Info on updated checklist (updated 7-1-2016):

- Items highlighted in yellow indicates a new requirement per newly adopted codes.
- Wording that is red in color indicates the requirement could be different from one AHJ to another.
- Wording that is brown in color indicates a newly added requirement to this checklist but it's not a new code requirement.

Farmington 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-IVERTERS**. The information contained herein is compiled from the *2014 National Electrical Code (NEC), 2015 International Residential Code*, manufacture and PV industry standards, and Farmington 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 backfed 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 ___ mph, ground snow load is to be based on ___ psf, and roof snow load is to be based on ___ 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* R903.2.
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). *IRC* R324.6.

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. ___ Trunk cables located outdoors for a micro inverter system are required to be either TC-ER or USE-2 cable and must be secured no more than 6' oc, per *NEC* 690.31(D).
20. ___ The wiring system used at the array must be the approved wiring system required per the micro inverter manufacture.
21. ___ Wires installed outside (even if in conduit) must be listed for wet locations per *NEC* 300.9.
22. ___ 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.
23. ___ 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.
24. ___ 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.
25. ___ Show conduit types, sizes, and how many conductors will be in each conduit.
26. ___ Specify locations where conduit and/or cables are to be installed.

Grounding and Bonding

27. ___ 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
28. ___ 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).

29. ___ If the PV racking system is equipped with integrated grounding/bonding, please provide manufacture specification sheets showing how integrated grounding/bonding is provided and show that such racking system is listed for such and is also listed in accordance with UL2703.
30. ___ 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.
31. ___ 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)
32. ___ 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).
33. ___ 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)

34. ___ Provide manufacture specifications for the solar PV modules (panels).
35. ___ Manufacture specs must show the PV modules are UL 1703 listed. *NEC* 690.4(B) and *IRC* R324.3.1.
36. ___ 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)

37. ___ Provide manufacture specifications for the inverter(s).
38. ___ Manufacture specs must show that inverter(s) is/are UL 1741 listed. *NEC* 690.4(B) and *IRC* R324.3.
39. ___ For utility interactive inverters, specs must show that the inverter is listed as such. *NEC* 690.4(B), 690.60, 690.61, and *IRC* 324.3.
40. ___ Specs must show whether or not the micro-inverters are the transformerless type.
41. ___ 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)

42. ___ 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.
43. ___ 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 service panel.
44. ___ 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).
45. ___ Factory installed conductors (wires) or bubars within a service panelboard cannot be tapped unless such taps are allowed by the service panel manufacture (documentation from the service equipment manufacture is required to prove this), or if the service equipment is to be field

evaluated and approved by a listed testing agency (such as UL, Intertek, ect). The connections must be per the listing of the panelboard. *NEC* 110.3(B).

46. ___ If a meter adapter is going to be used for the connection of the PV system to the supply-side of the service disconnect(s), please provide manufacture specification sheets and installation instructions for such meter adapter. Documentation must also be provided to show that the meter adapter is listed in accordance with UL 414. *NEC* 110.3.
47. ___ If the solar PV system is to backfeed electrical equipment on the load side (the home's side of the main service breaker(s)), then the following must be addressed:

    For protection of feeder wires, one of the following must be met:

    a. If the PV system will be connected to the end of feeder wires opposite to the feeder wire's main breaker, then the feeder wires must have an ampacity not less than the main breaker for the feeders or 125% of the inverter(s) AC output current (amps), whichever is larger. See *NEC* 705.12(D)(2)(1).
    b. If the PV system will not be connected to the end of feeder wires opposite to the feeder wire's main breaker, then the feeder wires must have an ampacity not less than 125% of the AC output current (amps) of the inverter plus the rating of the main breaker protecting the feeder wires. See *NEC* 705.12(D)(2)(1)(a).
    c. If the PV system will not be connected to the end of feeder wires opposite to the feeder wire's main breaker, then an overcurrent protection device (fuses or breaker) which is/are rated not less than the ampacity of the feeder wires must be provided on the load side of the inverter's AC output connection to the feeders. See *NEC* 705.12(D)(2)(1)(b).

    For protection of panelboard's busbars, one of the following must be met:

    a. The busbars must be rated not less than the main breaker (or fuses) protecting the panelboard plus 125% of the AC output current (amps) of the inverter(s). See *NEC* 705.12(D)(3)(a).
    b. If the inverter's AC breaker is located at the very end of the panelboard's busbars (at the opposite end of where the panel is fed from for the utility source), then the rating of the main breaker (or fuses) protecting the panelboard plus 125% of the inverter's AC output current (amps) cannot exceed 120% of the rating of the panelboard's busbars. See *NEC* 705.12(D)(3)(b). If this *NEC code* item is to be 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."
    c. The busbars in the panelboard must be rated not less than the sum of the ratings of all breakers in the panelboard, including the solar PV breaker but not counting the main breaker (or fuses) protecting the panelboard. If this *NEC code* item is to be used for the interconnection of the PV system, there must also be a sign located at the panelboard noting the following: "WARNING: THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES, EXCLUDING MAIN OVERCURRENT DEVICE, SHALL NOT EXCEED AMPACITY OF BUSBAR." See *NEC* 705.12(D)(3)(c).
    d. PV connections to multiple-ampacity busbars or to a center-fed panelboard is permitted as long as busbar loading calculations are provided to show that the ampacity of the panelboard's busbars will not be exceeded. See *NEC* 705.12(D)(3)(d). Note: please be aware that the noted busbar loading calculations are supposed to be provided under "engineering supervision," as noted per *NEC* 705.12(D)(3)(d). Whether or not such calculations are required to be performed by a licensed engineer is up to the AHJ (*NEC* 90.4).
48. ___ 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. See also the above requirements for connections on the load side of the service disconnect(s).

General Equipment Requirements

49. ___ 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.
50. ___ 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). (this item is subject to AHJ approval)
51. ___ 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)

52. ___ All signage is required to be permanently affixed to equipment or wiring method and be sufficiently durable to withstand the environment they are installed. *NEC* 110.21(B).
53. ___ Signage is not permitted to be hand written (unless it's necessary due to the information on the sign is subject to change). *NEC* 110.21(B).
54. ___ A sign is required at the service panel stating that the home has a PV system as an additional power source. *NEC* 705.10.
55. ___ 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(D) and *NEC* 705.10.
56. ___ A sign is required at the main PV system disconnect labeling it as such. *NEC* 690.13(B).
57. ___ 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.
58. ___ There must be a sign located at the service equipment which notes the following: "PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN." The sign must be reflective, with all letters capitalized, and letters are at least 3/8" in height. Wording must also be white on a red background. Please specify this information on the plans. See *NEC* 690.56(C).
59. ___ A sign is required to be provided adjacent to the "rapid shutdown" disconnect(s) labelling it/them as such (*NEC* 690.12 and 690.56(C)). Please specify this on the plans. Note: For a micro inverter system, the "rapid shutdown" disconnect is/are usually the electrical service disconnect(s) located in the service equipment.

Additional items to be corrected on the plans:

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