001 inch (0.025 mm) ≤ thickness < 0.012 in (0.30 mm) | Same as Type 1 | Same as Type 1 |
| 3 | Glass / 0.105 ± 0.030 inch (2.67 ±0.76 mm) | N/A | Polymer / 0.035 ± 0.02 inch (0.9 ±0.5 mm) | Glass / 0.105 ± 0.030 inch (2.67 ±0.76 mm) | Same as Type 1 | Same as Type 1 |
| 4 | Same as Type 1 | Same as Type 1 | Same as Type 1 | Same as Type 1 | 13 feet (1.82 m) or less in 4 minutes | Same as Type 1 |
| 5 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 4 | Same as Type 1 |
| 6 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 4 | Same as Type 1 |
| 7 | Same as Type 1 | Same as Type 1 | Same as Type 1 | Same as Type 1 | 8 feet (2.4 m) or less in 10 minutes | Same as Type 1 |
| 8 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 2 | Same as Type 7 | Same as Type 1 |
| 9 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 7 | Same as Type 1 |
| 10 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 1 | B Brand |
| 11 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 4 | Same as Type 10 |
| 12 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 7 | Same as Type 10 |
| 13 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 1 | A Brand |
| 14 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 4 | Same as Type 13 |
| 15 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 3 | Same as Type 7 | Same as Type 13 |

# Required Permit Information for Solar Powered Roof Vents




# Solar powered ridge vents constructed of metal, plastic or composition material

- Shall have a valid and current Product Approval issued by the Miami-Dade County Product Control Division.
- Or a Florida Product Approval (2017 Code Version) approved for use in the **HVHZ.**

# SOLAR POWERED RIDGE VENTS

- Shall be tested for wind driven rain in accordance with TAS 110 and Section 1523. **FBC Section 1515.2.5.**

# SOLAR POWERED RIDGE VENTS

- All solar powered ridge vents shall be restricted to the roof mean height tested in compliance with TAS-100(A), as listed in the manufacturer’s product approval.

# SOLAR POWERED RIDGE VENTS

- All solar powered ridge vents shall be tested for the type of roof system they are to be installed on; i.e. tile, asphaltic shingles, metal roof panels, and low slope systems, etc.

# SOLAR POWERED RIDGE VENTS

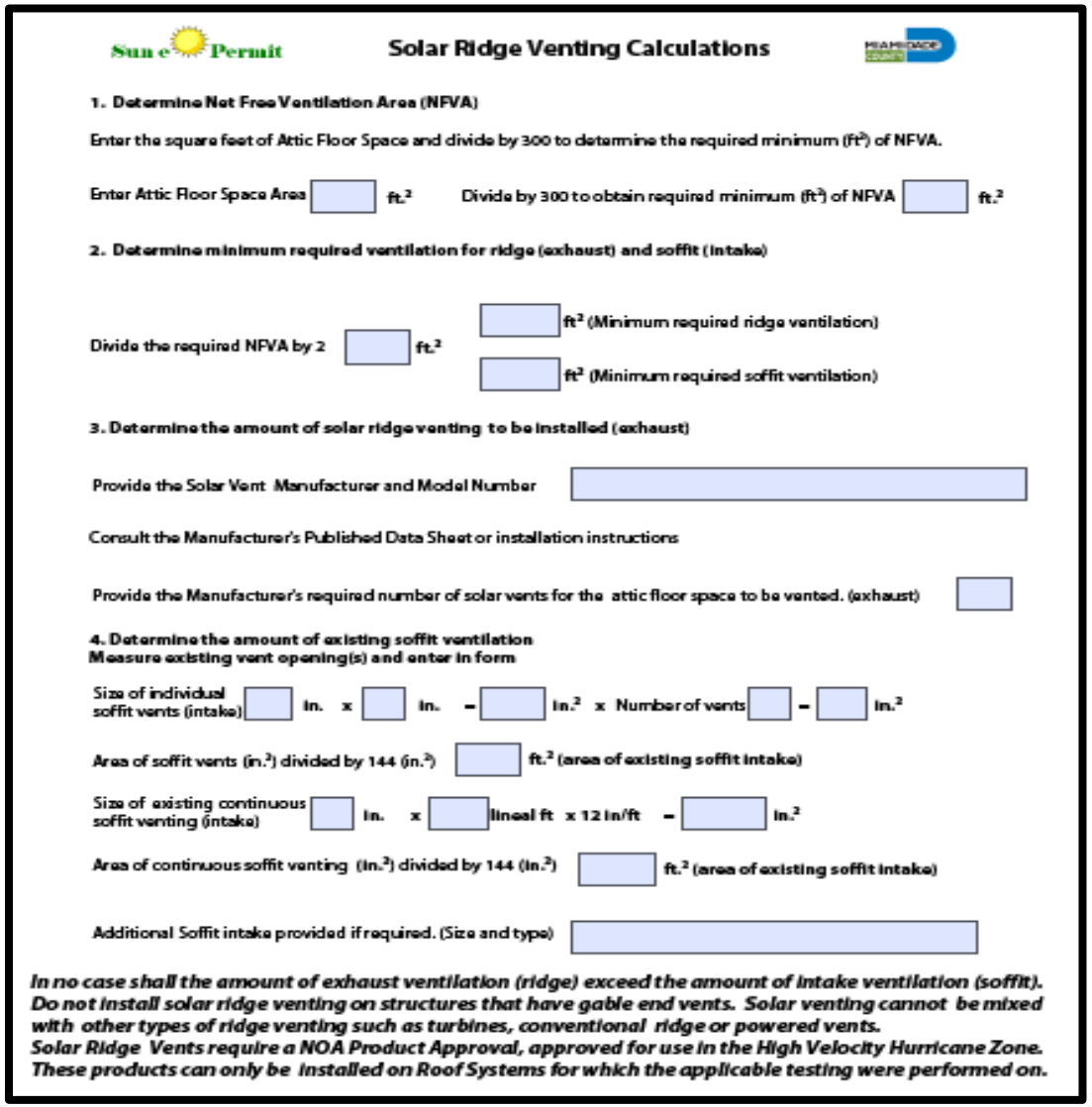
- A balanced venting system is required, per FHA/HUD guidelines.
- Provide 50% air flow through the soffit
- Provide 50% through the ridge (note: soffit intake may exceed ridge exhaust)

# SOLAR POWERED RIDGE VENTS

- Do not combine gable end venting, roof turbines, or other forms of ridge venting when installing solar powered ridge vents.
- Combining these types of vents with solar powered vents can cause reverse air flow and pull air into the attic through these products, making them act as an intake.

# MDC Solar Ridge Venting Calculation Form

# MDC Solar Ridge Venting Calculation Form



Sun e Permit

**Solar Ridge Venting Calculations**

**1. Determine Net Free Ventilation Area (NFVA)**

Enter the square feet of Attic Floor Space and divide by 300 to determine the required minimum ($ft^2$) of NFVA.

Enter Attic Floor Space Area [ ] $ft.^2$ Divide by 300 to obtain required minimum ($ft^2$) of NFVA [ ] $ft.^2$

**2. Determine minimum required ventilation for ridge (exhaust) and soffit (intake)**

Divide the required NFVA by 2 [ ] $ft.^2$

[ ] $ft^2$ (Minimum required ridge ventilation)

[ ] $ft^2$ (Minimum required soffit ventilation)

**3. Determine the amount of solar ridge venting to be installed (exhaust)**

Provide the Solar Vent Manufacturer and Model Number [ ]

Consult the Manufacturer's Published Data Sheet or installation instructions

Provide the Manufacturer's required number of solar vents for the attic floor space to be vented. (exhaust) [ ]

**4. Determine the amount of existing soffit ventilation**
**Measure existing vent opening(s) and enter in form**

Size of individual soffit vents (intake) [ ] in. x [ ] in. = [ ] $in.^2$ x Number of vents [ ] = [ ] $in.^2$

Area of soffit vents ($in.^2$) divided by 144 ($in.^2$) [ ] $ft.^2$ (area of existing soffit intake)

Size of existing continuous soffit venting (intake) [ ] in. x [ ] lineal ft x 12 in/ft = [ ] $in.^2$

Area of continuous soffit venting ($in.^2$) divided by 144 ($in.^2$) [ ] $ft.^2$ (area of existing soffit intake)

Additional Soffit intake provided if required. (Size and type) [ ]

***In no case shall the amount of exhaust ventilation (ridge) exceed the amount of intake ventilation (soffit).***
***Do not install solar ridge venting on structures that have gable end vents. Solar venting cannot be mixed with other types of ridge venting such as turbines, conventional ridge or powered vents.***
***Solar Ridge Vents require a NOA Product Approval, approved for use in the High Velocity Hurricane Zone.***
***These products can only be installed on Roof Systems for which the applicable testing were performed on.***

- Available on the Dept. Website
- Fillable form fields
- Print to pdf to remove layers and save completed form
- Consultant the manufacturer's Website for additional installation information

# Florida Solar Energy Center (FSEC)

- Per F.S. 377.05 and required in the **HVHZ**
- FSEC shall develop and adopt standards for all solar energy systems manufactured or sold in the State of Florida.
- All solar systems manufactured or sold in the State of Florida must meet the standards established by **FSEC** and shall display accepted results of approved tests.

# ALTERNTATIVE PV SYSTEM CERTIFICATION METHOD

Effective July 1 2017, All solar energy systems manufactured or sold in the state must meet the standards established by the FSEC, and shall display accepted results of approved performance tests in a manner prescribed by the FSEC, ***unless otherwise certified by an engineer licensed pursuant to Chapter 471 using the standards contained in the most recent version of the Florida Building code***.

# ALTERNTATIVE PV SYSTEM CERTIFICATION METHOD

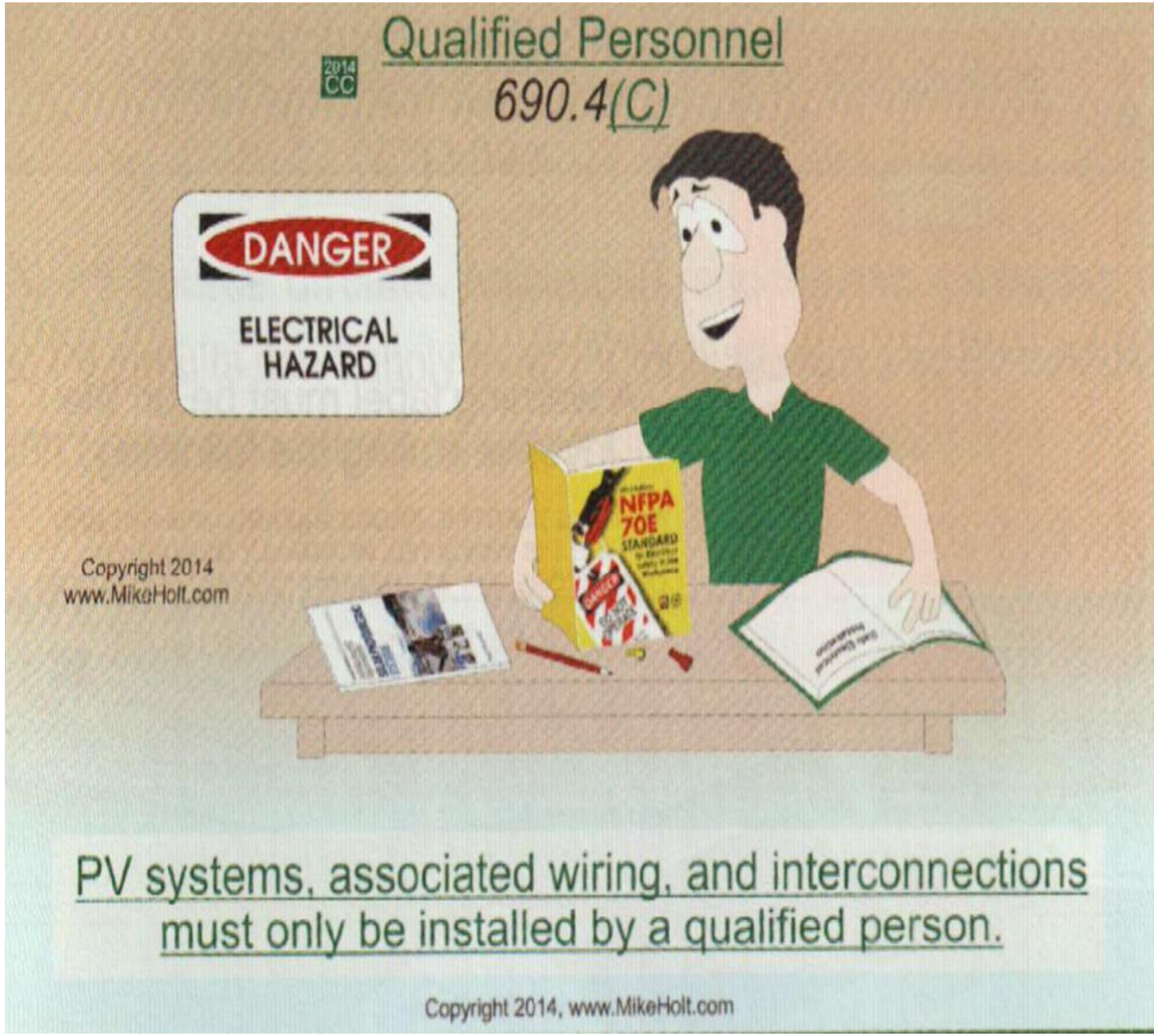
In lieu of a **FSEC** PV System Certification provide, the following note on plans submitted by the Professional Engineer sealing the plans.

# ALTERNATIVE PV SYSTEM CERTIFICATION METHOD

Per Fl. Statue 377.705 (revised 7/1/2017), I _____ PE (# _____) an engineer licensed pursuant to Chapter 471, certify that the PV electrical system and electrical components are designed and approved using the code requirements and standards contained in the Florida Building Code.

# SOLAR PHOTOVOLTAIC (PV) ELECTRICAL PLAN REVIEW REQUIREMENTS

Electrical Division


Qualified Personnel
2014 CC
690.4(C)
DANGER
ELECTRICAL HAZARD
NFPA 70E STANDARD
Copyright 2014
www.MikeHolt.com
PV systems, associated wiring, and interconnections must only be installed by a qualified person.
Copyright 2014, www.MikeHolt.com

# EXAMPLE

*A CODE COMPLIANT ROOF TOP INSTALLATION BY A QUALIFIED PERSON*

# *QUALITY OF WORK MATTERS!!*

## What you can't see won't hurt you??

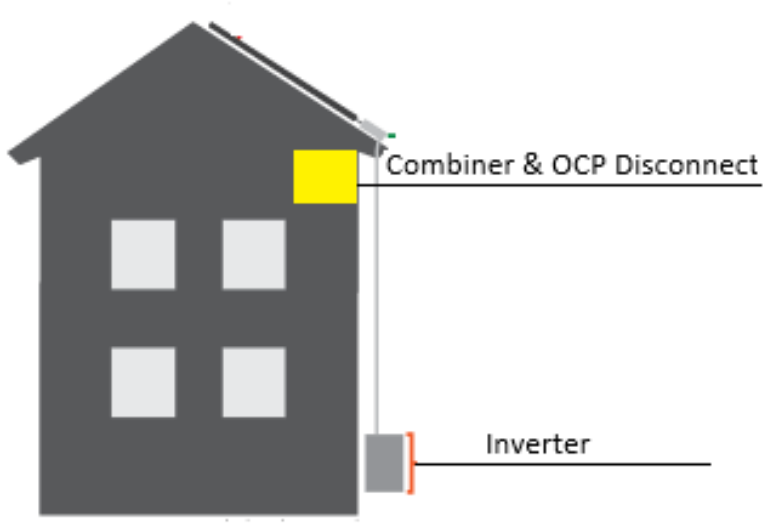
# SOLAR PV REQUIREMENTS:

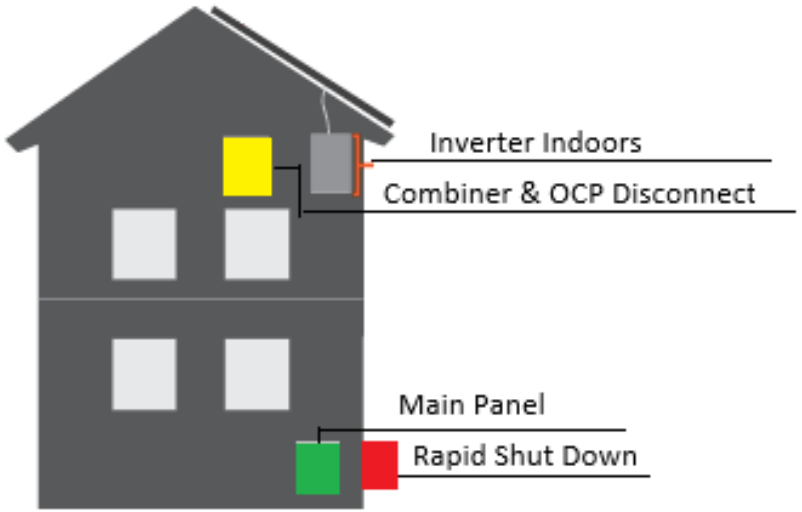
## PLAN REVIEW

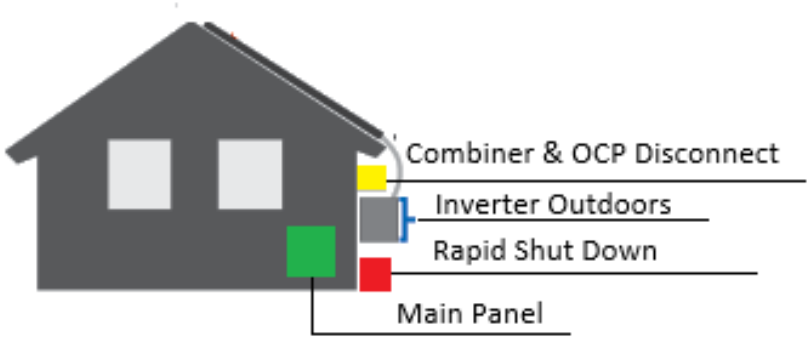
1. Provide a complete Solar Photovoltaic (PV) riser diagram showing all related equipment from the meter (Utility Grid tied system) to the solar array system. Designed in accordance to NEC 690.
2. Provide on the riser diagram all the bonding and grounding to be installed and the wire size required. NEC 690.43 & NEC 690.45
3. Show how the Solar Photovoltaic system will be connected to the existing electrical equipment providing the power to the structure. FBC 107
4. Provide for a relay that will produce a “Rapid Shutdown of PV Systems on Buildings NEC 690.12”.

EXAMPLE

*EQUIPMENT LOCATION*

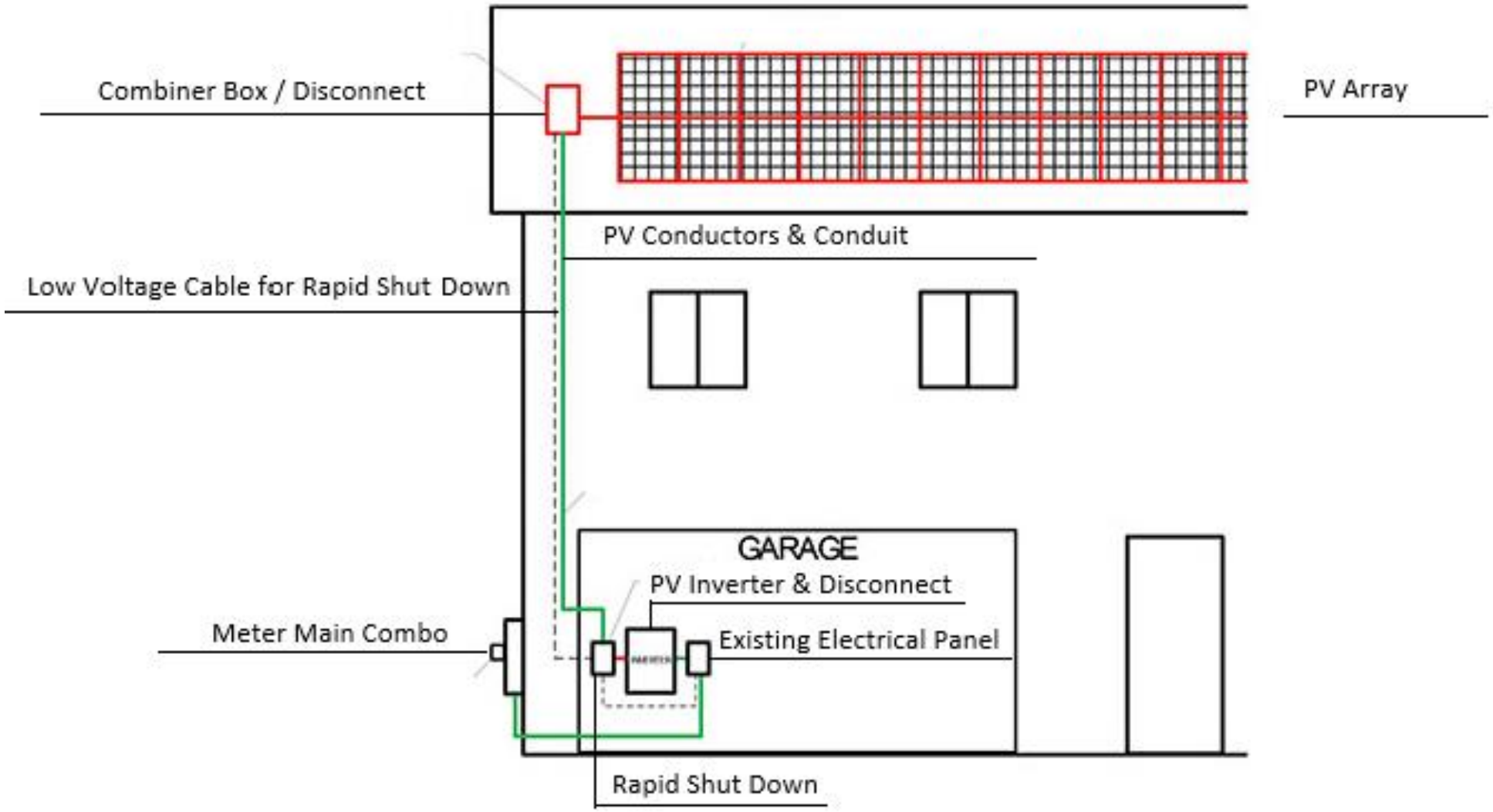


# EXAMPLE

## *EQUIPMENT LOCATION SCHEMATIC*



# EXAMPLE

*RAPID SHUTDOWN DEVICE*

# EXAMPLE

## *ROOFTOP STAND WITH INVERTOR & COMBINER BOX*

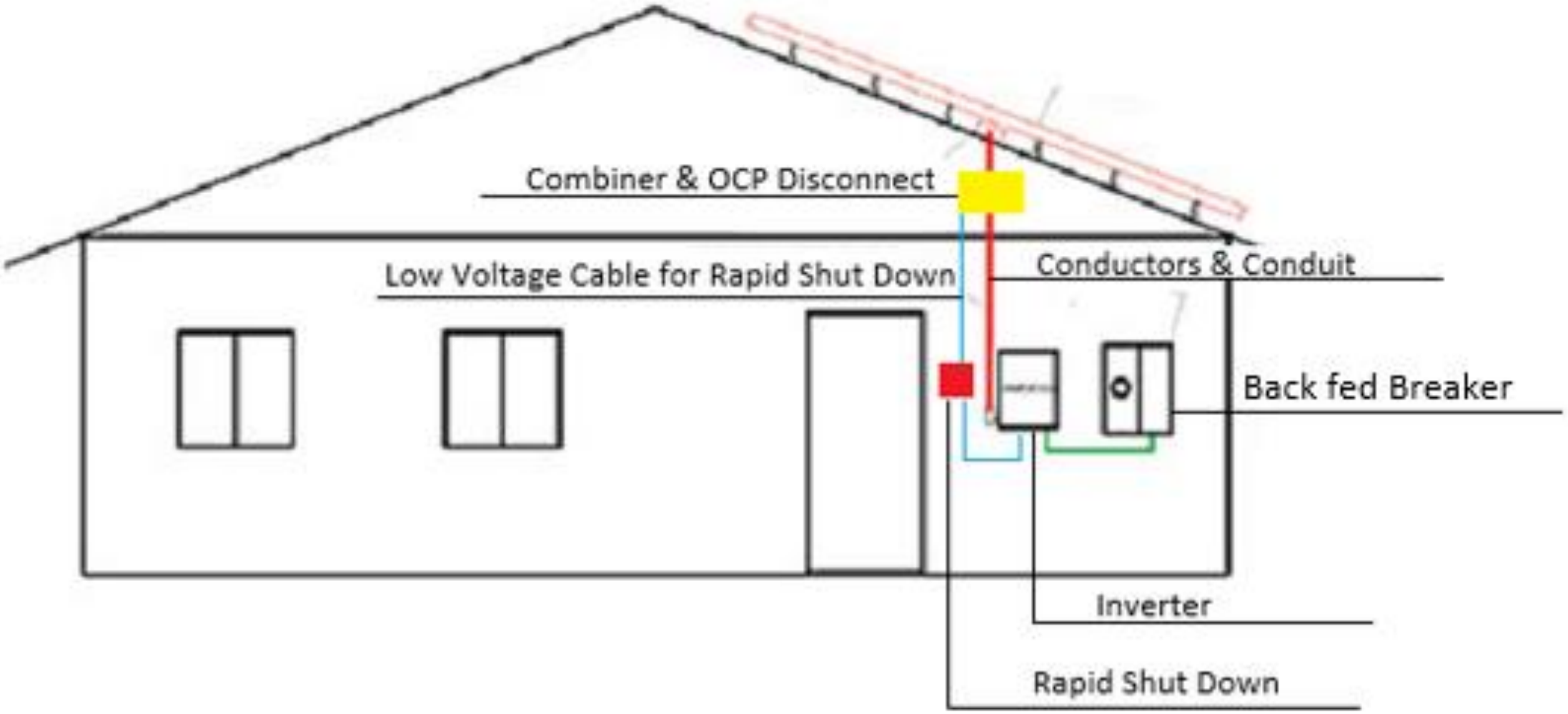
# CODE COMPLIANT INSTALL

NEMA 4
Combiner Box
with disconnect
built-in. Designed
for horizontal or
vertical mounting

5. Point of connection as per NEC 690.64 to comply with NEC 705.12.A allows for a supply side connection between the utility meter and service disconnecting means and as per FPL doesn't allow tapping inside the meter enclosure. (All work done on load side of inverter must be performed by a licensed Electrical Contractor).
6. Line side taps may not use residential service entrance conductors as per NEC 310.15.B.7. Service entrance conductors shall be sized to NEC Table 310.15.B.16.
7. Identify, if the meter is to be approved for net metering and note that the power company will need to change the meter. FBC 107
8. Provide a complete Solar Photovoltaic (PV) riser diagram showing all related equipment to a standalone system (Not tied into a Utility grid, the system is working offline). FBC 107

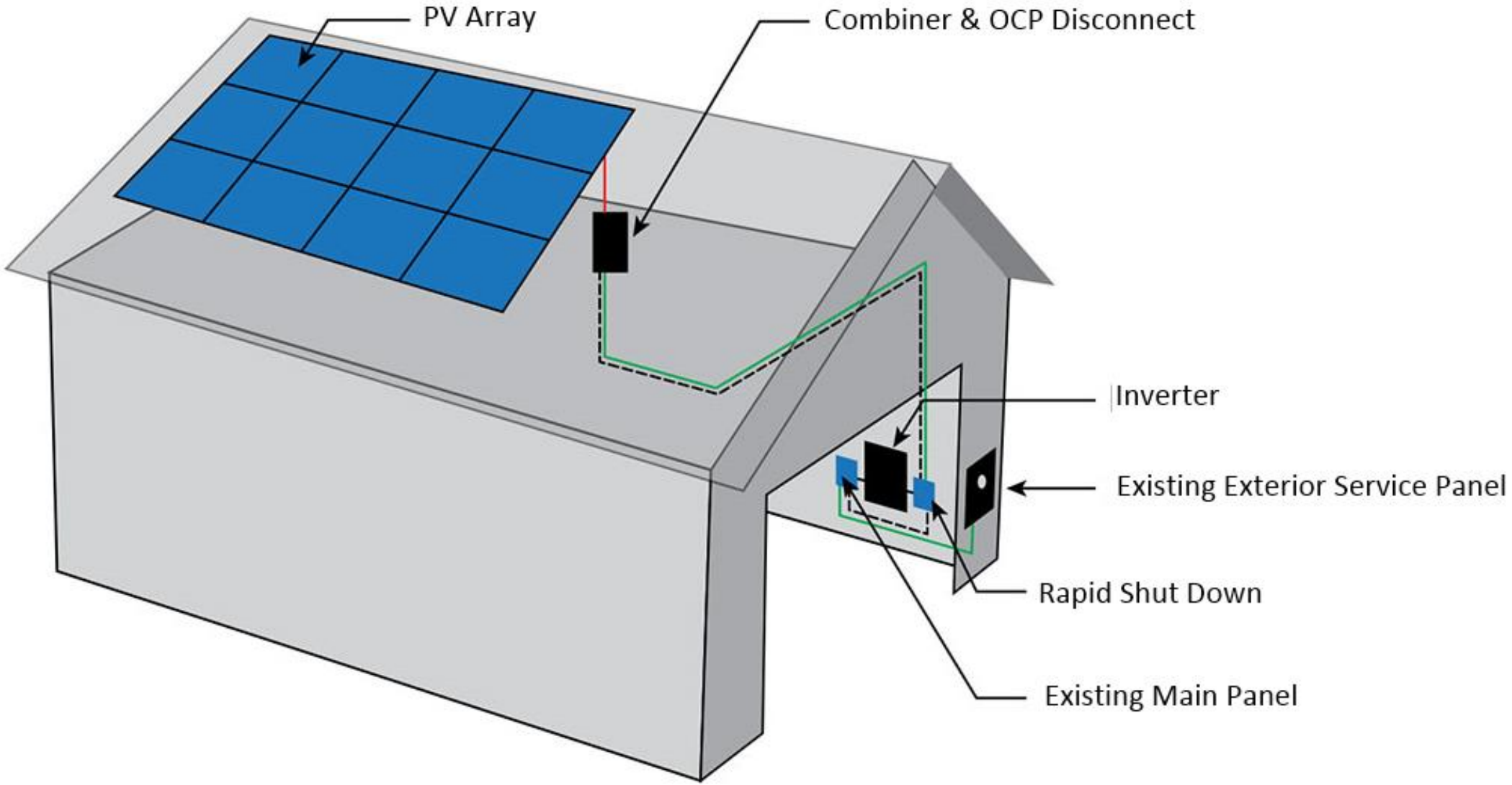
# EXAMPLE

*Single Family Install*



# EXAMPLE

## *EQUIPMENT LOCATION*



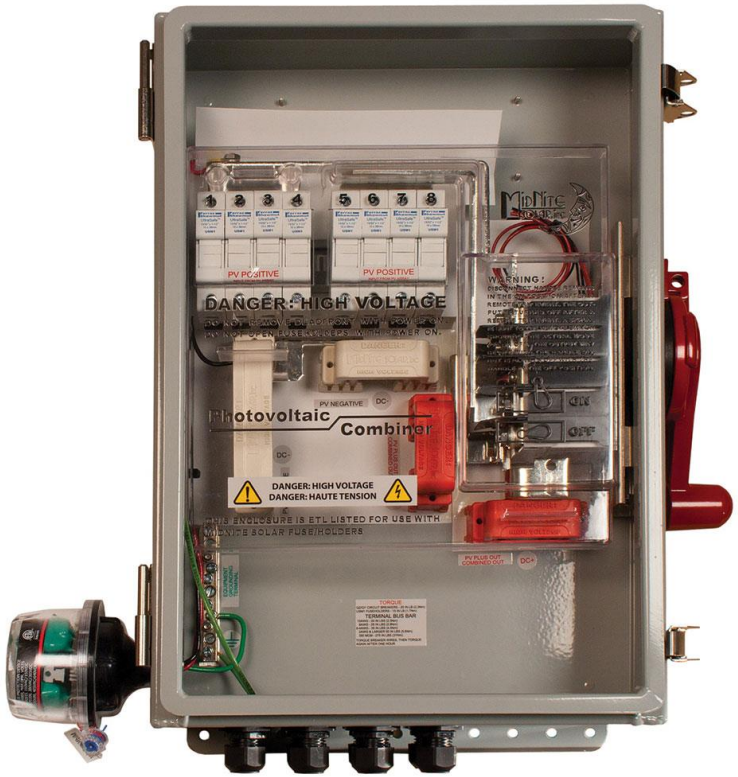
# EXAMPLE

*FREE STANDING/STAND ALONE PV SYSTEM*

9. Provide all wiring or cables and conduit related to this equipment installation. FBC 107
10. Submit a floor plan showing location of all electrical equipment. FBC 107
11. Provide protection for cables and raceways inside a structure as per NEC 300.4.
12. Arc-Fault Circuit Protection must be provided for PV Direct Current DC source with a PV system voltage of 80V or greater. NEC 690.11
13. Ground-Fault Detection and Interruption (GFDI) must be capable of: detecting a ground fault in the PV array dc current carrying conductors and components, including any intentionally grounded conductors. NEC 690.5 Provide proper warning labels.

# EXAMPLE

## *PV TYPE DISCONNECT ROOF AND WALL MOUNTED*




14. Submit load calculations to show what the existing equipment ampacity rating is and how the additional load imposed by the solar array will effect it. FBC 107
15. Show the calculations for derating of conductors above the roof. Show Ambient Temperature Correction Factors. NEC Table 690.31.E
16. The Ambient Temperature Correction Factors are based on 30 degree C or (86 degree F).
17. Provide for adjustment factors for more than three current carrying conductors in a raceway or cable must comply with Table 310.15.B.3.A

18. Provide a Florida Solar Energy Center (FSEC) Photovoltaic System Certification approval form for the proposed solar system or in lieu of FSEC certification, on the sealed plans provide the following note: per FL. STATUE 377.705 (REVISED 7/1/2017), I _____ PE#_____ an Engineer licensed pursuant to Chapter 471, certify that the PV electrical system and electrical components are designed and approved using the standards contained in the current version of the Florida Building Code. FBC 107
19. Provide from the property owner the signed "Owner Solar System Disclosure Form".
20. Provide title block information owner name/address/designer information. FBC107
21. Provide all notes on the plan for all of the required "Warning" notices/placards/signs/labels to be placed on equipment or raceways. NEC 690.7, NEC 690.10, NEC 690.35, NEC 690.51,NEC 690.52 and NEC 690.56

22. Provide on the raceway the warning label stating “WARNING: PHOTOVOLTAIC POWER SOURCE”. The label must be reflective with white text in capital letters not smaller than 3/8in on a red background. NEC 690.31
23. The warning sign(s) or label(s) shall comply with NEC 110.21.B
24. A sign must be placed as per NEC 690.17 where all terminals of the disconnecting means may be energized in the open position stating:

**“WARNING ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION”.**

# WARNING SIGNAGE

## *MINIMUM LETTER HEIGHT (3/8")*

- **Warning. " ELECTRICAL SHOCK HAZARD IF GROUND FAULT IS INDICATED NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED".** 690.5(C)
- **Warning. "SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUIT".** 690.10(C)
- **Warning. "PV SYSTEM DISCONNECT".** 690.13(B)
- **Warning. "DO NOT OPEN UNDER LOAD".** 690.16(B)
- **Warning. "ELECTRIC SHOCK HAZARD DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND THE LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION".** 690.17(E)

# REQUIREMENTS:

## EXAMPLES OF REQUIRED LABELING BASED ON NEC 690-705-110.21.13

- **Warning. "PHOTOVOLTAIC POWER SOURCE" See requirements.** 690.32(G) (3) & (4)
- **Warning. "ELECTRICAL SHOCK HAZARD. THE DC CONDUCTORS OF THS PHOTOVOLTAIC SYSTEM ARE UNDERGROUND AND MAY BE ENERGIZED".** 690.35(F)

**NOTE: THIS CHECK LIST IS COMPRISED OF THE MOST COMMON TURN DOWN REQUIREMENTS AND ISN'T DESIGNED TO MEET THE TOTAL REQUIREMENT FOR COMPLIANCE TO THE INSTALLATION OF ANY SOLAR PHOTOVOLTAIC (PV) SYSTEM.**

- 2014 Labels & Placard for the NEC requirements.

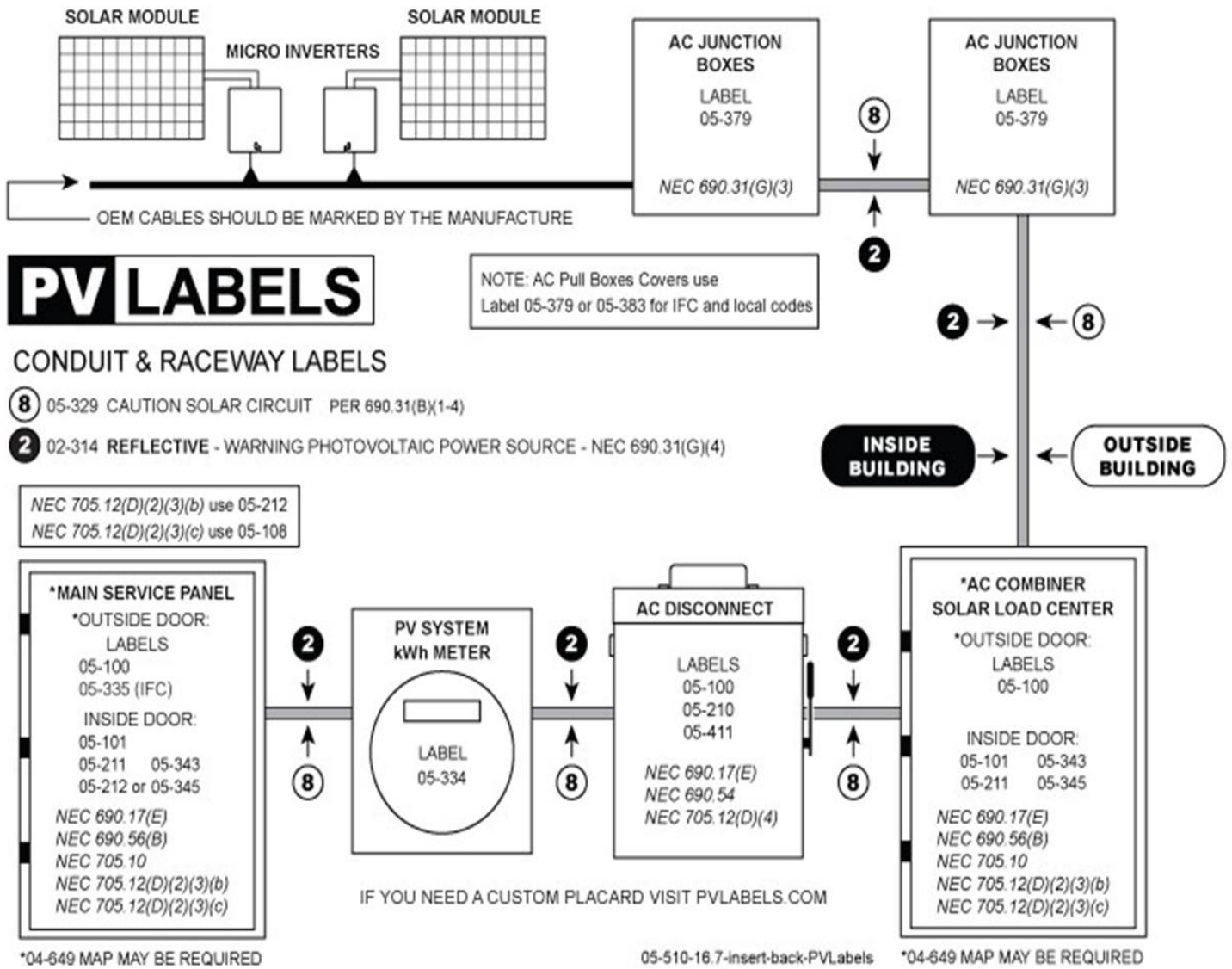
- 690.5(c) use #05-101
- 690.7(E)(3) use #05-103
- 690.10(C) use #05-213
- 690.13(B) use #03-327
- 690.16(B) use #05-325
- 690.17(E) use #05-100
- 690.31(B) use #05-801, (1) use#05-377 , (2) use#05-379 , and #05-381 , (3) use#05-377 , (4) use#05-801 .
- 690.31(G) (3) use #05-314
- 690.31(G)(4) use #02-218 and use #02-219
- 690.32(E) (2) use #05-326

- 2014 NEC 110.21(B) states that… field applied markings shall conform to ANSI Z535.4-2011.

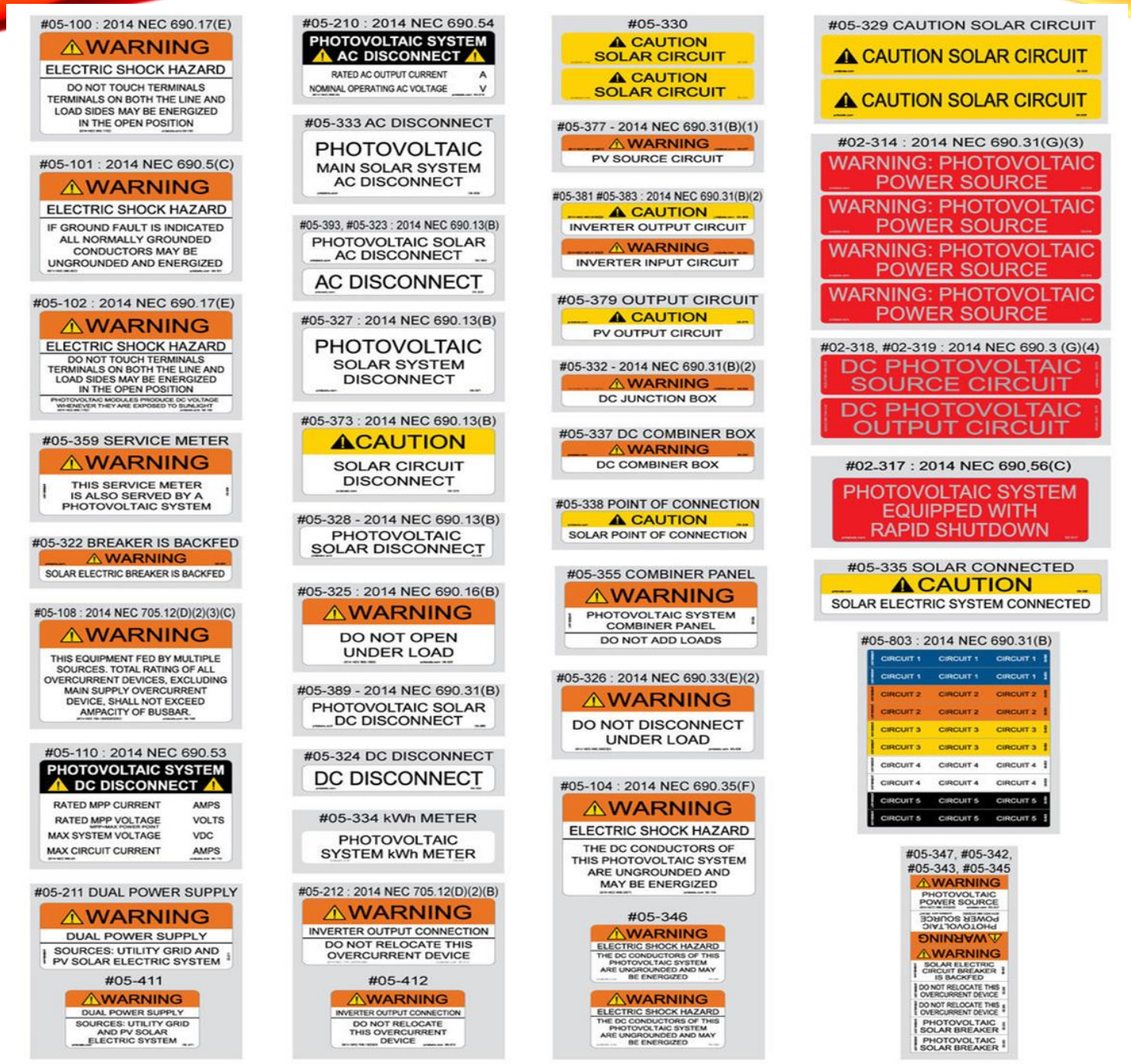
- 690.35(F) use#05-104
- 690.53 use#04-672
- 690.54 use#04-621
- 690.55 use#04-678
- 690.56(A) use#04-650
- 690.56(B) use#04-649
- 690.56(C) use#02-317
- 705.10 use#04-649
- 705.12(D) (2) use#05-212
- 705.12(D) (3) use#05-359

# PHOTOVOLTAIC SOLAR SYSTEM MARKING - MICRO INVERTERS

REQUIRED BASED ON 2014 NEC 690 AND NEC 705



# Examples of Labels



# EXAMPLE

*ROOFTOP COMBINER WITH RAPID SHUTDOWN RELAY*


# EXAMPLE

## 2 TYPE OF PV SYSTEM WORKING TOGETHER

# MOST COMMON PLANS PROCESSING REJECTIONS

1. Provide a complete riser diagram showing all equipment with wire sizes and indicate underground or overhead service lateral.
2. Correct ambient temperature calculations. NEC 690.7

   Annual extreme Low Temp 31F to 23F

   Annual extreme High Temp on Roof 104F

   Attic extreme High Temp 123F to 131F
3. Show the location of the rapid shut down controller as next to the PV disconnect or service main. NEC 690.12
4. Disconnecting means as per NEC 690.15 & 17 combiner box within 6' of the array as per NEC 690.15 C.
5. Provide ground fault protection as per NEC 690.11. Overcurrent protection as per 690.9.
6. Provide site plan showing the location of all of the equipment and the required signage. FBC 107 NEC 110.21.13 NEC 690 NEC 705

**RECOMMENDED**

# LOCATION OF ROOF MOUNTED PV MODULES:

FFPC NFPA 1 11.12

# ONE AND TWO FAMILY DWELLINGS AND TOWNHOUSES

1. PV modules shall be located in a manner that provides a 3-foot-wide clear access pathway from eave to ridge for each slope with PV modules installed.

- The pathway must be provided at a structurally strong location. FFPC NFPA 1 11.12.2.2.2.1.1

2. On single ridge roofs PV modules shall be located in a manner that provides two 3-foot-wide clear access pathways from eave to ridge for each slope with PV modules installed. FFPC NFPA 1 11.12.2.2.2.1.2

# EXAMPLE

*CLEARANCE FOR FIRST RESPONDERS*

# EXAMPLE

*A NEAT RESIDENTIAL INSTALL*

4. On hip and valley roofs PV modules shall be located no closer than 1.5 feet to a hip or valley if modules are to be installed on both sides of the hip or valley. Where modules are installed on only one side of the hip or valley of equal length, the PV modules shall be permitted to be placed directly adjacent to the hip or valley. FFPC NFPA 1 11.12.2.2.2.1.3

5. PV modules shall be located not less than three feet below the ridge. FFPC NFPA 1 11.12.2.2.2.2

# EXAMPLE

## *CLEARANCE FOR FIRST RESPONDERS*

**Please note:**

- **Ladder must be OSHA approved.**
- **Must extend at least 3 feet above the eave.**
- **Must be supported on firm ground and tied to structure when possible.**

REQUIRED:

# OTHER THAN ONE AND TWO FAMILY DWELLINGS AND TOWNHOUSES

1. PV modules shall be located in a manner that provides a minimum four foot wide clear perimeter around the edges of the roof for buildings with a length or width greater than 250 feet along either axis. FFPC NFPA 1 11.12.2.2.3.1

2. PV modules shall be located in a manner that provides a minimum six foot wide clear perimeter around the edges of the foot for buildings with a length or width greater than 250 feet along either axis. FFPC NFPA 1 11.12.2.2.3.1

3. Centerline access pathways shall be provided in both axes of the roof.
   - Pathways shall be run where the roof structure is capable of supporting the live load of fire fighters.
   - Pathways shall be run in a straight line.
   - Pathways shall provide not less than 4 feet clear to skylights, ventilation hatches, roof standpipes, and around roof access hatches.
   - At least one 4 foot clear pathway to the parapet or eave shall be provided. FFPC NFPA 1 11.12.2.2.3.2
4. Where the AHJ determines that the roof configuration is similar to a one or two family dwelling or townhouse, the AHJ shall allow the requirements for one and two family dwellings and townhouses to be followed. FFPC NFPA 1 11.12.2.2.2
5. Arrays of PV modules shall be no greater than 150 feet x 150 feet in distance in either axis. FFPC NFPA 1 11.12.2.2.3.3.1

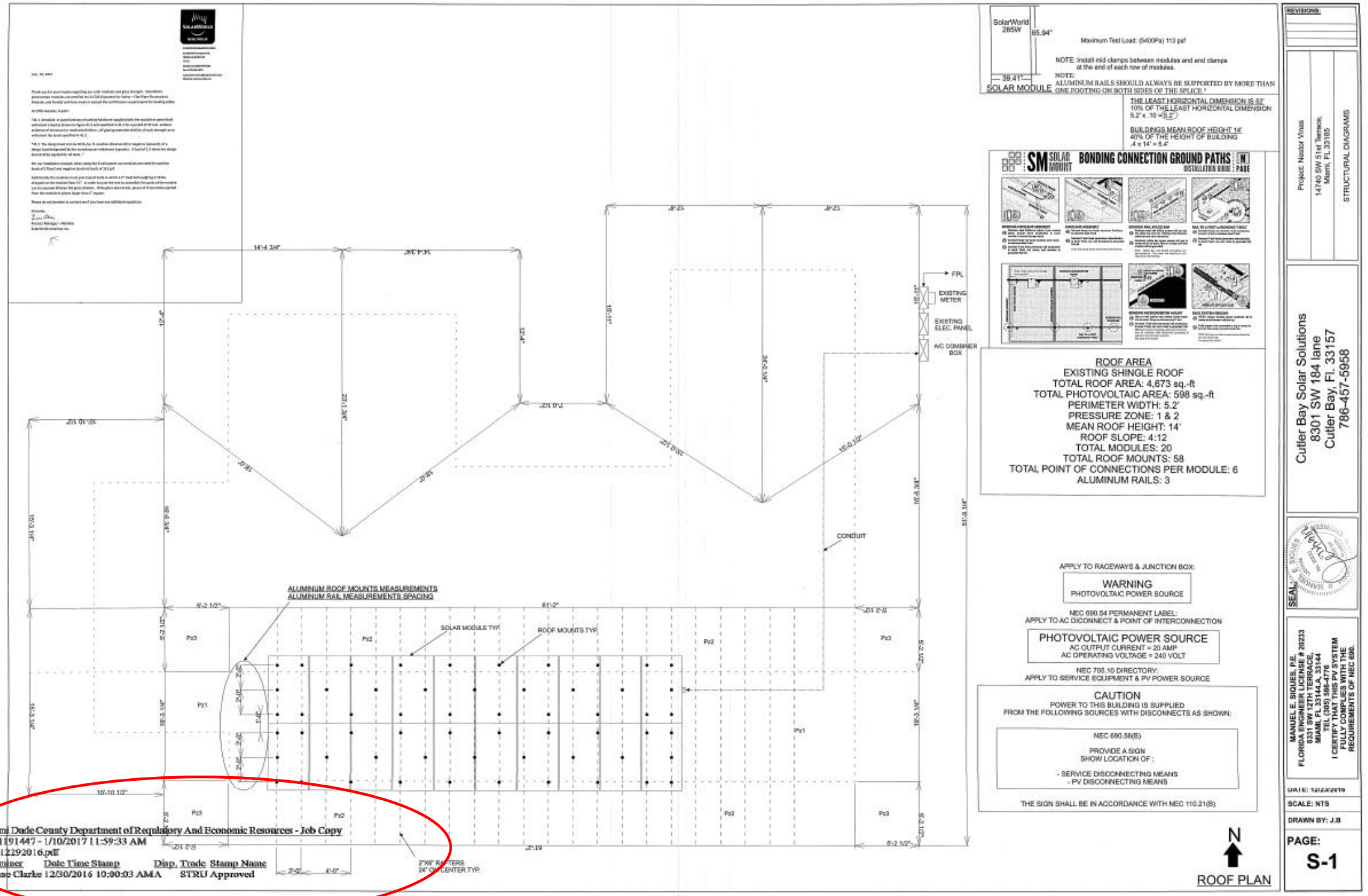
# ADDITIONAL INFORMATION

- Miami Dade County Building Department Electrical Check List for plan review is located at: http://www.miamidade.gov/permits/home.asp?cat=build&subcat=plan

**Note: This check list is comprised of the most common turn down requirements and isn't designed to meet the total requirement for compliance to the installation of any Solar Photovoltaic (PV) System.**

# PERMIT ISSUANCE

- As your plans are being routed and dispositions are entered, you may view the status via the Department's Plans Tracking system online at http://www.miamidade.gov/building/plantrack.asp.
- Once all the reviews are marked as approved, you may pay your permit fees online at http://www.miamidade.gov/permits/make-payments.asp and download your approved plans.
- When the permit is issued, you will receive an e-mail (if you provide a valid e-mail address) advising that the permit was obtained and that the plans are ready to be retrieved electronically. The e-mail will provide the link where you can view and print the final set of plans at no additional cost. This link will be available for 30 days after the e-mail is issued.
- You are responsible for delivering an official printed job copy of the plan set to the job site. The printed job copy must contain:
  - The MDC watermark on every page.
  - The MDC stamps and signatures from required plans examiners. The stamps and signatures on the paper job copy must be reconcilable against the electronic records at the time of inspection.
- If you do not receive the e-mail message or if you prefer you can print the official job copy by visiting the Building Department website at www.miamidade.gov/building/plantrack.asp then enter the process number and press submit. Then press the view permit and print as instructed.


SolarWorld 285W
65.94"
39.41"
SOLAR MODULE
Maximum Test Load: (5400Pa) 113 psf
NOTE: Install mid clamps between modules and end clamps at the end of each row of modules.
NOTE: ALUMINUM RAILS SHOULD ALWAYS BE SUPPORTED BY MORE THAN ONE FOOTING ON BOTH SIDES OF THE SPLICE.*
THE LEAST HORIZONTAL DIMENSION IS 52'
10% OF THE LEAST HORIZONTAL DIMENSION
5.2' x .10 = 5.2'
BUILDINGS MEAN ROOF HEIGHT 14'
40% OF THE HEIGHT OF BUILDING
.4 x 14' = 5.4'
SM SOLAR MOUNT
BONDING CONNECTION GROUND PATHS
INSTALLATION GUIDE
PAGE
ROOF AREA
EXISTING SHINGLE ROOF
TOTAL ROOF AREA: 4,673 sq.-ft
TOTAL PHOTOVOLTAIC AREA: 598 sq.-ft
PERIMETER WIDTH: 5.2'
PRESSURE ZONE: 1 & 2
MEAN ROOF HEIGHT: 14'
ROOF SLOPE: 4:12
TOTAL MODULES: 20
TOTAL ROOF MOUNTS: 58
TOTAL POINT OF CONNECTIONS PER MODULE: 6
ALUMINUM RAILS: 3
FPL
EXISTING METER
EXISTING ELEC. PANEL
A/C COMBINER BOX
CONDUIT
ALUMINUM ROOF MOUNTS MEASUREMENTS
ALUMINUM RAIL MEASUREMENTS SPACING
SOLAR MODULE TYP.
ROOF MOUNTS TYP.
Pz1
Pz2
Pz3
2"X6" RAFTERS 24" ON CENTER TYP.
APPLY TO RACEWAYS & JUNCTION BOX:
WARNING
PHOTOVOLTAIC POWER SOURCE
NEC 690.54 PERMANENT LABEL:
APPLY TO AC DICONNECT & POINT OF INTERCONNECTION
PHOTOVOLTAIC POWER SOURCE
AC OUTPUT CURRENT = 20 AMP
AC OPERATING VOLTAGE = 240 VOLT
NEC 705.10 DIRECTORY:
APPLY TO SERVICE EQUIPMENT & PV POWER SOURCE
CAUTION
POWER TO THIS BUILDING IS SUPPLIED FROM THE FOLLOWING SOURCES WITH DISCONNECTS AS SHOWN:
NEC 690.56(B)
PROVIDE A SIGN
SHOW LOCATION OF :
- SERVICE DISCONNECTING MEANS
- PV DISCONNECTING MEANS
THE SIGN SHALL BE IN ACCORDANCE WITH NEC 110.21(B)
N
ROOF PLAN
Miami Dade County Department of Regulatory And Economic Resources - Job Copy
D001191447 - 1/10/2017 11:59:33 AM
S-1-1229216.pdf
Examiner Date Time Stamp Disp. Trade Stamp Name
Jeanne Clarke 12/30/2016 10:00:03 AMA STRU Approved
REVISIONS
Project: Nestor Vinas
14740 SW 51st Terrace,
Miami, FL 33185
STRUCTURAL DIAGRAMS
Cutler Bay Solar Solutions
8301 SW 184 lane
Cutler Bay, Fl. 33157
786-457-5958
SEAL
MANUEL E. SIGUES, P.E.
FLORIDA ENGINEER LICENSE # 29233
8331 SW 12TH TERRACE,
MIAMI, FL 33144.A, 33144
TEL (305) 586-4776
I CERTIFY THAT THIS PV SYSTEM FULLY COMPLIES WITH THE REQUIREMENTS OF NEC 690.
DATE: 12/23/2016
SCALE: NTS
DRAWN BY: J.B
PAGE:
S-1

# SOLAR (PV) INSPECTIONS REQUIREMENTS

# REQUIRED INSPECTIONS

| PERMIT TYPE | CATEGORY | APPL TYPE | REQUIRED INSPECTIONS | | | |
|---|---|---|---|---|---|---|
| ELEC | 0034 | 27 | 002 | 004 | 001 | GROUND MOUNTED |
| ELEC | 0034 | 28 | 002 | 009 | 001 | ROOF MOUNTED |

## INSPECTION DESCRIPTIONS

004 – Foundation/Footing (Building Inspection)
009 – Time of Installation (Roofing Inspection)
002 – Rough*
001 – Final

***Note: Roofing/Building Inspection must be approved prior to calling Rough Electric Inspection**

# Inspection Routes and Results

- Inspection may be request:
  - Online at http://egvsys.miamidade.gov:1608/WWWSERV/ggvt/bnzaw960.dia
  - Telephone at (786)315-2100 or via the Automatic Voice Response System at (305)591-7966
  - In person at the Permitting and Inspection Center
- To request an inspection, you need your permit number and three digit inspection code. The hours to call for an inspection are from 7:30 a.m. to 4 p.m., Monday through Friday. Inspections requested prior to 4 p.m. are performed the next business day.
- Once your request has been made, you may view the inspection via the Routes and Results web page at https://bldgadmin.miamidade.gov/mobile2/map_route.asp.

e-Permitting

Search: Go

miamidade.gov

Resident | Visitor | Business | Employee

MIAMI-DADE

## Permit Inspection Request

| | | | |
|---|---|---|---|
| **Permit Number:** | **2018035591** | | |
| **Permit Type:** | ELEC | **Categories:** | 0034 |
| **Request Date:** | 03/13/2018 | **Request Time:** | 1000 |
| **Address:** | 23280 SW 117 PATH | | |

**Enter inspection type you would like to request and any comments you may have for the inspector.**
Inspection requests received before 4:00 p.m. will be added to inspector's route for next working day.
For inspection requests received on a county holiday, Saturday or Sunday, the request date will be changed to the next county working date and the inspection will be added to the inspector's route the next county working date after the inspection request date. For example:

Request received on Saturday October 5, will be changed to Monday October 7. Inspection will appear in the inspector's route for Tuesday October 8.

Request received on Monday October 14 (county holiday) will be changed to Tuesday October 15. Inspection will appear in the inspector's route for Wednesday October 16.

This inspection request function is only available between 6:00 a.m. and 8:00 p.m.

**Important notice relating to roofing inspections.**
**Property owners and roofing contractors.**
Please assist us in expediting the roofing inspection process by having an Occupational Safety and Health Administration (OSHA) approved ladder on the jobsite for use by the inspector on the day of inspection.
Thank you.

Inspection Type: 009 *

Comments for Inspector:
(If gated community, please enter access code in the comments field).

Update | Reset | Request Inspection for another permit.

* Required field.

**PLEASE ENTER INSPECTION TYPE AND/OR COMMENTS, THEN CLICK UPDATE**

Submit | Reset

For Address Format click here

## Welcome to Routes & Results website!

If you are a property owner and have an inspection you wish to see the status on, then you are in the right place! All you need to do is enter your permit number and press the search button. It will display the inspector's picture and a list of inspections he will be performing that day. Your permit number will be highlighted indicating where you are in his list and the order the inspection will be performed.

**IMPORTANT NOTICE RELATING TO ROOFING INSPECTIONS, PROPERTY OWNERS, AND ROOFING CONTRACTORS**

Please assist us in expediting the roofing inspection process by having an Occupational Safety and Health Administration (OSHA) approved ladder on the jobsite for use by the inspector on the day of inspection.

Map Route Table for Inspector

**Jerry Henry**

Office Number: 786-315-2426

**Please fill out a survey about your inspection experience,** Click here

Supervisor: **Amado Diaz** AMADO@miamidade.gov
Supervisor Number: (786) 315-2222
Director: **Stuart Bazerman** BHS@miamidade.gov
Director Number: (786) 315-2083

Wednesday, March 14, 2018

| # | Permit | Site Address | Category | Type | Status | Time | Comment | Additional Comments |
|---|---|---|---|---|---|---|---|---|
| 1 | 2018000238 | 8221 SW 138 AVE | 0001 ELECTRICAL | 1 FINAL | APPROVED | 8:52:56 AM | Demo of Gazebo only | |
| 2 | 2018033442 | 12505 SW 94 TER | 0001 ELECTRICAL | 2 ROUGH | | | | |
| 3 | 2017061493 | 12700 SW 128 ST | 0001 ELECTRICAL | 2 ROUGH | PARTIAL APPROVE COMPLX STRUCT | 9:53:58 AM | see plans e-1.01 for approved areas | |
| 4 | 2018021711 | 12915 SW 132 ST 5 | 0001 ELECTRICAL | 1 FINAL | | | | |
| 5 | 2018034742 | 8888 SW 136 ST 180 | 0032 DATA COMMUNICATION CABLES<br>0035 TELEPHONE WIRING / INSTALLATION | 1 FINAL | | | | |
| 6 | 2017044043 | 12755 SW 93 AVE | 0001 ELECTRICAL | 1 FINAL | | | | |
| 7 | 2018020484 | 12725 SW 98 CT | 0023 SWIMMING POOLS | 48 ROUGH/SLAB | | | | |
| 8 | 2018034775 | 8301 SW 112 ST | 0026 TEMP SERVICE TEST & REPAIR | 13 TEMPORARY FOR TESTING | | | | |

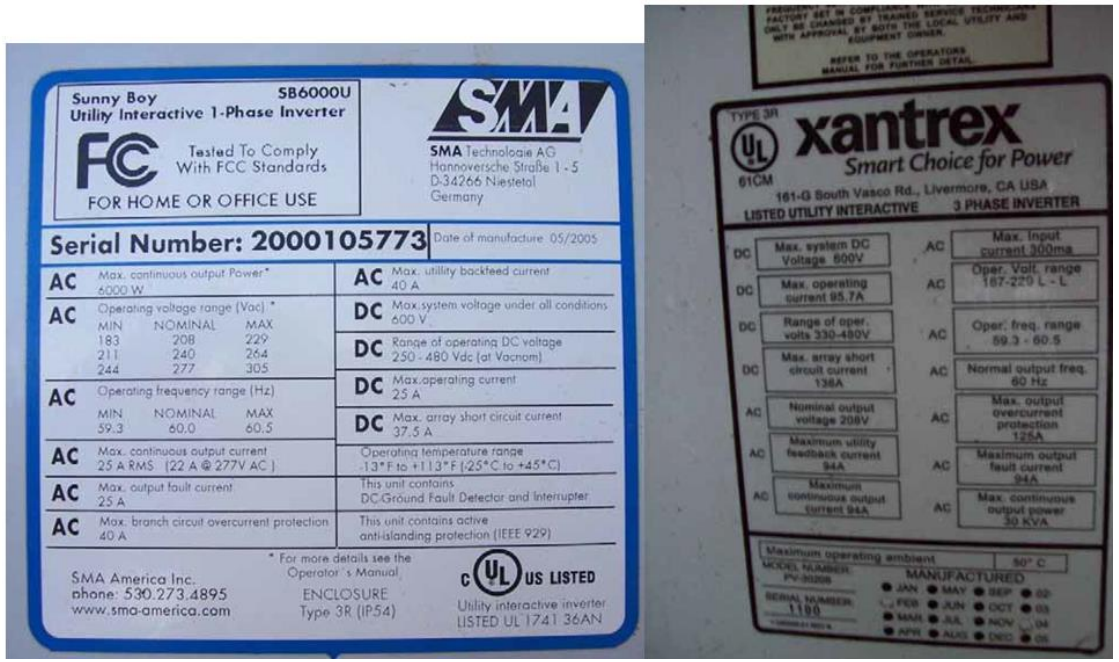
# Inspection Requirements

- Make sure you have the approved set of plans on site.
- Make sure that you have the Notice of Commencement posted on site if the estimated value is over $2,500.
- OSHA approved ladder must be on-site in order for inspectors to perform the inspections for rooftop installations.

# ELECTRICAL INSPECTOR CHECK LIST

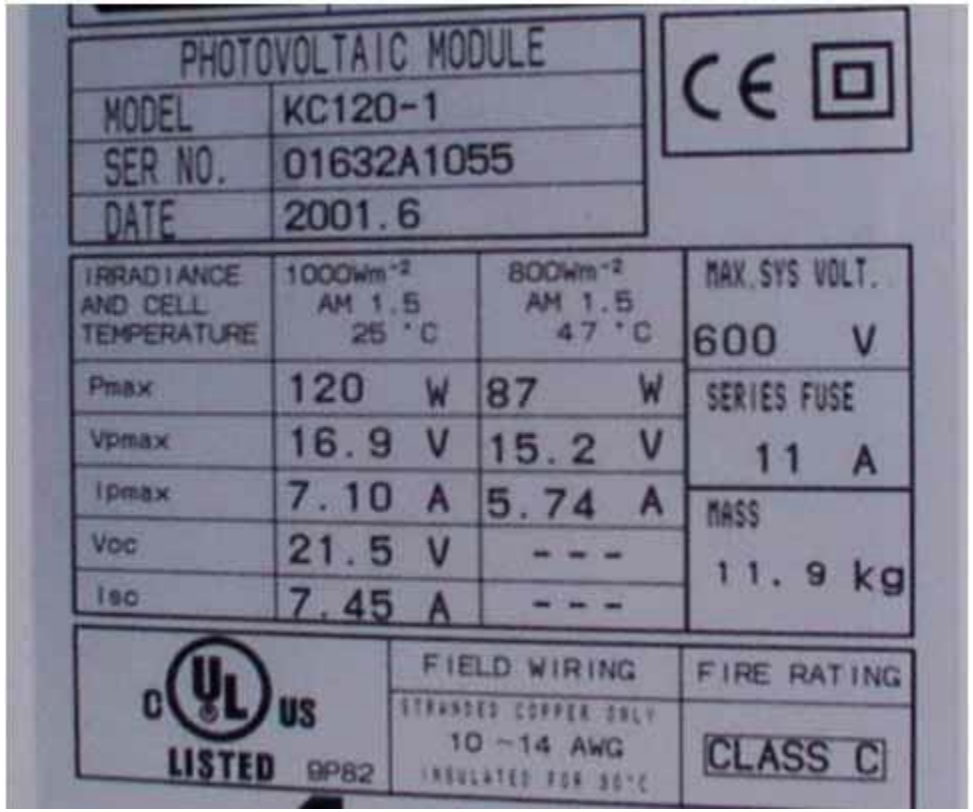
- **Array Mounting Information:** Mounting detail drawing includes roof type and age, mounting system, fastener spacing, and penetration weather sealing method**.**
- **Equipment Approval:** All equipment is identified, listed, and exact per plans 110.3(B).
- **Site Drawings:** Site drawings include descriptions and locations of major components.
- **Electrical Diagram:** Electrical diagram includes component interconnects, conductor types and sizes, conduit types and sizes, disconnects, and point of interconnection.
- **AC Modules:** AC modules have appropriate markings: Overcurrent protection, Disconnects Means, Photovoltaic Source Circuit and Inverter Output Circuit. 690.6 (A) (B) (C) (D) ; 690.52

# TYPICAL LABEL









# OVERCURRENT PROTECTION

- **Protected Circuits:** PV source circuit, PV output circuit, inverter output circuit, and battery circuit conductors and equipment are protected in accordance with Article 240. 690.9(A); 240
- **Multiple Power Sources:** Circuits connected to multiple power sources are provided overcurrent protection from each source. 690.9(A)
- **Ratings**: Overcurrent protection devices are rated for not less than 125% of the maximum currents calculated or determined in 690.8(A). 690.9(B); 240.4;
- **Transformers:** Overcurrent protection is provided for power transformers in accordance with Section 450.3 . 690.9(F); 450.3

# CODE COMPLIANT INSTALL


# *OVERCURRENT PROTECTION*

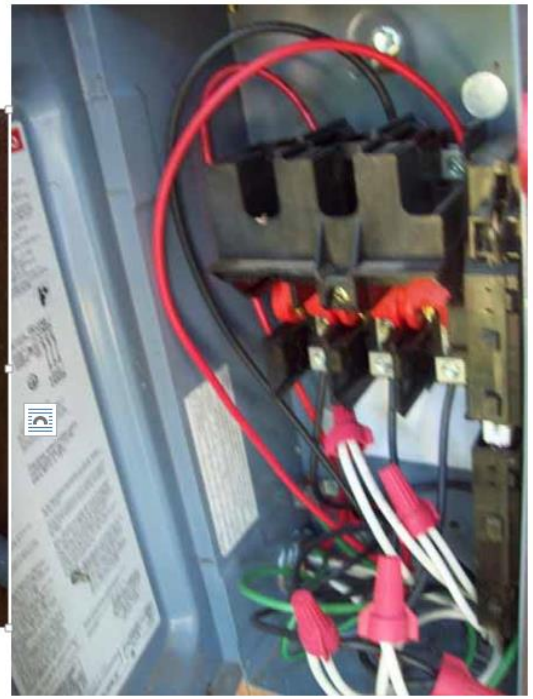
- **Listed for DC**: Overcurrent protection devices in DC circuits are listed for such use and have the appropriate voltage, current, and interrupt ratings. 690.9(C)
- **1000 V Limit:** Maximum system voltage is **600 V for dwellings**. Other installation with a maximum PV system voltage over 1000 volt shall comply with Article 690. Circuits over 150 V to ground shall be accessible only to qualified persons. 690.7(C); 690.7(D)

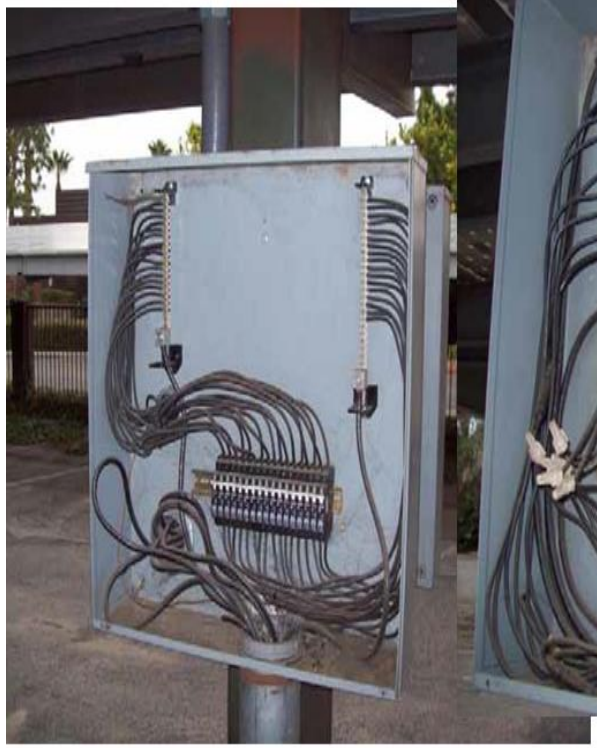
# CODE COMPLIANT INSTALL



# NON –CODE COMPLIANT INSTALL

## Properly Rated Disconnects and Inverters

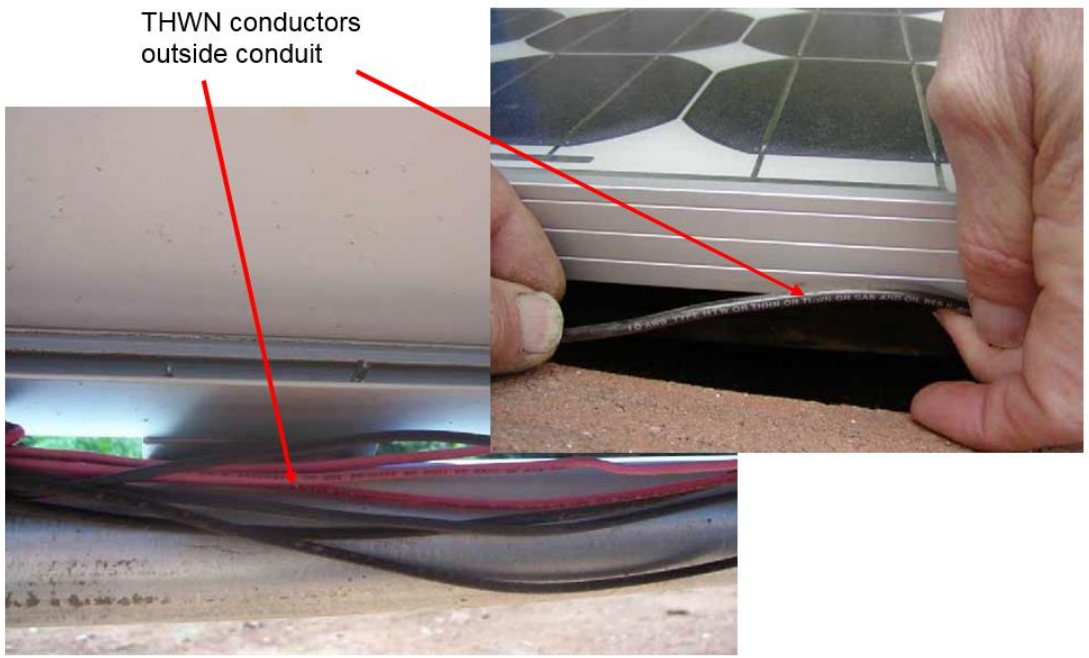



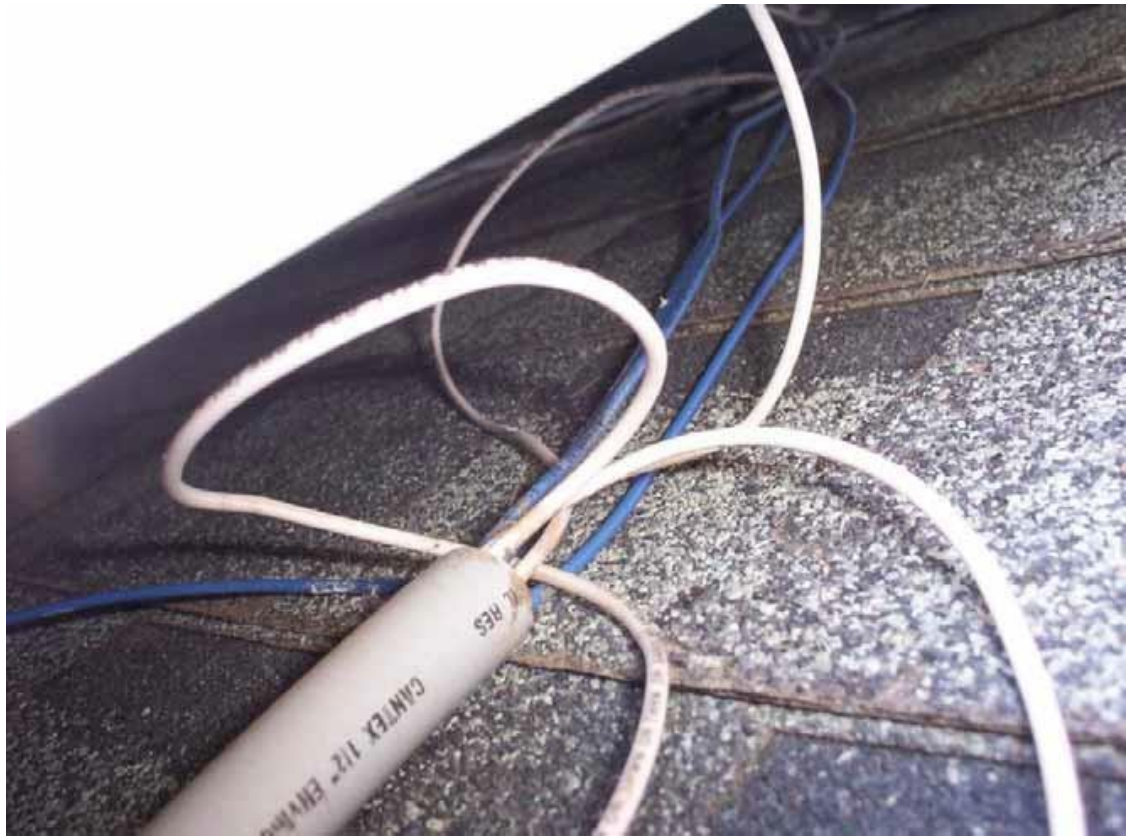


# *WIRING METHODS & CONDUCTUOR SIZING*

- **Wiring Method for Conduit:** PV source- and output-circuit conductors operating at more than 30 V and installed in readily accessible locations are in conduit. 690.31(A)
- **Single-Conductor Cable:** Conductors have 90°C, sunlight, and wet service resistances. Single conductor type USE-2 and specifically listed and labeled PV wire is permitted in PV source circuits. 690.31(C)(1)
- **Identification and Grouping:** PV source- and output-circuit conductors are not run together with conductors of other systems. 690.31(B)

# *INCORRECT CONDUCTORS & INCORRECT USE OF CONDUCTORS.*



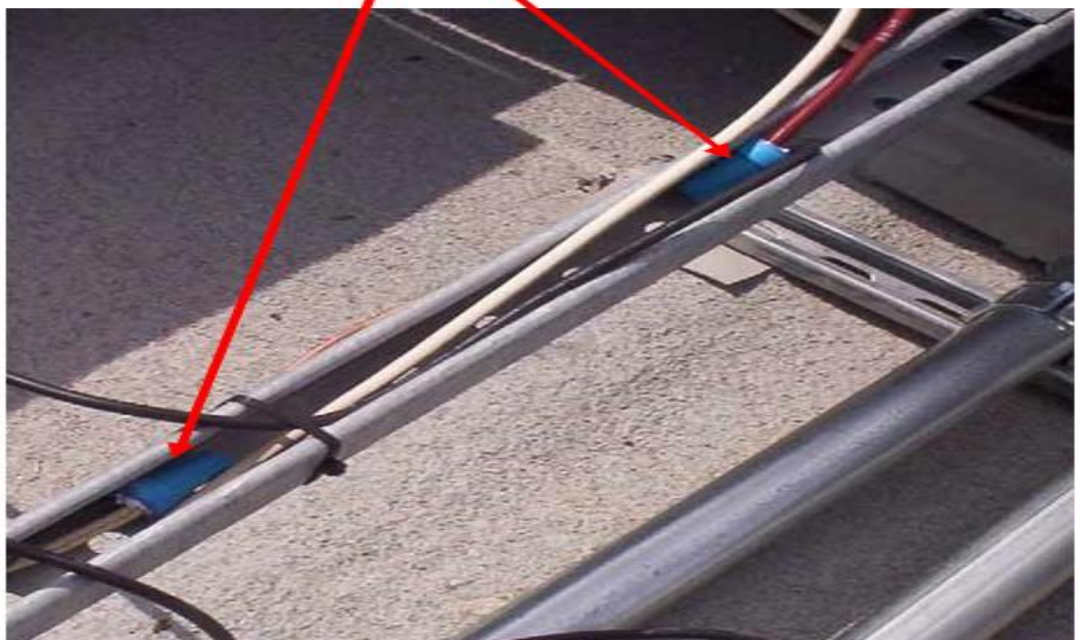



# NON-CODE COMPLIANT INSTALL

NEMA 3R disconnect on sloped roof designed for vertical mounting only

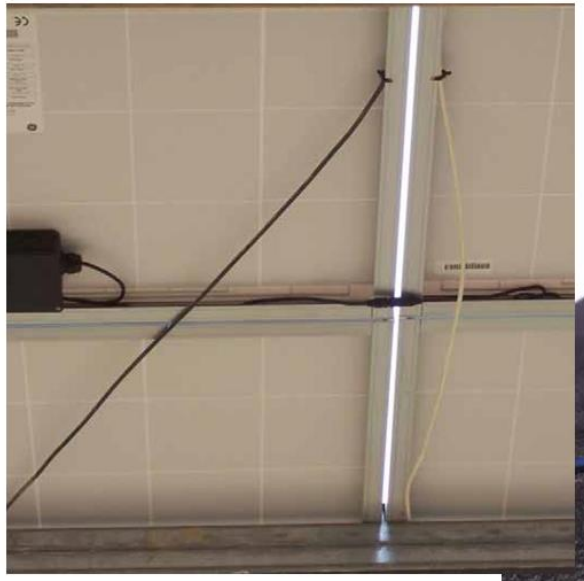
Black cover to shield improperly installed switch only served to make switch invisible

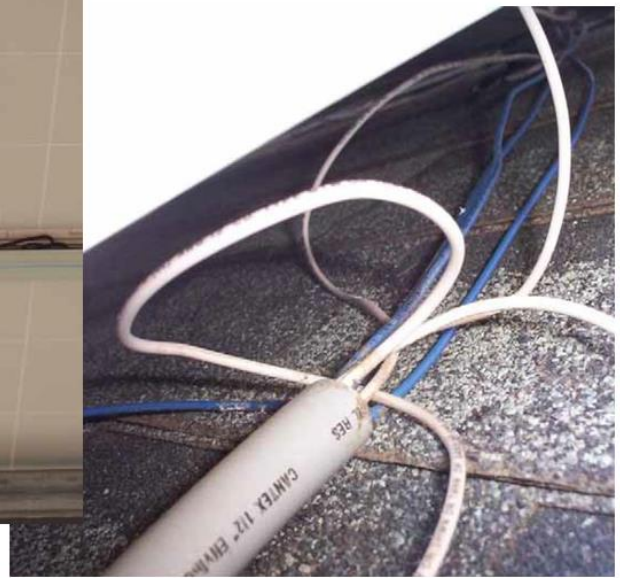
Waterproof wirenuts must be in j-boxes



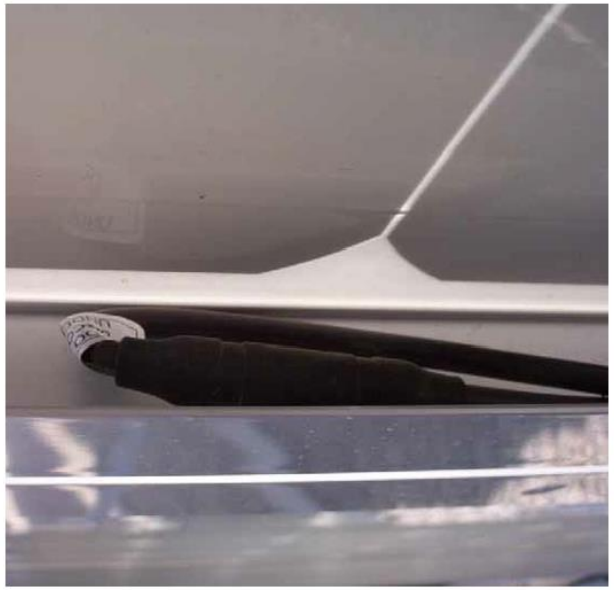
# NON-CODE COMPLIANT INSTALL

## Wire Management—Follow structural members & What the…?



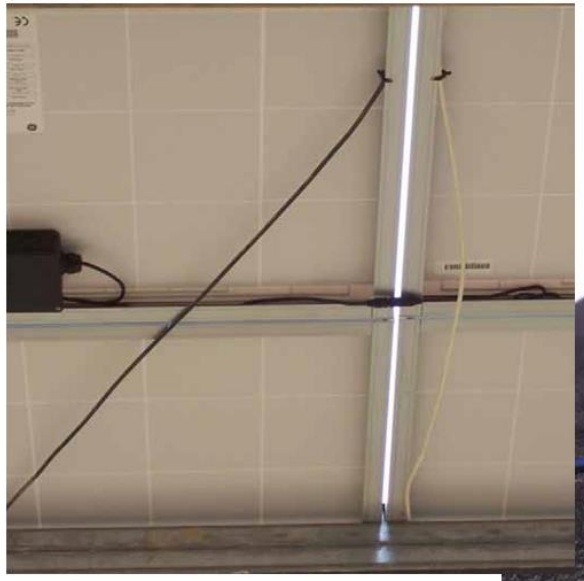


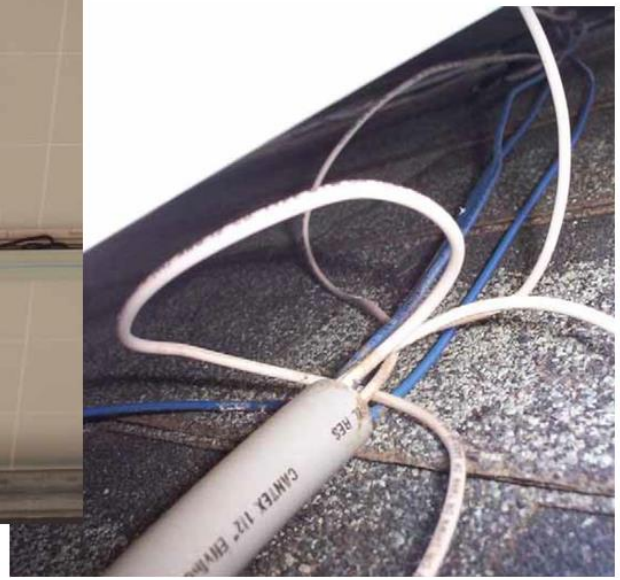
## Wire Management —wire bending radius



# NON-CODE COMPLIANT INSTALL

## Wire Management—Follow structural members & What the…?





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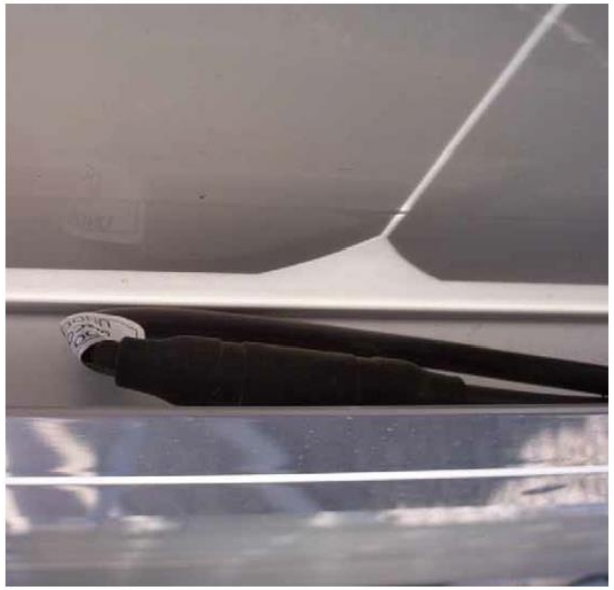


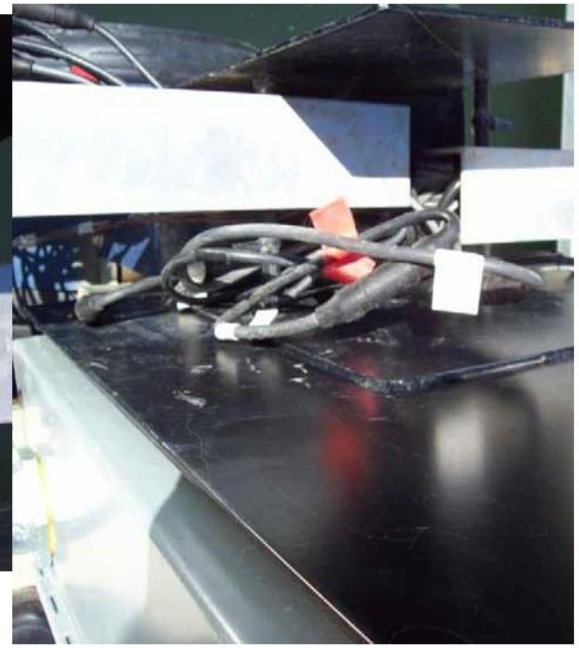
# NON-CODE COMPLIANT INSTALL

# *WIRING METHODS & CONDUCTUOR SIZING*

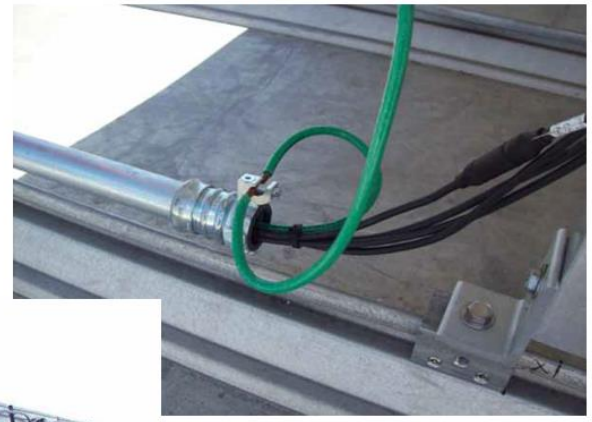
- **Flexible Cord and Cable:** Flexible cords and cables where used to connect the moving parts of a tracking PV system, shall comply with 400.5. 690.31(E); 400.5
- **Small Conductors Cable:** Single-conductor cables in sizes 16 AWG and 18 AWG are permitted for module interconnections if they meet the ampacity requirements of 690.8. 690.31(F); 310.15
- **PV Source Circuit:** Where DC or AC systems are ran inside of a building, they shall be in metal conduit from the point of penetration into the building to the first point of disconnecting means. 690.31(G)
-

# *THE INCORECT & CORRECT MEANS OF WIRE MANAGEMENT*

## Wire Management—Physical Damage



## Wire Management—Proper



# *WIRING METHODS & CONDUCTUOR SIZING*

- **Connectors:** Connectors are polarized, non-interchangeable, guarded, latching or locking, have "first-to-make/last-to-break" contact for grounded conductor, and either are rated for interrupting current or require a tool to open. 690.33A, B, C, D, E,
- **Electrical Connections:** Connectors are listed for the intended use and environment. Screw terminals are tightened to recommended torque. Crimp-on terminals are used with a appropriate crimping tool. 110.14
- **Access to Boxes:** Junction, pull, and outlet boxes located behind the modules or panels shall be rendered accessible directly by displacing the module or panel. 690.34; 314

# WHAT DO YOU THINK??



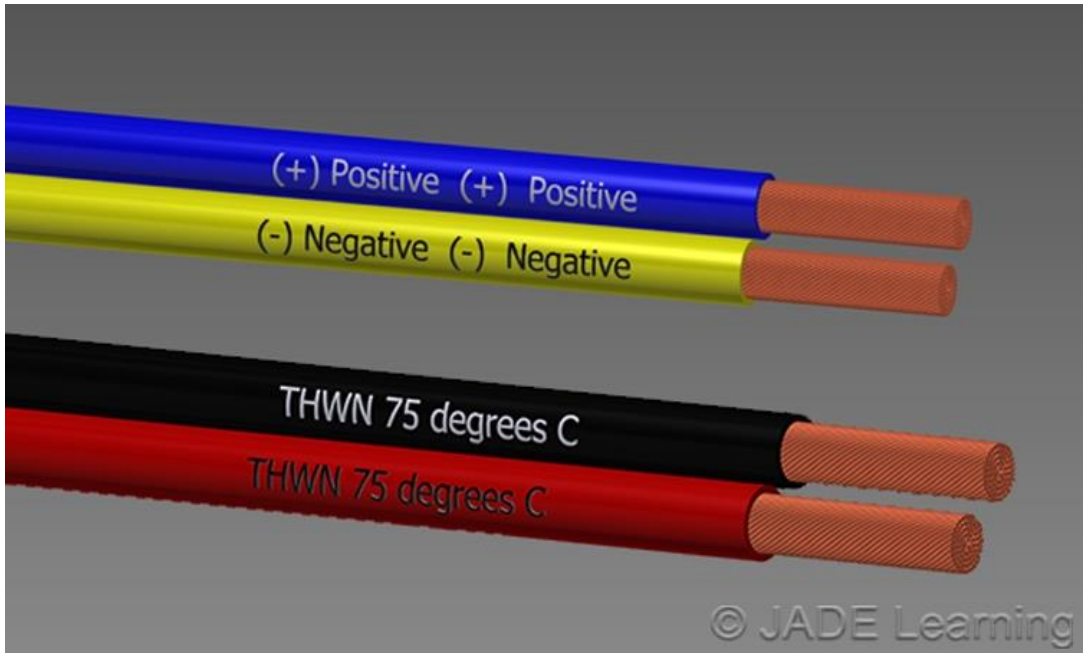

# *WIRING METHODS & CONDUCTUOR SIZING*

- **Color Codes:** Grounded conductors are marked white or gray and grounding conductors shall be green, green/yellow, or bare. 310.12
- **Protection Against Physical Damage:** Cable and conductors where are subject to physical damage shall be protected. 300.4
- **Single 120 – Volt Supply:** No multiwire branch circuits are allowed on stand-alone 120 V inverter output circuit or panels. 690.10(C)
- **Arc-Fault Circuit Protection (Direct Current):** PV systems with dc source circuit, dc output circuits, or both, operating at a PV system maximum system voltage of 80 volts or greater , shall be protected by a listed (dc) arc-fault circuit interrupter, PV type, or other system components listed to provide equivalent protection. 690.11

# WIRING METHODS & CONDUCTUOR SIZING

**Rapid Shutdown of PV System on Buildings:** PV system installed on or in a building shall include a rapid shutdown function that controls specific conductors in accordance with 690.12(1) through (5). 690.12


**Identification of Branch Circuits Supplied From DC. System:** See 210.5 (C) (2) **(Color Identification).** 210.5(C) (2

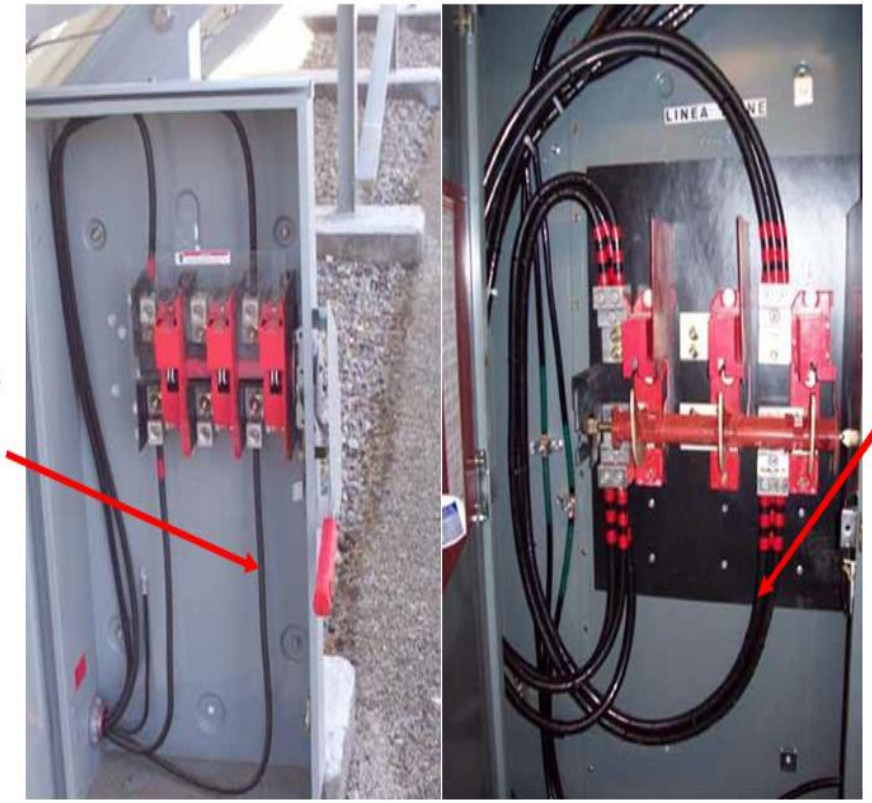


# *DISCONNECTS*

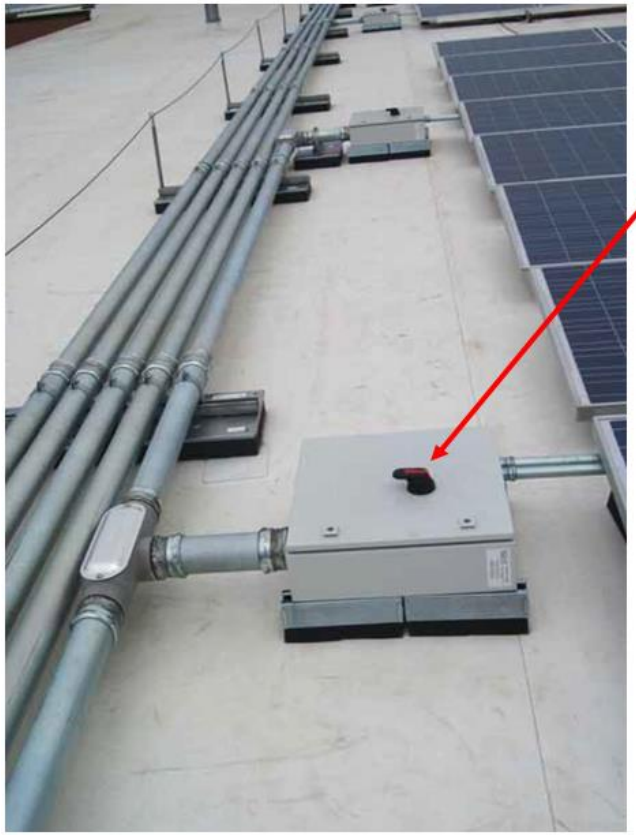
- **Building or Other Structures Supplied by PV system:** A means shall be provided to disconnect all ungrounded dc conductors of a PV system. 690.13
- **Location/Disconnecting of PV Equipment:** Array disconnect is installed at a readily accessible location either on the outside of the building or structure or inside nearest the point of entrance of the system conductor. 690.13(A);690.15
- **Marking:** Each PV system disconnect is marked as such, and suitable for the intended use. 690.13(B)
- **Grouping:** There are no more than six disconnects for each source of power. Disconnects for each power source are grouped together. 690.13(E)

# CODE COMPLIANT INSTALL

Incorrect
Breaking of
grounded
conductor



Correct



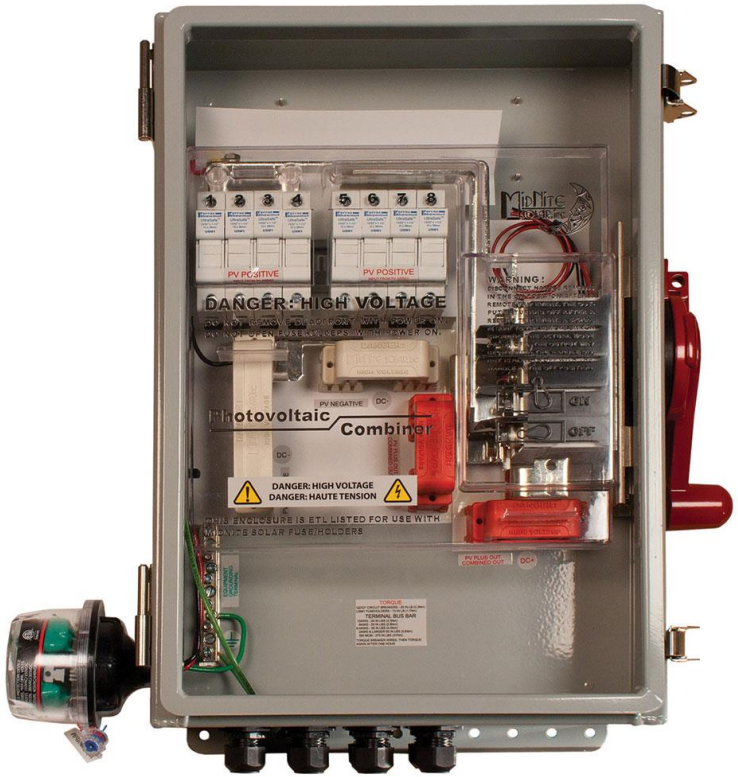
NEMA 4
Combiner Box
with disconnect
built-in. Designed
for horizontal or
vertical mounting

# *DISCONNECTS*

- **Equipment Disconnects:** Disconnects are provided to disconnect equipment (inverters, batteries, charge controllers from all ungrounded conductors of all power sources.
- **Disconnecting Means:** A disconnecting means shall be provided to disconnect a fuse from all sources of supply if the fuse is energized from both directions.
- **Disconnect Types:** Disconnects open all ungrounded conductors, are readily accessible, externally operated, have ON/OFF indication, and have appropriate interrupt rating. Manually operated switches and circuit breakers may fulfill these requirements. 690.17(A) (B) (C) (D) (E)

# EXAMPLE

## *PV TYPE DISCONNECT ROOF AND WALL MOUNTED*




# GROUNDING

- **Ungrounded PV Power Systems:** Ungrounded systems include disconnects, overcurrent protection, and ground-fault protection. Equipment is listed for use with ungrounded systems. 690.35
- **Module Connection Arrangement:** Module connections are such that removal of a module does not interrupt a grounded conductor to another PV source circuit. 690.31(J)
- **Ground-Fault Protection:** Ground fault protection is provided for grounded arrays. 690.5
- **PV System Grounding:** PV system shall comply with one of the following: Ungrounded system 690.35, Grounded two-wire system 690.5, Grounded bipolar system (center tap) 690.5, All other methods see 250.4(A). 690.41; 250.4(A)

# NON-CODE COMPLIANT INSTALL.
# INSTALL PER MANUFACTURERS INSTRUCTIONS

Notice slight gap caused by properly installed clip.

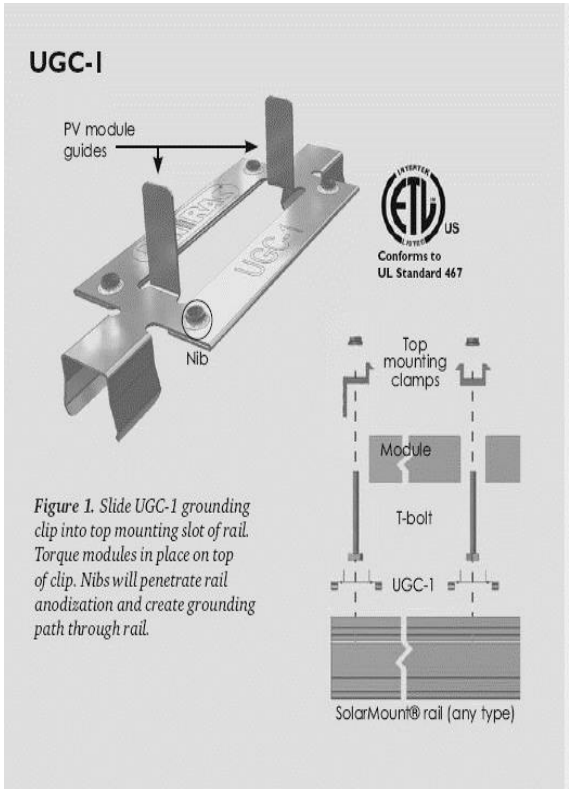



*Figure 1. Slide UGC-1 grounding clip into top mounting slot of rail. Torque modules in place on top of clip. Nibs will penetrate rail anodization and create grounding path through rail.*

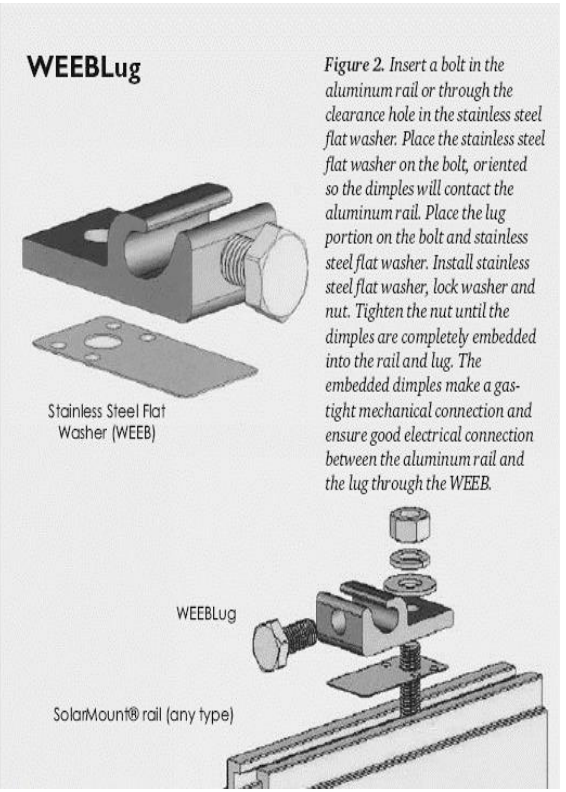
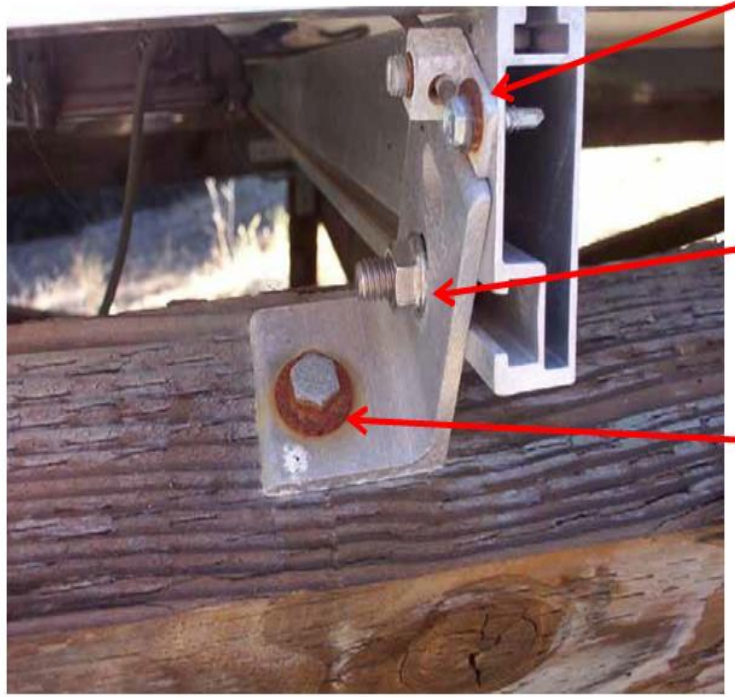


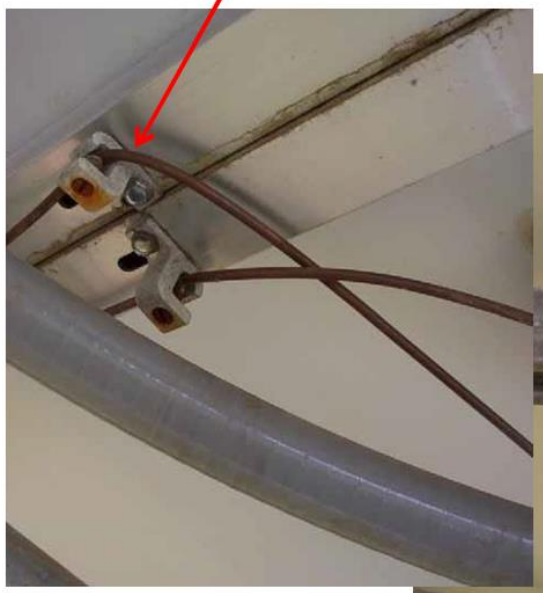

*Figure 2. Insert a bolt in the aluminum rail or through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt and stainless steel flat washer. Install stainless steel flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug. The embedded dimples make a gas-tight mechanical connection and ensure good electrical connection between the aluminum rail and the lug through the WEEB.*

# GROUNDING

- **Point of System Grounding Connection:** DC grounding is made at a single point on the PV output circuit. 690.42
- **Equipment Grounding:** Non-current-carrying metal components are grounded, including module frames, mounting structures, equipment, conduit, and boxes. 690.43
- **Equipment Grounding Conductors:** Equipment grounding conductors are routed with PV circuit conductors. 690.43(A) (B) (C) (D) (E) (F)

# NON-CODE COMPLIANT INSTALL



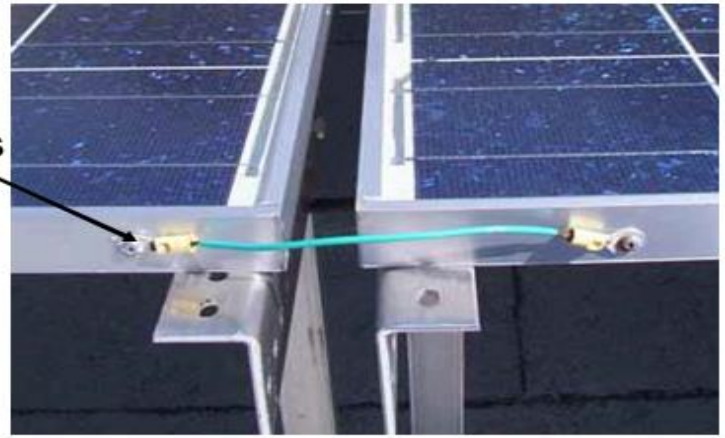

# GROUNDING

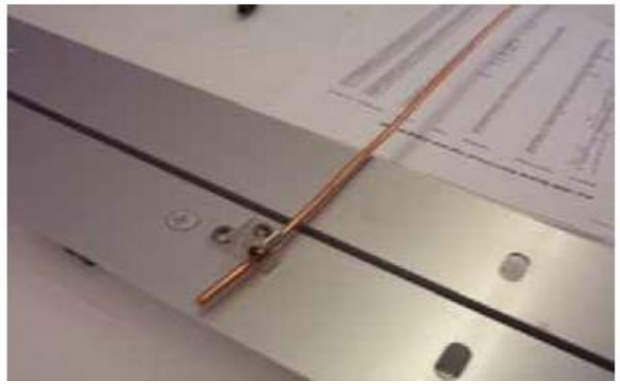
- **System with AC and DC Grounding Requirements:** If system includes both AC and DC systems, the grounding electrode systems are bonded together. The bonding conductor is sized for the larger of the AC and DC requirements. Separate DC and AC grounding electrodes are permitted, or both grounding systems may use the premises AC grounding electrode. The grounding electrode conductor is sized to meet both AC and DC grounding requirements. 690.47(C); 250
- **Additional Auxiliary Electrode for Array Grounding:** Array is grounded with separate grounding electrode system, unless it would be within 6' of premises electrode. 690.47(D)

# NON-CODE COMPLIANT INSTALL

Improper Cad Tek screw used to hold lug

Wrong connectors





# *OTHER POWER SOURCES*

- **Point of Connection:** The output of interactive inverter is connected to either the supply side or the load side of the utility service disconnect. (**Not in meter can as per FPL Net Metering Guidelines FAC-6.065**). 690.64: 705.12
- **Dedicated Overcurrent and Disconnect:** The source interconnection of one or more inverter installed in one system shall be made at a dedicated circuit breaker or fusible disconnect. 705.12(D) (1)

# CODE COMPLIANT INSTALL


# *OTHER POWER SOURCES*

- **Bus or Conductor Ampere Rating:** 125% of the inverter output circuit current shall be used in the ampacity calculation for the following: (1) – (3) steps. 705.12(D) (2)
- **GFCI**: Interconnection is on the line side of all ground-fault protection equipment. 705.32
- **Suitable for Back-feed:** Circuit breakers used for load-side connections are suitable for such operation. 705.12(D) (4)

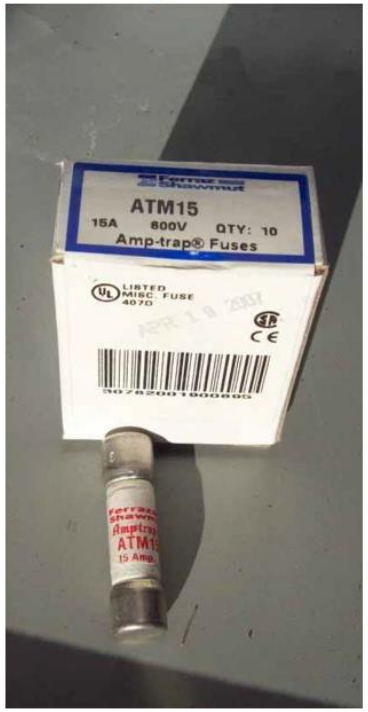
# CODE COMPLIANT INSTALL

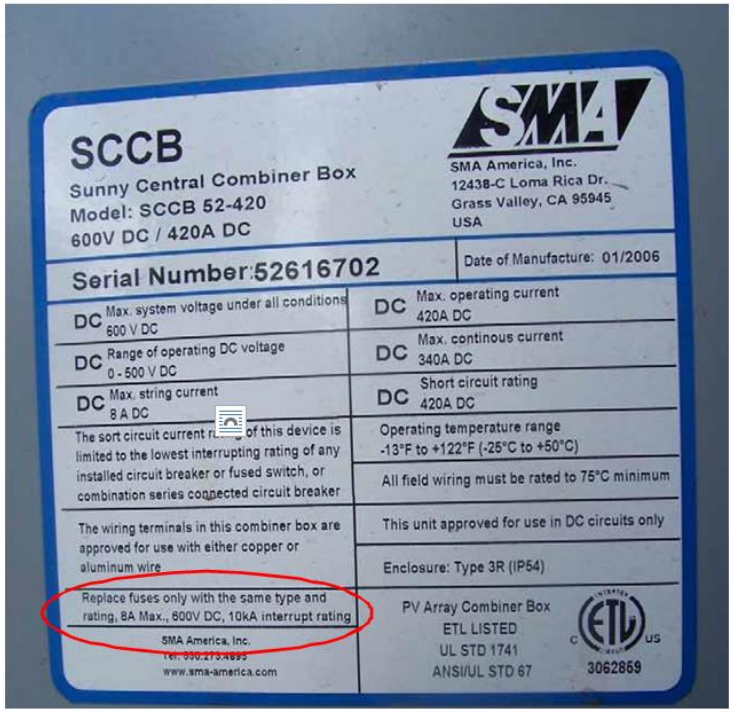
# *BATTERIES & CONTROLERS*

- **General:** Battery bank is installed in accordance with Article 480. 690.71(A); 480
- **Guarded of Live Parts:** Battery terminals and other live parts are guarded and adequate working space is provided. 690.71(B)(2); 480.9
- **Current Limiting:** Current-limiting fuses are installed on battery output circuits. 690.71(C)
- **Battery Interconnection: (A) Flexible Cable:** Battery interconnections are made with #2/0 AWG or larger flexible cables that are listed for hard-service use and identified as moisture-resistant. 690.74(A); 400

# WHAT DO YOU THINK??

## Proper Current Rating?




## Correct Fuses and Terminals?

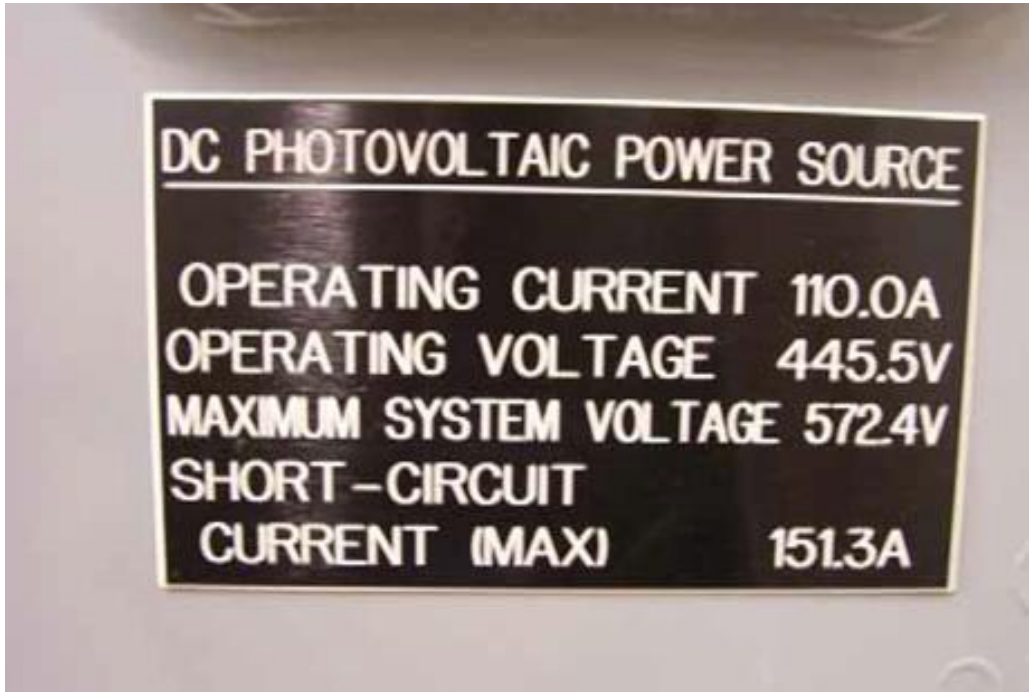
# *BATTERIES & CONTROLERS*

- **Battery Nonconductive Cases and Conductive Racks:** Batteries in banks of greater than 48 V nominal are in non-conductive cases. Conductive racks are permissible, if no materials within 6" from top of battery case. (Requirements do not apply to VRLA batteries.) 690.71(D)
- **Battery Maintenance Disconnect Means:** A disconnect is provided for the grounded conductor of each string for battery systems over 48 V. Disconnect is accessible only to qualified persons. 690.71(F)

# *LABELS/WARNINGS*

- **Labels and Markings:** A warning label shall appear on the utility-interactive inverter or be applied by the installer near the ground-fault indicator at a visible location. 690.51
- **Modules:** PV modules shall be marked with identification of terminal or leads as to polarity, maximum over-current device rating for module protection, and with the following ratings: (1) Open-circuit voltage. (2) Operating voltage.(3) Maximum permissible system voltage.(4) Operating current.(5)Short-circuit current. (6) max power Maximum power. 690.51
- **Direct–Current PV Power Source:** PV power source is labeled with maximum power current, maximum power voltage, maximum system voltage, short-circuit current, and maximum rated output current of charge controller (if installed) at the DC disconnect. 690.53

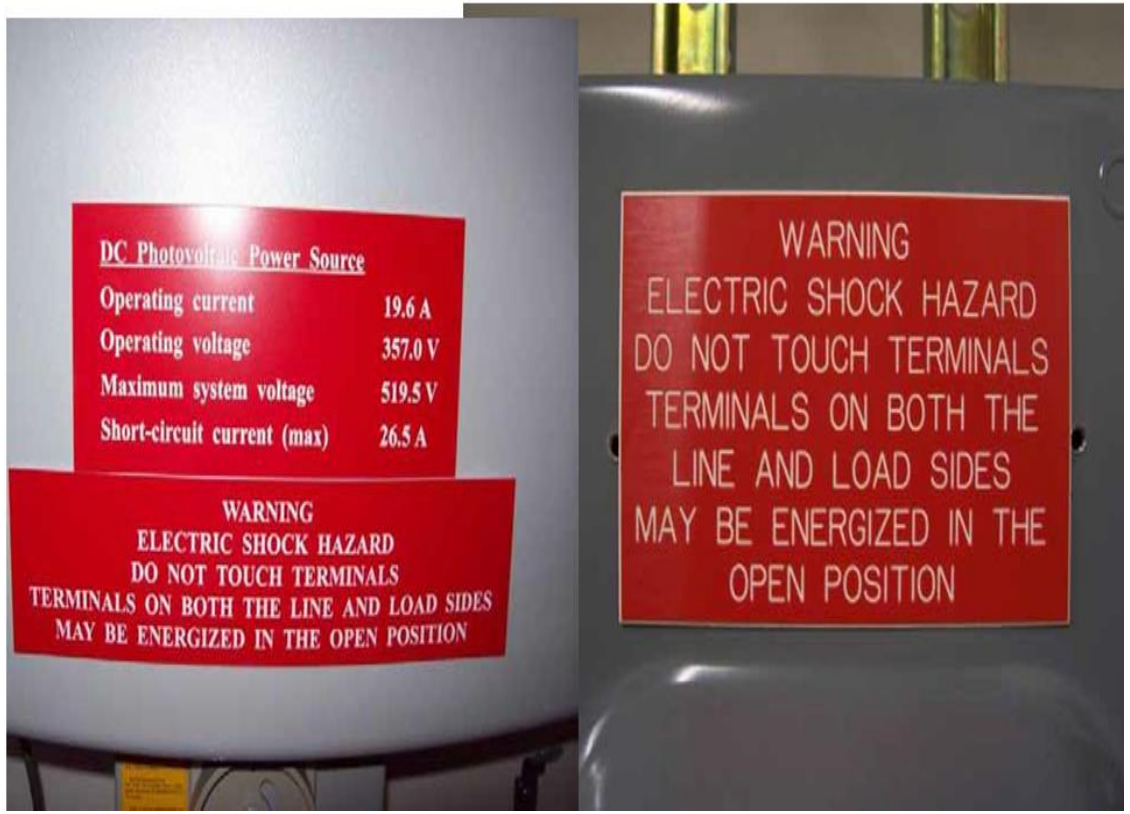
# WARNING SIGNAGE

# *LABELS/WARNINGS*

- **Interactive System Point of Interconnection:** All interactive system point of interconnection with other source shall be marked at an accessible location at the disconnecting means as a power source and with the rated ac output current and the nominal operating ac voltage. 690.54
- **PV Power System Employing Energy Storage:** BPV power systems employing energy storage shall be marked with the maximum operating voltage, including any equalization voltage and the polarity of the grounding circuit conductor. 690.55
- **Facilities with Stand-Alone Systems:** Building or structures with PV stand-alone systems shall have a permanent plaque or directory providing the location of all disconnecting means. 690.56(A)

# WARNING SIGNAGE

# *LABELS/WARNINGS*

- **Utility & PV Power Source:** Building or structures with both utility and PV systems shall have a permanent plaque or directory providing the location of all disconnecting means for all source systems. 690.56(B)
- **Single 120 V Supplies:** A stand-alone system supplied by a 120 V inverter includes a label warning against connecting multiwire branch circuits. 690.10(C)
- **Markings:** Ungrounded systems include a label warning of a shock hazard. 690.35(F)

# *LABELS/WARNINGS*

- **Interrupting Rating:** If all terminals of disconnect are energized when open, a label warns as such.  690.17(E)
- **Marking:** Panels containing overcurrent protection devices supplying power to busbar are marked to indicate all sources of supply. 705.12(D) (3)
- **Back-Fed Breakers:** Back-fed circuit breakers for load-side connections are labeled as inverter output connections with a warning not to relocate. 690.10(E)
- **All Labels a Markings Shall Be:** Adequately warn of the hazard using effective words and / colors and or / symbols. Be permanently affixed to the equipment or wiring method. Not be hand written. Be of sufficient durability to withstand the environment involved. 110.21(B)

# *WARNING SIGNAGE MINIMUM HIGHT (3/8")*

- **Warning. " ELECTRICAL SHOCK HAZARD IF GROUND FAULT IS INDICATED NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED".** 690.5(C)
- **Warning. "SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUIT".** 690.10(C)
- **Warning. "PV SYSTEM DISCONNECT".** 690.13(B)
- **Warning. "DO NOT OPEN UNDER LOAD".** 690.16(B)
- **Warning. "ELECTRIC SHOCK HAZARD DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND THE LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION".** 690.17(E)

# *WARNING SIGNAGE MINIMUM HIGHT (3/8")*

- **Warning. "PHOTOVOLTAIC POWER SOURCE" See requirements.** 690.32(G) (3) & (4)
- **Warning. "ELECTRICAL SHOCK HAZARD. THE DC CONDUCTORS OF THS PHOTOVOLTAIC SYSTEM ARE UNDERGROUND AND MAY BE ENERGIZED".** 690.35(F)

# ADDITIONAL INFORMATION

Miami Dade County Building Department Electrical Check List for inspections is located at:

http://www.miamidade.gov/permits/home.asp?cat=build&subcat=plan

**Note: This check list is comprised of the most common turn down requirements and isn't designed to meet the total requirement for compliance to the installation of any Solar Photovoltaic (PV) System.**

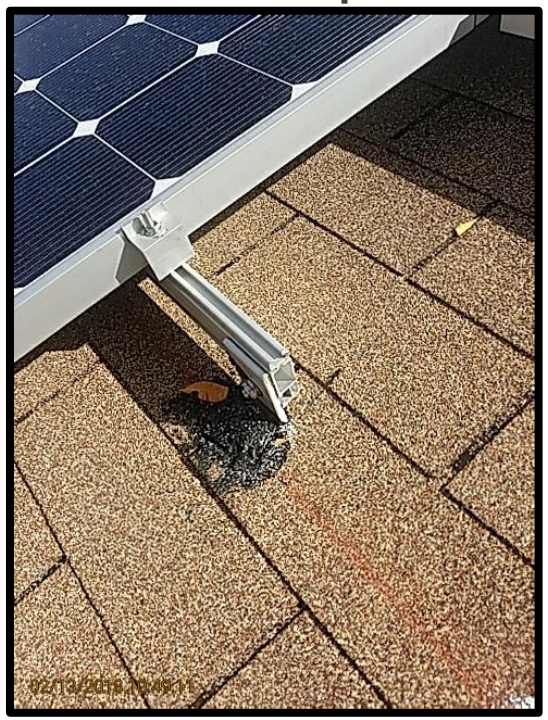
# Building/Roofing Inspection Requirements

# Improper panel installation

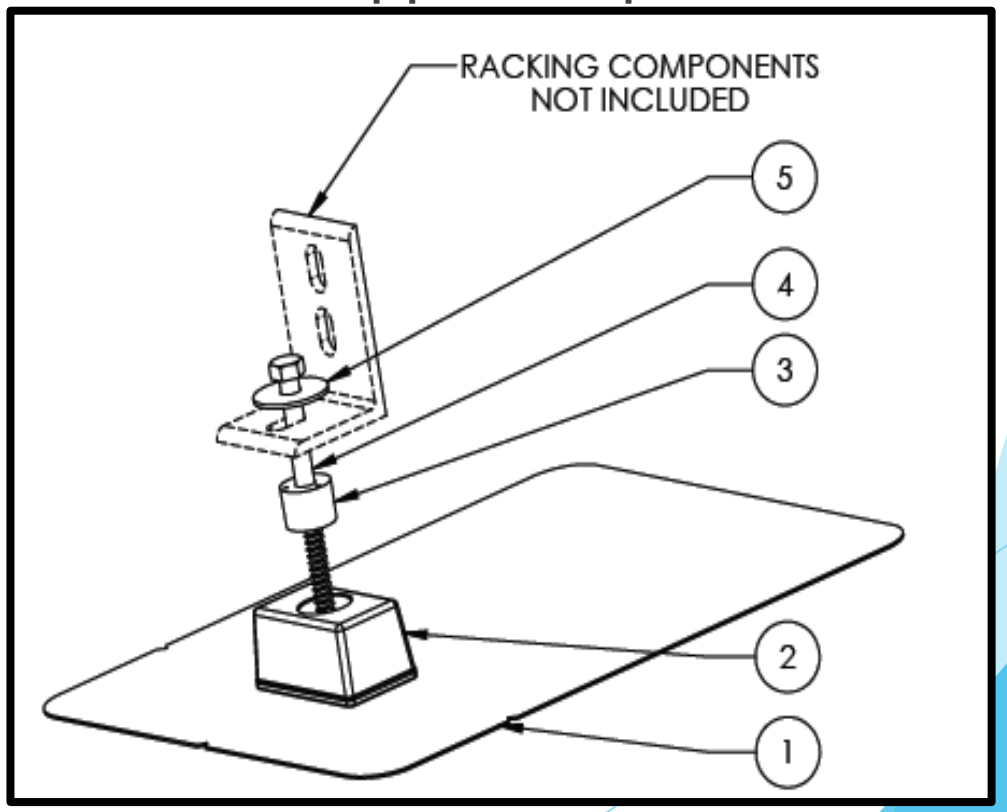
# Improper panel installation
# Wire management not in compliance with Bldg Code

# JOB SITE INSTALLATION

Approved shingle flashing detail on plans



Job site installation does not match approved plans



# JOB SITE INSTALLATION

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# Helpful Resources


QUESTIONS?

**Miami-Dade County Permitting and Inspection Center**
11805 SW 26th Street
Miami, Florida 33175
Open: 7:30 a.m. - 4 p.m.
Monday-Friday, excluding legal holidays

**Main phone:** 786-315-2000
**Voice response:** 305-591-7966
bldgdept@miamidade.gov

**HELPFUL LINKS**

Florida Building Code

www.floridabuilding.org

Building Main Website

www.miamidade.gov/building/

Plans Tracking

www.miamidade.gov/building/plantrack.asp