Info on updated checklist (updated 8-8-2021):

- Items highlighted in yellow indicates a new requirement per most recently 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 is not a new code requirement.

_____ 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 *2020 National Electrical Code (NEC)*, *2015 International Residential Code (as amended by the State of Utah)*, manufacturer and PV industry standards, and _____ 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 manufacturer 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 manufacturer specs and system component information. Manufacturer specifications are required for the following items: micro-inverters, solar 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.
5. ___ If there will be new underground conduit installed for the system, please show on the site plan the location where such conduit will be installed and also specify the burial depth of such conduit, in accordance with NEC 300.5.
6. ___Show on the site plan the location of the rapid shutdown disconnect (or location of any disconnect or breaker that will be acting as the rapid shutdown disconnect for the solar PV system). The rapid shutdown disconnect must be readily accessible on the outside of the home. *NEC* 690.12(C). Note: since the micro inverters must be listed as utility interactive, they shut down within two seconds upon loss of connection with a utility source of power. Therefore, any AC disconnect or breaker that isolates the micro inverters from the utility grid (or another source

of power, such as an energy storage system), and such disconnect or breaker is readily accessible and located outside the home or building, could be considered as the rapid shutdown disconnect for the PV system.

Solar PV Mounting System

7. ___ Specify the type of roof covering and note how many layers of such covering.
8. ___ 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.
9. ___ 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).
10. ___ Provide manufacturer info that shows the mounting system is listed for the mounting of PV modules on the roof (for roof mounted systems). PV racking must be listed per **UL 2703**.
11. ___ Specify on the plans the spacing of supports per the manufacturer 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)**
12. ___ Provide information on how all roof penetrations (supports, J-boxes, conduit etc…) are going to be properly flashed. *IRC* R903.2.
13. ___ 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.
14. ___ 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). The documents must also show how the racking is to be constructed. *IRC* R324.6. The ground-mount racking system must also be shown to be listed per **UL 2703**.
15. ___ For a ballasted roof racking system, please provide documentation and engineering calculations from the ballast racking manufacturer to show that such system can handle the local wind loads (___ mph) and has also been evaluated to be able to withstand seismic loads (for a seismic zone D). Such documentation must also specify how many ballast blocks are required for each section of the array in order to withstand such loads. The racking system must also be shown to be listed per **UL 2703**.

Line Diagram

16. ___ Specify exactly how many solar PV modules (panels) there will be per AC circuit (the number of micro inverters per circuit cannot exceed what is noted on the inverter spec sheets).
17. ___ Specify how many AC circuits (ie. how many AC strings) are to be installed for the PV system.
18. ___ Show all PV system and electrical components, such as: J-boxes, micro-inverters, panelboards, and disconnects. Indicate where all the components will be located in or on the home (or on the property).
19. ___ Indicate the electrical panelboard that the PV system will tie into: A sub-panelboard or the home's electrical service panelboard.
20. ___ Specify on the diagram the ratings of all breakers or fuses (AC overcurrent protection devices), including existing breakers feeding any panelboards that are to be backfed by the PV system.
21. ___ Show all wire sizes, and wire types (including any existing feeder wires that are to be backfed by the PV system).
22. ___ Manufacturer AC trunk cables located outdoors for a micro inverter system are required to be listed and identified for the application and must be secured no more than 6' oc. *NEC* 690.31(C)(3).

23. ___ Wires installed outside (even if in conduit) must be listed for wet locations per *NEC* 300.9.
24. ___ Specify the size and type of all equipment grounding conductors for each section of wiring on the diagram and note size and type of any grounding electrode conductors. (note: Most inverters are NOT solidly grounded and are referred to as being "functionally grounded" inverters. Such inverters typically do not require a grounding electrode conductor, but all types of PV systems will require equipment grounding conductors ran with circuit wiring). *NEC* 690.43 through 690.47.
25. ___ The AC circuit conductors (wires) must be at least #12 AWG copper (#10 AWG is recommended) or as otherwise required per the solar module (panel) manufacturer. Note: wires may need to be increased in sized due to conduit fill or ampacity derations per *NEC* Table 310.15(C)(1), Table 310.15(B)(1), and 310.15(B)(2) where applicable. (note: if conduit is ran above the roof, the requirements of *NEC* 310.15(B)(2) will not apply as long as the conduit is held at least 7/8" or more above the roof's surface).
26. ___ 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. *NEC* 110.3(B)
27. ___ If an AC combiner panelboard is to be installed (which is dedicated only for the PV system AC breakers and monitoring), the AC combiner panelboard itself and the conductors (wires) between an AC combiner panel and the point of interconnection breaker, must have an ampacity not less than the sum of the rated AC output current (amps) of all micro inverters for the system multiplied by 125%. *NEC* 690.8(B) and 690.9(B).
28. ___ Show conduit types, sizes, and how many conductors will be in each conduit.
29. ___ Specify locations where conduit and/or cables are to be installed.

Grounding and Bonding

30. ___ Provide detailed info on the types of connectors and/or devices that will be used for bonding solar 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 and 110.3(B).
31. ___ If the PV racking system is equipped with integrated grounding/bonding, please provide manufacturer 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 **UL 2703**.
32. ___ 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 lug and clip assemblies are all ok for this purpose if installed per manufacturer requirements. Must provide info on any other types of connectors if used. *NEC* 110.3(B)
33. ___ 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* 250.120(C)
34. ___ 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(C). If the array circuit conductors enter conduit or enclosures, the equipment grounding conductor must also be installed in such conduit or enclosures. *NEC* 300.3(B) and 690.43(C).
35. ___ Please specify on the plans the type of grounding electrode(s) used for grounding the existing electrical equipment for the home (or detached structure) 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* 690.47 and 250.50 through 250.66.

PV Modules (Panels)

36. ___ Provide manufacturer specifications for the solar PV modules (panels).

37. ___ Manufacturer specs must show the PV modules are **UL 1703 or 61730** listed. *NEC* 690.4(B) and *IRC* R324.3.1.
38. ___ 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)

39. ___ Provide manufacturer specifications for the inverter(s).
40. ___ Manufacture specs must show that inverter(s) is/are UL 1741 listed. *NEC* 690.4(B) and *IRC* R324.3.
41. ___ For utility interactive inverters, specs must show that the inverter is listed as such. *NEC* 690.4(B), 705.40, and *IRC* 324.3.
42. ___ Specs must show the maximum number of micro-inverters that can be connected to each AC circuit.

Electrical Service Upgrades

43. ___ **IF** the home's service panel will be upgraded, please clearly specify on the line diagram the exact model number of the new service panel you are going to install and provide manufacturer specification sheets for such service panelboard. Such information is required in order to verify compliance with the requirements of *NEC* 705.11 or 705.12 for the interconnection of the PV system. Also, the authority having jurisdiction (AHJ) has the authority to determine if the existing service equipment for the home is required to be upgraded. *NEC* 110.3(A).

Point of Interconnection Requirements (Rules for backfed panelboards)

44. ___ 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* 705.11 or 705.12 are going to be met.
45. ___ 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) (in existing service equipment), then the rating of the backfed AC breaker cannot exceed what is allowed to be plugged into the breaker slot (noted on the service panelboard's label), and also cannot exceed the rating of the service conductors (wires) for the home. *NEC* 705.11(A) and 110.3(B).
46. ___ Factory installed conductors (wires) or busbars within a service panelboard cannot be tapped unless such taps are allowed by the service panel manufacturer (documentation from the service equipment manufacturer 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) and 705.11(D).
47. ___ If taps will be made to non-factory-installed conductors between the utility meter base and service disconnect for the building (ie. supply-side taps), then each of the following must be specified on the plans:
    a. Please specify that the fused PV disconnect switch (which protects the tap wires) must be listed and labeled as "suitable for use as service equipment." This is required per *NEC* 705.11, 230.82(6), and 230.66.
    b. Since the fused PV disconnect is to be considered as a service disconnect, please also specify that there must be a main bonding jumper within such enclosure and specify the size and type of such main bonding jumper. This is in accordance with *NEC* 250.24 and 250.25.
    c. The ground wire within the conduit between the PV disconnect switch and the main service equipment will be considered as the grounding electrode conductor (GEC) for the PV disconnect service equipment (see *NEC* 250.24(D)). As such, please note on the plans that the GEC must be bonded to each end of the metal conduit, as required per *NEC* 250.64(E).

d. The supply-side tap conductors (wires) leading from the fused disconnect to the point of taps at the service cannot be less than #6 AWG copper (or #4 AWG aluminum) and such tap conductors must be installed per *NEC* 230.30. See *NEC* 705.11(B). The conductors also cannot be smaller than what is required per *NEC* 705.28 (i.e. which is usually 125% multiplied by the output ampacity rating of the inverter(s)).
e. The disconnect must be located on either the outside of the home or the first readily accessible location inside the home where the tap conductors first enter the building (unless item 705.11(C)(1) is met). See *NEC* 705.11(C).

48. ___ 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.
49. ___ 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:

(note: instead of using 125% of the output current rating of the inverter(s), if there is a PCS system (Power Control System) then it is permissible to use 125% of the ampacity output setting of the PCS equipment instead of the amp rating of the inverter(s) – See *NEC* 705.12):

For protection of feeder wires, ONE of the following items ('a' through 'd' shown below) 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 first sentence of *NEC* 705.12(B)(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(B)(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 more 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(B)(1)(b).
d. If the PV backfed breaker will be connected to busbars which have feeder wires connected to **feed-through lugs** on the same busbars as the PV breaker, then either of the plan review requirements per items 50-b or 50-c (shown above in this checklist) must be complied with for protecting the feeder wires that are connected to the feed-through lugs (see *NEC* 705.12(B)(3)(6)).

For protection of panelboard's busbars, ONE of the following items ('e' through 'h' shown below) must be met:

e. 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(B)(3)(1).
f. 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(B)(3)(2). 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."

g. 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(B)(3)(3).

h. PV connections to multiple-ampacity busbars or to a center-fed panelboard is permitted as long as the PV backfed breaker is in either the very top or the very bottom slot of the center-fed panelboard, AND 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(B)(3)(4). The rating of the PV backfed breaker cannot exceed the rating of the breaker slot that it will be plugged into (as noted per the panelboard's label).

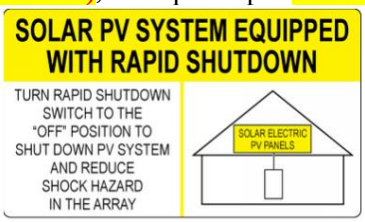
50. ___ If feeder taps are to be performed in order to connect the PV system to the electrical system of the home, then the tap rules of *NEC* 240.21(B) must be followed (in addition to those found under *NEC* 705.12(B)(1)). See also the above requirements for connections on the load side of the service disconnect(s).
51. ___If a Power Control System (PCS) is to be used for this project, documentation must be provided to show that the equipment is listed as such and the requirements of *NEC* 705.13 must be addressed.

General Equipment and Wiring Requirements

52. ___ PV equipment and disconnecting means are not permitted to be installed in a bathroom. *NEC* 690.4(E).
53. ___Where a disconnect switch of equipment (operating more than 30 volts) is located where readily accessible to unqualified persons, any enclosure door or hinged cover that exposes live parts when open must be locked or require a tool for opening the disconnect. *NEC* 690.15(A) and 690.13(A).
54. ___ 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.
55. ___Provide a note on the plans stating that any wiring above the roof not kept directly under solar modules must be installed in conduit (or enclosures) for protection and such conduit or enclosures (if metal) must be connected to the equipment grounding conductor of the system. *NEC* 300.4, 250.96, and 690.31(C)(3).
56. ___ 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 (a fence around the entire property will not count for this), or to enclose the back sides of the solar modules (panels) so there is not any readily accessible wiring (such as using metal mesh with smooth edges and opening not larger than ½", for example). See NEC 690.31(A). The plans must be very specific on the method of protection and how the equipment or materials for such protection will be installed (this item is subject to AHJ approval and interpretation on what constitutes wiring being "guarded")
57. ___ 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)

58. ___ 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).
59. ___ 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).
60. ___ A sign is required at the service panel stating that the home has a PV system as an additional power source. *NEC* 705.10.
61. ___ 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.
62. ___ The following sign (or one similar) with the exact wording shown and with the wording on yellow background, must be provided on the outside of the service panelboard (or other approved location), as required per *NEC* 690.56(C):



63. ___ A sign is required at the home's service equipment giving the location of the rapid shutdown disconnect if the disconnect is not located next to the utility service panel. *NEC* 690.56(C) and *NEC* 705.10.
64. If the home or building has an existing solar PV system, and the existing PV system has a different type of rapid shutdown system (ie. not module-level shutdown), or no rapid shutdown system at all, then a sign must be provided on the service equipment which shows a detailed layout of the both the new and existing solar PV array on the building, and such sign must highlight which portion of the array has a different or no rapid shutdown system provided (ie. the sign must show which portion of the array will remain energized even after rapid shutdown is initiated). *NEC* 690.56(C)(1).
65. ___ A sign is required to be provided adjacent to the disconnect(s) or breaker(s) that activate rapid shutdown labelling it/them as the "Rapid Shutdown Switch for Solar PV System" (*NEC* 690.55(C)(2)). Please specify this on the plans.

Additional items to be corrected on the plans:

_____
_____
_____
_____
_____
_____
_____
_____