



## Fruit Heights City Residential Solar Photovoltaic (PV) System Plan Review For systems utilizing MICRO-INVERTERS

BUILDING ADDRESS \_\_\_\_\_  
SUBDIVISION \_\_\_\_\_ LOT \_\_\_\_\_  
OWNER'S NAME \_\_\_\_\_  
CONTRACTOR \_\_\_\_\_

This checklist is compiled for plan checking purposes for residential solar photovoltaic (PV) systems utilizing **MICRO-INVERTERS**. The information contained herein is compiled from the *2011 National Electrical Code (NEC)*, *2012 International Residential Code*, manufacture and PV industry standards, and **Fruit Heights City** requirements. This checklist is not intended to indicate any change of any code or ordinance by inference or omission.

This review is not all inclusive and all system components and equipment must be installed per adopted code, city ordinances, and manufacture requirements regardless of whether or not such items or issues have been addressed using this checklist.

### **ITEMS REQUIRING CORRECTION (items marked with an X):**

#### **General**

1. \_\_\_ Provide two complete sets of construction drawings, line diagram(s), and site plan.
2. \_\_\_ Provide two complete sets of manufacture specs and system component information.  
Manufacture specifications are required for the following items: micro-inverters, modules (panels), disconnect switches, any new AC panelboards, and the supporting racking system.

#### **Site Plan**

3. \_\_\_ Site plan must show the location of the home's service panelboard, any sub-panelboard (that is to be backed by the PV system), locations of any disconnects, and layout of the solar PV modules (panels).
4. \_\_\_ Show any detached structure on the property if solar modules (panels) are to be installed thereon and show dimensions from such structure to property lines.

#### **Solar PV Mounting System**

5. \_\_\_ Specify the type of roof covering and note how many layers of such covering.
6. \_\_\_ Indicate what type of rafters the roof is composed of (engineered trusses, dimensional lumber, TJI etc...), and note the size, spans, and spacing of the rafters.
7. \_\_\_ Show that the existing roof rafters can safely handle the new loads of the system. Note: Engineering to meet this requirement *may* not be required if the existing rafters are engineered trusses, the roof only has one layer of asphalt shingles, and the total weight of all racking system with PV modules (panels) installed does not exceed 5 lbs per square foot and there is not more than 60 lbs per solar racking support **(subject to City approval)**.
8. \_\_\_ Provide manufacture info that shows the mounting system is listed for the mounting of PV modules on the roof (for roof mounted systems).
9. \_\_\_ Specify on the plans the spacing of supports per the manufacture specs and show that such system can handle the local wind and snow loads and is designed for such. **Maximum wind load is to be based on 150 mph, ground snow load is to be based on 43 psf, and roof snow load is to be based on 40 psf. (this information differs from city to city)**
10. \_\_\_ Provide information on how all roof penetrations (supports, J-boxes, conduit etc...) are going to be properly flashed. *IRC M2302.2.2.*



11. \_\_\_ Specify on the plans that solar PV modules (panels) cannot be installed over or block any attic vents, plumbing vents, furnace or water heater vents etc.
12. \_\_\_ For a ground-mount racking system, please provide complete plans of the structure indicating that all associated requirements of the code are met (setbacks, square footage of the racking footprint, size/spacing of footings, connectors, snow loads, wind loads etc).

### **Line Diagram**

13. \_\_\_ Specify exactly how many solar PV modules (panels) per AC circuit will be installed (the number of micro inverters per circuit cannot exceed what is noted on the inverter spec sheets).
14. \_\_\_ Specify how many AC circuits are to be installed for the PV system.
15. \_\_\_ Show all PV system components, such as: J-boxes, micro-inverters, panelboards, and disconnects. Indicate where all the components will be located in or on the home.
16. \_\_\_ Indicate the electrical panelboard that the PV system will tie into: A sub-panelboard or the home's electrical service panelboard.
17. \_\_\_ Specify on the diagram the ratings of all breakers or fuses (AC overcurrent protection devices), including existing breakers feeding any panels that are to be backfed by the PV system.
18. \_\_\_ Show all wire sizes, and wire types (including any existing feeder wires that are to be backfed by the PV system).
19. \_\_\_ The wiring system used at the array must be the approved wiring system required per the micro inverter manufacture.
20. \_\_\_ Wires installed outside (even if in conduit) must be listed for wet locations per *NEC* 300.9.
21. \_\_\_ Specify the size and type of all equipment grounding conductors and grounding electrode conductors. (note: transformerless micro-inverters often do not require a grounding electrode conductor, but all types of PV systems will require equipment grounding conductors). *NEC* 690.43 through 690.47.
22. \_\_\_ The AC circuit conductors (wires) must be at least #12 AWG copper (#10 AWG is recommended). Note: wires may need to be increased in sized due to conduit fill or ampacity derations per *NEC* Tables 310.15(B)(3)(a), 310.15(B)(3)(c), and table 310.15(B)(2)(a) where applicable.
23. \_\_\_ The rating of the fuses or breaker for the micro-inverter's AC output circuit must be sized in accordance with the micro-inverter's manufacture spec sheets.
24. \_\_\_ Show conduit types, sizes, and how many conductors will be in each conduit.
25. \_\_\_ Specify locations where conduit and/or cables are to be installed.

### **Grounding and Bonding**

26. \_\_\_ Provide detailed info on the types of connectors and/or devices that will be used for bonding modules, supports, and other metal equipment to the equipment grounding conductor. All devices used for bonding frames of PV modules or other equipment to the grounding system must be listed and identified for the purpose. *NEC* 690.43
27. \_\_\_ Provide info showing that if the metallic mounting structures (rails, supports etc.) for the PV modules are also going to be used for grounding purposes are identified as equipment grounding conductors or shall have identified bonding jumpers connected between each separate metallic section and be bonded to the grounding system. *NEC* 690.43(C).
28. \_\_\_ Lugs for bonding aluminum rails and modules must be listed for outdoor use and also for bonding PV rails and modules. Burndy CL50.1TN lugs, ILSCO GBL4 DBT lugs, and WEEBL 6.7 lug and clip assemblies are all ok for this purpose if installed per manufacture requirements. Must provide info on any other types of connectors if used.
29. \_\_\_ Indicate on the plans how the equipment grounding conductor(s) will be installed and protected from damage. If grounding conductors are exposed then a minimum of #6 copper conductors must installed. All grounding conductors must be protected from damage or be installed in conduit. *NEC* 690.46, 250.120(C), and 250.64(B)



30. \_\_\_ Please note on the plans that equipment grounding conductors shall be ran with the associated circuit conductors when those conductors leave the vicinity of the PV array, as required per *NEC* 690.43(F).
31. \_\_\_ Please specify on the plans the type of grounding electrode(s) used for grounding the existing electrical service for the home and specify the size of the existing grounding electrode conductor (wire) that connects to it. If the existing grounding electrode system is not adequate, please specify that a new system will be installed and specify the type of electrode to be used (concrete encased, ground rods, metal water pipe and ground rod, etc). See *NEC* 250.50 through 250.66.

#### **PV Modules (Panels)**

32. \_\_\_ Provide manufacture specifications for the solar PV modules (panels).
33. \_\_\_ Manufacture specs must show the PV modules are UL 1703 listed. *NEC* 690.4(D)
34. \_\_\_ Solar PV Module spec sheets must show the **STC** rated open circuit voltage (Voc) and short circuit current (Isc) of the modules (panels).

#### **Inverter(s)**

35. \_\_\_ Provide manufacture specifications for the inverter(s).
36. \_\_\_ Manufacture specs must show that inverter(s) is/are UL 1741 listed. *NEC* 690.4(D)
37. \_\_\_ For utility interactive inverters, specs must show that the inverter is listed as such. *NEC* 690.4(D) and 690.60- 690.61
38. \_\_\_ Specs must show whether or not the micro-inverters are the transformerless type.
39. \_\_\_ Specs must show the maximum amount of micro-inverters that can be connected to each AC circuit.

#### **Point of Interconnection Requirements (Rules for backfed panelboards)**

40. \_\_\_ Provide photos of the service panelboard and any backfed sub-panelboards, and provide photos of all panelboard's interior labels. Photos must be with the panelboard's front covers open and show the ratings of all breakers therein. The photos of labels must also clearly show the rating of the panelboard. These photos are essential to determining if the requirements of *NEC* 705.12(A) or 705.12(D) are going to be met.
41. \_\_\_ If a service panelboard upgrade is to be performed, please specify the rating, manufacture, and model number of the panelboard. Please also provide manufacture spec sheets on such panel.
42. \_\_\_ If the solar PV system is to backfeed an AC breaker on the supply side (service side) of the home's main service breaker(s), then the rating of the backfed AC breaker cannot exceed what is allowed to be plugged into the breaker slot (noted on the panelboard label), and also cannot exceed the rating of the service conductors (wires) for the home. *NEC* 705.12(A).
43. \_\_\_ If the solar PV system is to backfeed an AC breaker on the load side (the home's side of the main service breaker(s)), then the sum of the ratings of the main breaker protecting the panelboard and the rating of the solar PV breaker cannot exceed 120% of the rating of the panelboard. To meet this requirement, the PV breaker must also be located at the very end of the panelboard's busbars (opposite of where the panelboard is fed from the utility source of power). This must be specified on the plans. *NEC* 705.12(D)(2) and (D)(7). **Note:** [This calculation applies to every panelboard that is to be backfed by the PV system.](#)
44. \_\_\_ If feeder taps are to be performed in order to connect the PV system to the electrical system of the home, then the tap rules of *NEC* 240.21(B) must be followed. In addition, the sum of the rating of the main breaker (protecting the existing feeder conductors) and the rating of the PV breaker (or fuses) cannot exceed 120% of the ampacity rating of the feeder conductors being tapped, *NEC* 705.12(D)(2).
45. \_\_\_ Factory installed conductors (wires) within a service panelboard cannot be tapped unless such taps are to be field evaluated and approved by a listed testing agency (such as UL, Intertek, etc...). This is in accordance with the listing of the panelboard. *NEC* 110.3(B)

#### **General Equipment Requirements**

46. \_\_\_ Provide a note on the plans stating that all wiring must be properly supported by devices or mechanical means designed and listed for such use, and for roof-mounted systems, wiring must



be permanently and completely held off of the roof surface. See *NEC* 110.2, 110.3(A), 110.3(B), and 300.4.

- 47. \_\_\_ For a ground-mount system, please specify on the plans exactly how the wiring at the array is going to be protected so the wiring is not readily accessible. Typically, this is accomplished by providing a lockable fence immediately around the array, or to enclose the back sides of the solar modules (panels) so there is not any readily accessible wiring. See *NEC* 690.31(A) (see also the same section in the 2014 *NEC* for additional information).
- 48. \_\_\_ Provide info showing that all equipment is listed and rated for wet locations and is listed as “rain tight” if installed outdoors. See *NEC* table 110.28.

**Signage (specify the following signage requirements on the plans)**

- 49. \_\_\_ A sign is required at the service panel stating that the home has a PV system as an additional power source. *NEC* 705.10.
- 50. \_\_\_ A sign is required at the home’s service box giving the location of the main PV system disconnect (this is typically the first AC breaker that is backfed by the PV system) if the disconnect is not located next to the utility service panel. *NEC* 690.4(H) and *NEC* 705.10.
- 51. \_\_\_ A sign is required at the main PV system disconnect labeling it as such. *NEC* 690.14(C)(2).
- 52. \_\_\_ A sign is required at any breaker or AC panelboard which is backfed by the PV system. Such sign must note the rated AC output current (amps) and AC voltage of the inverter(s). *NEC* 690.54.
- 53. \_\_\_ If the 120% rules of *NEC* 705.12 (D)(2) and (D)(7) are utilized, then please specify that a sign is required at the PV backfed breaker location noting the following: “Warning, Inverter Output Connection, Do Not Relocate This Overcurrent Device.” Note: See also item #43 in this review for more info.

**Additional items to be corrected on the plans:**

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