Solar Code Official Inspection Guide

A grid-tied, or utility-interactive, PV system utilizes sunlight to generate electrical power, which is often used directly on-site and, at times, fed into the utility's grid. To store power for later use, some utility-interactive systems have an integrated battery back-up feature. A standard utility-interactive PV systems consists of a Solar PV Array (an assembly of solar modules), inverter, combiner/junction box, DC disconnect, AC disconnect, and a Net-Meter. A battery back-up utility-interactive system will have Batteries, Charge Controller, and DC overcurrent protection as additional components. This guide provides the basic information and code citations to inspect a solar PV installation. For more information on solar in Utah please visit: http://www.solarsimplified.org/. For a free on-line solar code official training from the U.S. Department of Energy please visit: https://www.nterlearning.org/web/guest/course-details?cid=402 (CEUs available).

Basic System

- PV Module – The device that generates the DC Power by utilizing sunlight. It consists of an assembly of photovoltaic cells sealed behind an anti-reflective coating, usually within a type of a frame. (The term "Module" is often used interchangeably with "Panel".)
    - Types of Modules
        - Monocrystalline
        - Polycrystalline
        - Thin-Film
        - Shingle Modules

- Inverter – The Instrument that converts the DC (Direct Current) electricity generated by the solar modules into AC (Alternating Current) electricity. Inverters can be used for grid-tied systems, which integrate into a utility's grid, or with stand-alone, off-grid systems. Known as the "brain" of a system, inverters have many key features which are continually improving as technology advances. The features, which can vary significantly due to the different types of Inverters, range from high efficiency power conversion, high surge capacity, and frequency/harmonic distortion regulation to battery charging capability, remote control operation, load transfer switch capability, system monitoring and analysis and more.
    - Central Inverter – takes the combined DC electricity from *numerous* pv modules and then converts it into AC electricity. Modules are connected together in what is called a 'series' or 'parallel' string.
    - Micro-Inverter – converts DC electricity from *a single* pv module to AC electricity which is combined with electricity converted by other micro-inverters and then fed into the electrical grid. Micro-inverters are usually installed on or very near the module it's converting power for. While an entire array can have its power output significantly reduced by even minimal shading, from trees, debris or snow, on just a single solar

module an array, utilizing micro-inverters, isolates such issues to the module, thereby, maximizing power output of the array.

- Racking – The mounting system on which the system components are fastened.
- Electrical Wiring
- Combiner/Junction Box – Brings multiple currents of electricity together.
- DC & AC Disconnects - To remove the electrical generation from the grid in case of an emergency or power outage.
- Net Meter – A meter that measures the electricity produced by the PV system that is fed into the utility grid.
- Batteries – If the system will be equipped with a backup or will be off-grid.
- Charge Controller – Controls and regulates the charging of the batteries.

Mounting of the Solar Array. (Roof, Ground, Pole)

- Pitch roof installation.
  - ♦ Mounting is installed or attached to approved truss or structural member.
  - ♦ Roof flashing is installed correctly as to not cause water leak.
  - ♦ Racking rails are securely fastened to roof mounts.
  - ♦ Solar modules securely fastened to racking rails.
- Ballast Roof installation.
  - ♦ Mounting is installed or attached with proper amount of ballast blocks.
  - ♦ If penetrations inspect for correct installation.
  - ♦ Racking is securely fastened to itself.
  - ♦ Solar modules securely fastened to racking.
- Ground mount install.
  - ♦ Pipe or posts are installed in proper sized footing and or foundation.
  - ♦ Pipe or posts are installed with proper sized pipe. (Schedule 80 or 40)
  - ♦ Racking rails are securely fastened to pipe.
  - ♦ Solar modules securely fastened to racking rails.
- Pole Mount install.
  - ♦ Pipe or pole installed in proper sized footing and or foundation.
  - ♦ Pipe or pole is installed using the proper size. (schedule 80 or 40)
  - ♦ Solar mounting is attached to pole as per manufacturer specs.
  - ♦ Solar modules securely fastened to mounting frame.

Wiring of the Solar Array

- Inspect all DC wires have been sized according to NEC 690.8.
- Inspect that DC overcurrent protection is in place according to NEC 690.9
- Inspect that DC disconnecting means are in accordance with NEC 690.17
- Inspect that all DC conductors are in protected raceways NEC 690.31

- Inspect that the solar system is grounded according to NEC 690.41 through 690.50.
- Inspect that all labels are installed on equipment according to NEC 690.51 through 690.56
- Inspect visually that all wires are protected from harm and secured.

Installation of Inverters

- Inspect that inverters are in there NEMA rated locations.
- Inspect that all inverters are installed in accordance with NEC 110.26
- Inspect that the mounting location is structural fit for the Inverters.

Installation of Solar Modules

- Inspect that the Modules are securely fastened to the Racking.
- Inspect that the Modules are Grounded to the racking or directly to the Grounding conductor.
- Visually inspect the installation for straight lines, flush with each other and if there might be any shading issues.

Interconnection to the utility

- Inspect that the proper Overcurrent protection device is installed.
- Inspect that the bus rating on the load center is not exceeded and is accordance to NEC 705.12.
- Inspect that the load center is labeled according to NEC 705.12 (D) (7)

Batteries

- Installation of batteries refer to the NEC 690.71 and 480

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