



CITY OF CYPRESS

Building Division

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RESIDENTIAL PHOTOVOLTAIC SYSTEMS

ALL WORK SHALL REQUIRE COMPLIANCE WITH THE 2013 CBC, 2013 CRC, 2013 CEC, 2013 CPC, 2013 CMC AND 2013 ENERGY REGULATIONS TITLE 24

A permit is required to install a photovoltaic system. Permits are required prior to installation or replacement of photovoltaic systems. This handout is intended to provide general information, contact the Building Safety Division for any specific questions or additional information.

Installation Standards and Plan Requirements

1. Photovoltaic systems shall be installed by qualified persons. This is defined as a person who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved. (CEC 690.4E)
2. Panels shall be adequately anchored to the roof framing. (CBC 1613.5, CRC R908)
3. **Structural Calculations required when array coverage exceeds 250 sq.ft. over 2 story, or 350 sq.ft over 1 story.**
4. Penetrations of the roof material shall be sealed in accordance with the roofing manufacturer's requirements. (CBC 102.4 and CRC R102.4)
5. **Min 11" x 17" sheet for plan submittal. (3) Complete sets.**
6. Show the size and location of the electrical service panel rating and main circuit breaker. Min service disconnecting means shall have a rating of not less than 100 amperes, 3 wire. (CEC 230.79(C))
7. Provide a **Project Description** with a complete and detailed "**Scope of Work**" on the **cover sheet**. This must include **all** elements of the project including the **PV system size in Kw**, number of panels, type of inverter system used (micro inverters or standard), roofing type and pitch, **area of array coverage**, **# of stories**, etc.
8. Show on plans the required working clearances around the Service meter main, AC Disconnect, Inverters, and DC disconnects.
9. Show on plans the required access, pathways, and smoke ventilation clearances around the arrays per CRC R331.4.
10. Electrical diagram showing PV array configuration, wiring system, overcurrent protection, inverter disconnect, grounding, required signs and AC connection to building (see supplied standard electrical diagram) Specification sheets, installation manuals (if available) for all manufactured components including, but not limited to, PV modules, inverter(s), combiner box, disconnect and mounting system.
11. Provide the attachment details, flashing details, construction design for the unit and any supporting frame members (sealed by the appropriate design professional) for the Wind Zone, additional loading, and any site conditions.
12. Electrical calculations showing that all wire sizing has been determined with proper ampacity, conduit fill and ambient de-rating factors.

Electrical Plan Requirements

13. Photovoltaic panels, inverters, modules, and all other associated equipment shall be listed by a nationally recognized testing laboratory (i.e., UL) for the intended application.
14. Photovoltaic circuits shall not be located in the same raceway, junction box, outlet box, etc. as non-photovoltaic circuits. (CEC 690.4B)
15. Photovoltaic systems with DC circuits shall have arc-fault protection (when greater than 80volts). (CEC 690.11)
16. The photovoltaic main disconnecting breaker shall be located at the opposite end of the bus bar from the main disconnecting circuit breaker. (CEC 705.12D)

17. GFCI protection shall be provided at the inverters. (CEC 690.5)
18. Photovoltaic conductors shall be sized at 125% of the maximum photovoltaic current. (CEC 690.8B)
19. A disconnecting means shall be provided to disconnect the conductors within the building from the photovoltaic system conductors. This disconnect shall be readily accessible from the outside of the building or inside at the nearest point of entrance of the conductors. (CEC 690.14C)
20. A disconnecting means shall be provided for all photovoltaic equipment. If the equipment is energized from more than one source, the disconnecting means shall be grouped and identified. (CEC 690.15)
21. When the photovoltaic inverters are connected on the load side of the main disconnect (after the main breaker), the sum of the photovoltaic disconnects shall not exceed 120% of the main electrical panel rating. And shall comply with 705.12(D)(1)-(d)7. **Note on plans “NOT CENTER FED PANEL”.**(CEC 690.64)
22. Center fed panels CANNOT use the 120% increase.
23. **If breaker is to be de-rated, submit load calculations signed by contractor performing work or Electrical Engineer.**
24. Circuit breakers that are back-fed must be suitable for such operation (circuit breakers labeled “Line” and “Load” are not suitable for back-feeding.) (CEC 690.64)
25. All equipment frames shall be grounded. (CEC 690.43)
26. A ground conductor shall be provided that is sized based on the disconnect size connected to the existing grounding system. (CEC 250.47)
27. **Provide UL 1703 Fire Classification for racking system and modules. Provide specifications of Class Type for Modules (1 or 2) and Fire Classification specification for racking system and what Type of Modules used.**

Marking/Labeling Requirements

All marking and labeling shall be a minimum 3/8 inch high white letters on a red background and the material shall be suitable for the environment where it is located. Marking and labeling shall be applied as follows:

28. All interior and exterior direct-current (DC) conduit, enclosures, raceways, cable assemblies, junction boxes, combiner boxes, disconnects and the main disconnect shall be labeled with the wording “WARNING: PHOTOVOLTAIC POWER SOURCE.” The labeling shall be located every 10 feet, within 1 foot of turns or bends, and within 1 foot above and below penetrations of roof/ceiling assemblies, walls or barriers. (CBC 3111, CRC R331)
29. The utility-interactive inverter shall be labeled at the ground-fault indicator with the wording “WARNING: ELECTRICAL SHOCK HAZARD IF A GROUND FAULT IS INDICATED. NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED.”
30. The DC disconnect, if all terminals are hot while open, and the AC disconnects that are energized from two directions, shall be labeled with the wording “WARNING: ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINES AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.”
31. The photovoltaic breaker shall be labeled with wording “WARNING: INTERFERE OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE.”
32. Provide signage per CEC 690.52(Complete information on Plans), 690.53(Complete information on plans), 705.10 (Directory Placard)
33. Placard must be installed stating: **“MAIN BREAKER HAS BEEN DOWNSIZED FROM ____A to ____A FOR PHOTOVOLTAIC SYSTEM. DO NOT UPSIZE MAIN BREAKER.”**

Roof Pathways and Roof Ventilation (CBC 3111, CRC R331)

Panels shall be located to provide the following roof-top clearances (except for roofs with a slope of 2:12 or less)

34. Roof access points shall not be over window or door openings.
35. Hip roofs shall have a three foot wide pathway from eave to the ridge.
36. Single-ridge roofs shall have two accesses that are each three foot wide from eave to the ridge.
37. Hips and valleys with panels on both sides shall have an 18 inch clearance from each side to the hip and valley. When panels are located on only one side of the hip or valley, they can be placed directly adjacent to the hip or valley.
38. Ridge – Panels/modules are to be located no higher than three feet below the ridge.
39. Panel Fire Classification – Rooftop mounted photovoltaic systems shall have the fire classification as required by CMC 1505.1 Minimum Class B rated. (CBC 1509.7.2)

SEE EXAMPLES ON NEXT PAGE

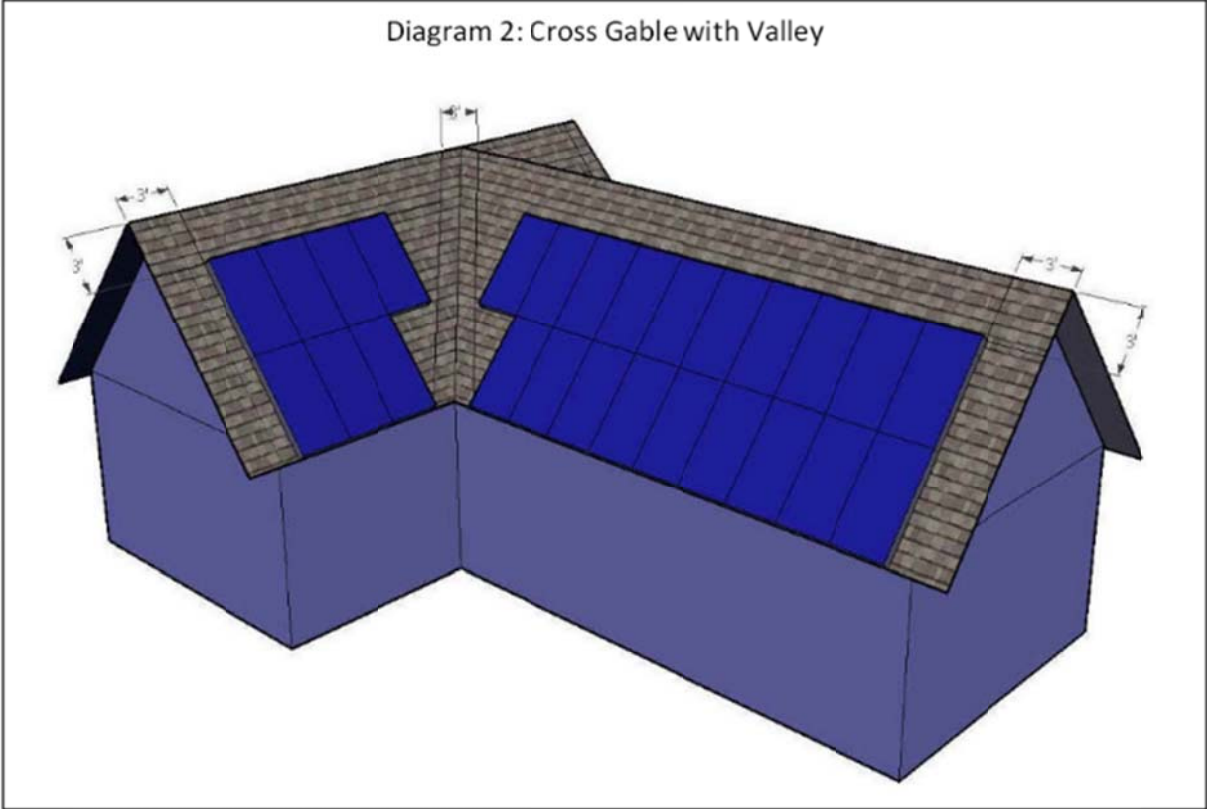
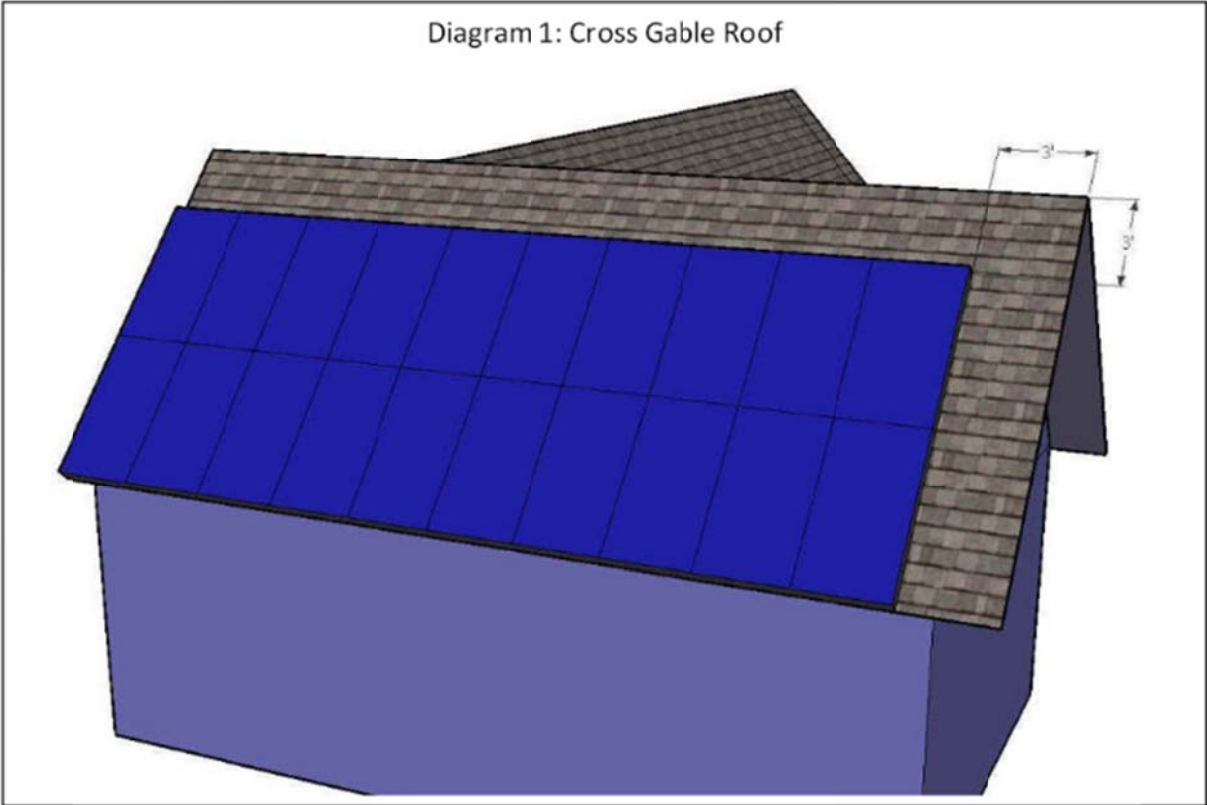
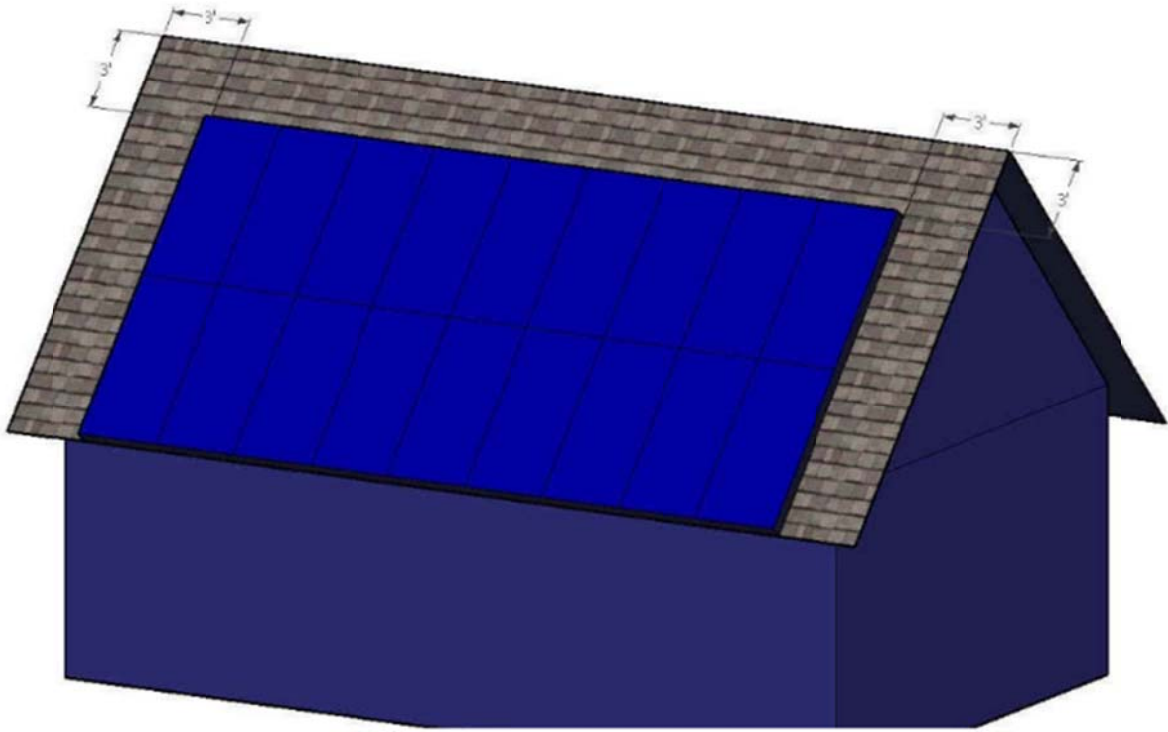
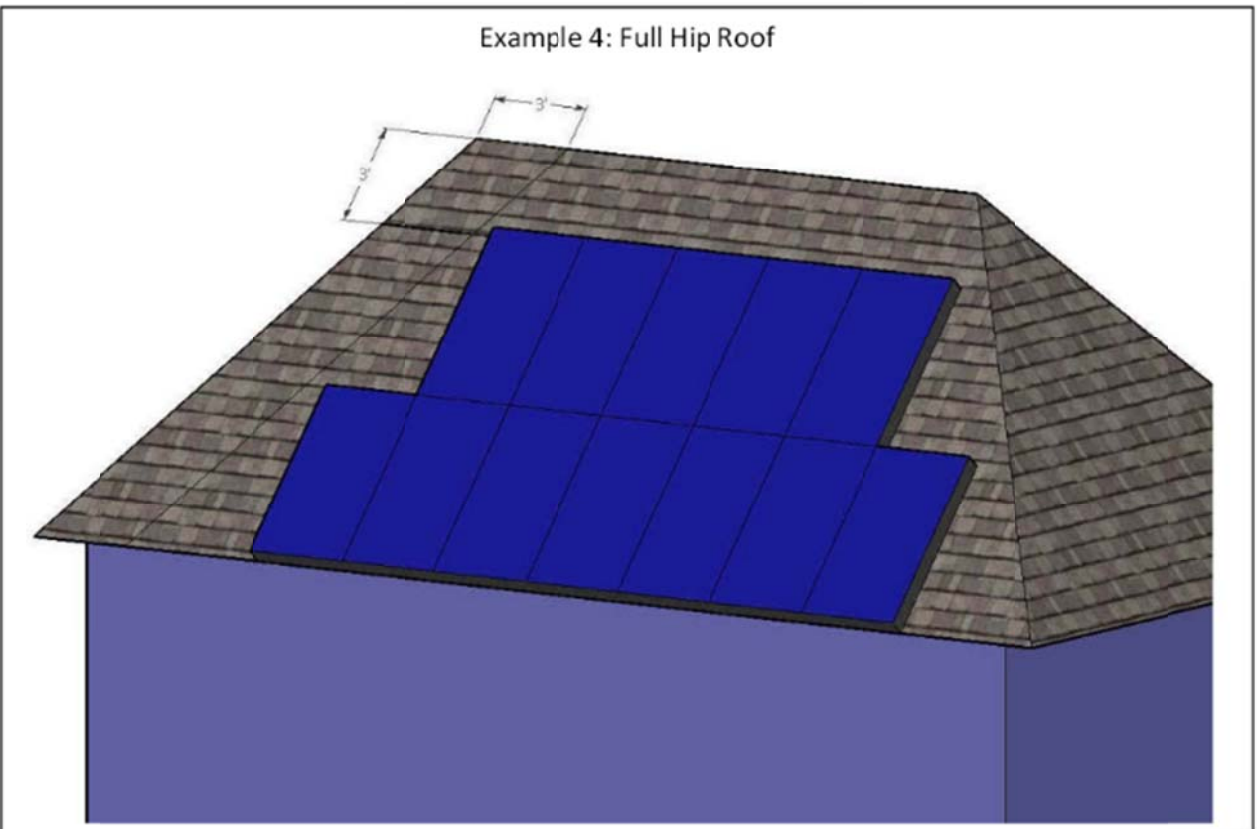


Diagram 3: Full Gable



Example 4: Full Hip Roof



Structural Requirements (required on structural calculations when required by #3 above)

General

1. Show Basis of Design **on the plans**: (CBC 1603)
 - a. Roof live load.
 - b. Wind design data:
 - i) Ultimate wind speed and normal wind speed, mph.
 - ii) Applicable Internal Pressure Coefficient.
 - iii) Components and Cladding pressure, psf.
 - iv) Risk Category
 - v) Wind exposure.
 - c. Earthquake design data:
 - i) Risk Category
 - ii) Seismic Importance Factor
 - iii) Mapped S_s and S_1 .
 - iv) Site class.
 - v) Seismic design category.
 - vi) Basic seismic-force-resisting system(s).
 - vii) Design base shear
 - viii) C_s , R .
 - ix) Analysis procedure used.
2. Codes:
 - a. 2013 CBC and as amended by City Ordinance.
3. Material specifications on the plans:
 - a. Manufactured products: ICC ES report or report by other approving agency based on the 2012 IBC. Submit copy of the ICC ESR.
4. Wood design:
 - a. CBC Chapter 2306 & Section 3403.3 and NDS 2012: Check existing roof rafters/beams due to additional solar panel weights.
 - b. Specify & detail framing connections on the plans.

Wind & Seismic Design

5. Seismic forces per CBC 1613 and ASCE 7-10, chapter 13.
6. Wind design using exposure C shall be based on the following procedures:
 - a. ASCE 7-10 chapters 26-30
 - b. CBC chapter 1609
7. Check additional wind/seismic load per CBC Section 3403.4 Exception. If existing lateral elements meet this exception then existing lateral elements do not have to be upgraded i.e. "permitted to remain unaltered". Check wind uplift loads to determine connection capacity for fasteners to existing or new framing. Provide connection detail specifying the connector type.

Required Inspections

Two site inspections are required:

1. First inspection to include: PV mounting bases, stanchions, roof flashings, rails, roof shingle/tile penetrations, conductor type and sizing, conduit runs, combiner boxes, rough electrical components. Provide a ladder for Building Inspection. Structural calculations (when applicable), building plans and Inspection Card to be on site and available for the Building Inspector. **NO** PV modules to be mounted until all the above components have been inspected and approved.
2. Second/Final inspection to include: Verifying conductor size/conductor type, grounding and bonding components, transfer switches, combiner boxes, through-roof penetrations, panel boards, disconnects and warning labels. Sealants, caulking products need to be listed and approved for the application. Contractor shall have the product cut sheets, caulking and sealant product available for the Building Inspector.