DEVELOPMENT SERVICES DEPARTMENT

Building Safety Division

PHOTOVOLTAIC SYSTEM – 2005 NEC
PLAN CHECK WORKSHEET

(Please indicate Yes, No, or provide the required information)

1.0 - SUPPLIED DIAGRAMS *The following shall be included in the permit package:*

❑ Yes ❑ No (A) A basic site diagram
❑ Yes ❑ No (B) The location of electrical equipment is identified on the plan
❑ Yes ❑ No (C) Structural calculations for other than SFD per Section 6.0(C)
❑ Yes ❑ No (D) The Array Configuration including any existing Rooftop Equipment, Plumbing Vents, Exhaust Vents or Flues.
❑ Yes ❑ No (E) A 3-line diagram

The 3-line diagram shall indicate the following:

❑ Yes ❑ No (F) The Combiner/Junction box
❑ Yes ❑ No (G) Conduit from Array to Photovoltaic (PV) Power Source Disconnect
❑ Yes ❑ No (H) The equipment grounding
❑ Yes ❑ No (I) All disconnects
❑ Yes ❑ No (J) Conduit from disconnect to Inverter
❑ Yes ❑ No (K) The Inverter
❑ Yes ❑ No (L) Conduit from the Inverter - to the Disconnect - to the Panel
❑ Yes ❑ No (M) The System grounding
❑ Yes ❑ No (N) The Point of connection attachment method

2.0 - INVERTER INFORMATION

❑ Yes ❑ No (A) Cut sheets for the Inverter
❑ Yes ❑ No (B) The Inverter is listed for utility interactivity *(see CEC list of eligible inverters)*
_____ (C) Inverter Model Number
_____ (D) Maximum continuous output power at $40^{O}C$ *(from Cutsheet or listing Label)*
_____ (E) Input voltage range of Inverter

3.0 - PV MODULE INFORMATION

❑ Yes ❑ No (A) Cut sheets for the PV modules
❑ Yes ❑ No (B) The modules are listed *(see CEC list of eligible modules)*
_____ (C) Open-circuit voltage (VOC) from the listing label
_____ (D) Maximum permissible system voltage from the listing label
_____ (E) Short-circuit current (ISC) from the listing label
_____ (F) Maximum series fuse rating from the listing label
_____ (G) Maximum power at Standard Test Conditions (P_{mp} on label)
_____ (H) Voltage at V_{mp} from listing label
_____ (I) Current at I_{mp} from listing label

4.0- ARRAY INFORMATION

_____ (A) Number of modules in series

_____ (B) Number of parallel source circuits

_____ (C) Total number of modules

_____ (D) Operating Voltage = (number of modules in series x module voltage at V_{mp})

_____ (E) Operating Current = (number of parallel source circuits x module current at I_{mp})

_____ (F) Maximum system voltage 690.7 = (V_{oc} * 1.13 * number of modules in series)

_____ (G) Short-circuit current 690.8 = (I_{sc} * 1.25 * number of parallel source circuits)

5.0 - WIRING AND OVERCURRENT PROTECTION

❑ Yes ❑ No (A) Wire type is 90°C suitable for wet locations

❑ Yes ❑ No (B) Conductor ampacities are sufficient

❑ Yes ❑ No (C) Provide adjusted ampacities for temperature with calculations

_____ (D) Maximum PV source circuit current (I_{sc}*1.25)

_____ (E) Minimum PV source circuit conductor ampacity (I_{sc} * 1.25 * 1.25)

_____ (F) Minimum PV output circuit conductor ampacity (I_{sc} * 1.25 * 1.25 * number of parallel source circuits)

_____ (G) Minimum inverter output circuit conductor ampacity (inverter output in Watts / minimum operating voltage * 1.25) or continuous output * 1.25

❑ Yes ❑ No (H) Source circuit overcurrent protection is sufficient

❑ Yes ❑ No (I) If the inverter is listed for no back feed current and only two parallel strings are connected to the inverter, then overcurrent protection is not necessary.

❑ Yes ❑ No (J) If the inverter is not listed for any back feed current, does each source circuit have overcurrent protection in compliance with the listed maximum series fuse?

❑ Yes ❑ No (K) Overcurrent protection on Inverter Output Circuit is sufficient

❑ Yes ❑ No (L) Point of connection meets provisions of NEC 690.64

_____ (M) Point of connection panel buss bar rating (120% rule is for Residential ***ONLY***)

6.0 - ROOF INFORMATION *(for rooftop systems on single family dwellings)*

❑ Yes ❑ No (A) Are the conductors from the PV Array run through the house? (If yes, indicate what method will be used to address the protection issues).

_____ (B) Weight of array for rooftop systems. (Lbs. per Sq. Ft. including mounting hardware)

_____ (C) What is the age of the building (roof structure) *(For single family dwellings under 30 years old and the array weight is less than 5lbs/sq. ft., then engineering calcs are unnecessary for roof loading)*

❑ Yes ❑ No (D) If the roof structure is over 30 years old, describe the structural elements:

- ❑ _____Size of rafters (e.g. 2” x 6”)
- ❑ _____Span of rafters (e.g. 14’)
- ❑ _____Spacing of rafters (e.g. 24” o.c.)

_____ (E) Identify roofing type (e.g. comp. shingle, masonry tile, shake, etc.)

❑ Yes ❑ No (F) The detail of PV panel mounting attachment to the roof-framing members is provided?

_____ (G) Identify the method of sealing the roof penetrations (e.g. flashing, sealed with urethane caulk, etc.)

7.0 - GROUND MOUNTING STRUCTURE *(for ground-mounted structures)*

❑ Yes ❑ No	(A) The weight of array is indicated (pounds per square foot – including mounting hardware)
❑ Yes ❑ No	(B) The details of the array supports, framing members, and foundation posts and footings are provided
❑ Yes ❑ No	(C) The information on the mounting structure(s) construction is provided *(If the mounting structure is unfamiliar to the local jurisdiction or is more than six feet above grade, engineering calculations are required)*

8.0 - INSPECTION GUIDELINES FOR ALL PHOTO VOLTAIC SYSTEMS

- Equipment, conduit, and wiring are installed according to approved plans.
- At a minimum a copy of the one-line diagram and the plot plan should be available at the site for the inspector's use during field inspections.
- If any variations exist between the reviewed plans and the site installation, those changes should be noted on those drawings along with any necessary explanation as to why adjustments were made to the plans.
- If substantial changes are found in the field installation, the as-built changes may need to be referred back to plan review to ensure code compliance.

9.0 - FIELD INSPECTION CHECKLIST FOR ELECTRICAL ON-LINE:

- PV module model number matches plans and cut sheets
- PV modules are properly grounded
    - Modules should be grounded with lugs or equipment grounding screws on each module and mounting rails or some equivalent grounding method.
    - Equivalent grounding could be stainless or bi-metallic star washers bonding anodized aluminum module frames to roof-mounted rails and attaching grounding wire to a lug on the rails.
    - Another method is to attach a bonding wire from each module to a lug on the rails with the grounding wire attached to a lug on the rails.
- Check that the wiring is consistent with the callouts on the plans (number of modules)
- Check that the cable and conduit is properly supported
- Where plug connectors are used for module wiring, inspect a sample of the connections to make sure that the connectors are fully engaged.

10.0- STRUCTURAL ATTACHMENT

- The structure is attached according to the plans and directions.
- The plans should have a detail of the structural attachment.
- The field inspector should review the field structural attachment to confirm that it matches the supplied detail.
- The inspector should confirm that the modules are firmly attached to the structure by firmly pulling up on the modules at several locations *(installers can miss structural members with their lag screws or other blind attachments)*

11.0- SIGN INSTALLATION REQUIREMENTS

- ❑ Sign Construction:
  - The signs should be of sufficient durability to withstand the environment involved.
  - For outdoor signs, the sign should be either metal or plastic with engraved or machine printed letters, or electro-photo plating, in a contracting color to the sign background.
  - Plexiglas-covered paper or laminated paper directories are also acceptable provided that the signs are sufficiently protected from the environment involved. The signs or directories shall be attached to the electrical equipment or located adjacent to the identified equipment.
- ❑ Provide a sign identifying DC power system attributes at DC disconnect (690.53 Photovoltaic Power Source).
  <u>This sign must include:</u>
  - Operating current (provided in initial plan review – sum of parallel source circuit operating currents)
  - Operating voltage (provided in initial plan review – sum of series modules operating voltage in source circuit)
  - Maximum system voltage (690.7)
  - Short-circuit current (690.8)
- ❑ Provide a sign identifying AC point of connection (690.54)
  <u>This sign must include:</u>
  - Maximum AC operating current
  - Operating voltage (120, 208, 240 or 480 volts)
- ❑ Check that Inverter matches callouts on one-line diagram
- ❑ Provide a sign identifying switch for alternative power system
  - A sign should be mounted on or next to the PV system disconnecting means with the words to the effect of "PV System Disconnect" in a minimum of 3/8" high letters.
  - If this disconnect is not located at the service disconnect, following the requirement in NEC 690.56 (B): *NEC 690.56 (B) Facilities with Utility Services and PV Systems. Buildings or structures with both utility service and a photovoltaic system shall have a permanent plaque or directory providing the location of the service disconnecting means and the photovoltaic system disconnecting means, if not located at the same location.*
- ❑ **IF** system includes an **Optional Standby System**, provide a sign at the main service disconnect (702.8) notifying the type and location of the optional standby system.
  - The primary purpose for this sign is to identify location of disconnects for a system supplying power to a building in addition to the utility service.