Simplified Solar Permitting Guidelines

Improving Permit Review and Inspection for Small Solar Systems

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SIMPLIFIED PV PERMIT GUIDELINES

- The information in these guidelines are intended to provide a format whereby local jurisdictions and contractors can permit simple PV system installations where only a basic review is necessary.

- It is likely that most residential and some small commercial PV systems will comply with these simple criteria that address the requirements for PV systems in the building, electrical, and fire codes.
Guideline Contents

1. **Eligibility List** – Defines the size, electrical, structural, and fire safety requirements for solar installations to qualify for simplified permitting.

2. **Structural Review** – Enable applicants to "fill in the blanks" to explain the structural details of a rooftop solar PV system.

3. **Electrical Review** – Enable applicants to "fill in the blanks" to explain the electrical configuration of a solar PV system.

CURRENT LAWS, REGS & CODES

This Guideline is not intended to create, explicitly or implicitly, any new requirements.

- NEC Article 690, 705, and chapters 1-4
- IRC R331, R902, R905, R908
- IBC 1505, 1509, 1511
- IFC 605.11
- ASCE 7-10, 7-16

Purposes of Simplified Permitting

- A simplified, expedited permit process for small solar PV systems simplifies and consolidates the structural, electrical and fire review of the PV system
- It can eliminate the need for detailed engineering studies and often avoids unnecessary delays
- It is not the intent of an expedited process to circumvent the engineering process
- It is to recognize the similarities among these smaller systems and establish guidelines to determine when a PV project is within the boundaries of typical, well-engineered systems that are clearly compliant with electrical and building codes.

SIMPLIFIED PV PERMIT GUIDELINES

Step 1: Gather required information for permit:
1. Permit application required by the local jurisdiction. Permit applications normally include information about the project scope, project location, and the installer.
2. Site plan showing location of major components on the property. This drawing need not be exactly to scale, but it should represent relative location of components at site (see supplied example site plan). PV arrays in compliance with IRC fire setback requirements need no separate fire service review (with Fire Service MOU).
SIMPLIFIED PV PERMIT GUIDELINES

Gather required information for permit (cont.):

3. Electrical worksheets showing PV array configuration, wiring system, overcurrent protection, inverter, disconnects, required signs, and ac connection to building (see supplied standard electrical diagram).

4. Specification sheets and installation manuals (if available) for all major PV system components such as, PV modules, dc-to-dc converters, inverters, and mounting systems.

PV+ESS Permitting Guidelines

Step 1: Gather Required Information for Permit
1. Permit application required by the local jurisdiction. Permit applications normally include information about the project scope, project location, and the installer.
2. Site plan showing location of major components on the property. This drawing need not be exact to scale, but it should represent relative location of components at site (see supplied example site plan). PV arrays in compliance with IRC fire setback requirements. Energy storage in acceptable locations.
3. Electrical worksheets showing PV array configuration, wiring system, overcurrent protection, ESS components, inverters, disconnects, required signs, and AC connection to building (see supplied standard electrical diagram).
4. Specification sheets and installation manuals (if available) for all major PV system components such as: PV modules, DC-to-DC converters, ESS components, inverters, and mounting systems.

Step 2: PV System Electrical Code Installation Requirements
1. Major electrical components including PV modules, DC-to-DC converters, and inverters, are identified for use in PV systems.
2. Array mounting system UL703 certified for bending and grounding. Alternatively, the array mounting system may incorporate UL7039 grounding devices to bond separate exposed metal parts together or to the equipment grounding conductor. The PV array consists of no more than 2 series strings per inverter input and no more than 2 series strings in total per inverter.
3. Field-installed PV array wiring meets the following requirements (all loads must be identified):
   a. All exposed PV source circuit wiring is no smaller than 12 AWG PV wire or #22 cable.
   b. All PV source circuit wiring in surface is no smaller than 12 AWG BTHX (THHN, or THWN).
   c. Equipment sized for the maximum DC voltage applied to the equipment (not NAC in all blank that do not apply to the specific installation).
   d. Use NEC 805.7 NEC values.
   e. Maximum Vic rated maximum input voltage (must be greater than Vic max or Vic).
   f. Inverter-rated maximum input voltage (must be greater than a). Inverter input max: Max module Vic x n in series.
   g. Specifications in the manual.
4. PV system installation on buildings meet requirements for conductors in 690.12.
5. The PV system disconnecting means meets the requirements of 690.12.
The “Box” to Qualify Simple Permits

- PV system uses standard diagrams
- One- and two-family rooftop installations or structure of same construction.
- String inverter, dc converter, or microinverter
- Complies with eligibility checklist
Overall Limitations of Location

- Snow load no greater than 60 PSF (pounds per square foot).
- Wind load no greater than 150 MPH

Guidelines Cover Most of 48 States

- Snow load no greater than 60 PSF (pounds per square foot).
- Wind load no greater than 150 MPH
- Not Exposure D (waterfront)
- Not on steep hill (5% grade)
- Roof mean height 40’ or less
- Roof structure meets IRC
- No structural damage
ELIGIBILITY CHECKLIST FOR SIMPLIFIED PV PERMITTING

Member-Attached PV Array Requirements:

- 1. Array is set back from all roof edges and ridge by at least twice the gap under the modules (or more, where fire access pathways are required).
- 2. Array does not cantilever over the perimeter anchors more than 19”.
- 3. Gap under modules (roof surface to underside of module) is no greater than 10”.
- 4. Gaps between modules are (select one below):
  - a. at least 0.25” on both short and long sides of modules, or
  - b. 0” on short side, and at least 0.50” on long sides.

ELIGIBILITY CHECKLIST FOR SIMPLIFIED PV PERMITTING

Member-Attached PV Array Requirements (cont):

- 5. Mounting rail orientation or rail-less module long edges:
  - a. run perpendicular to rafters or trusses, and attached to them
- 6. The anchor/mount/stand-off spacing perpendicular to rafters or trusses:
  - a. does not exceed 4’-0”, and anchors in adjacent rows are staggered where rafters or trusses are at 24” or less on center

Structural Summary Takeaway

1. Houses that were built in compliance with building structural codes, can support PV.
2. Single layer of roofing (no second layer of comp).
3. PV modules mounted within 2” and 10” of roof deck.
4. PV array distributed weight less than 4 lb/ft²
5. Typical rafter with supports 48” apart or closer (each anchor row mounted on alternating trusses) meet structural code requirements (represents most of housing stock).
ELIGIBILITY CHECKLIST FOR SIMPLIFIED PV PERMITTING

Member-Attached PV Array Requirements (cont):

5. Mounting rail orientation or rail-less module long edges:
   - b. run parallel to rafters and are spaced no more than 4'-0" apart, Ground Snow Load is no greater than 10 psf, and Design Wind Speed does not exceed 120 mph.

6. The anchor/mount/stand-off spacing perpendicular to rafters or trusses (select one below):
   - a. does not exceed 4'-0", and anchors in adjacent rows are staggered where rafters or trusses are at 24" or less on center (see Figure), or
   - b. does not exceed 4'-0", anchor layout is orthogonal, roof slope is 6:12 or less, Ground Snow Load is no greater than 10 psf, and Design Wind Speed does not exceed 120 mph, or
   - c. does not exceed 6'-0", anchor layout is orthogonal, roof slope is 6:12 or less, Ground Snow Load is zero, and Design Wind Speed does not exceed 120 mph.

Sheathing Attached Limitations

- Snow load no greater than 60 PSF
- Wind load no greater than 140 MPH
- Not Exposure D (waterfront)
- Not on steep hill (5% grade)
- Roof mean height 30’ or less
- Roof structure meets IRC
- Mfg Truss or Kiln Dry Rafters
- No structural damage
- Tributary area matters
BANDS OF STRENGTH—Middle 16” of Sheet

ELIGIBILITY CHECKLIST FOR SIMPLIFIED PV PERMITTING—Sheathing—No Bands of Strength

a. Some anchors are not within bands of strength, and all the following (i., ii. & iii.) apply:
   i. Edge of array is more than 3 feet from any roof edge (Wind Zone 1), and
   ii. Tributary area is 9 ft² or less (up to half the area of a 60 cell PV module), and
   iii. Wind Exposure B only, and design wind speed does not exceed 120 mph.

ELIGIBILITY CHECKLIST FOR SIMPLIFIED PV PERMITTING—Sheathing—Bands of Strength

b. All anchors are within bands of strength, and all of the following (i., ii. & iii.) apply:
   i. Edge of array is more than 3 feet from any roof edge (Wind Zone 1), and
   ii. Tributary area is 14 ft² or less (40”x48”).
   iii. One of the two wind cases below (x. or y.) applies:
      x. Exposure B, and design wind speed does not exceed 140 mph, or
      y. Exposure C, and design wind speed does not exceed 120 mph.

ELIGIBILITY CHECKLIST FOR SIMPLIFIED PV PERMITTING

8. Anchor-to-sheathing connection has an allowable stress design (ASD) uplift capacity of at least 166 lbs. under short duration loading, which corresponds to a mean ultimate tested uplift capacity of at least 520 lbs.

GENERAL STATEMENT FOR CHECKLIST:

If any structural item cannot be checked off, the building official may require the installer to provide structural calculations and/or details, stamped and signed by a design professional, addressing the unchecked item.

anchor-to-sheathing connection has an allowable stress design (ASD) uplift capacity of at least 166 lbs. under short duration loading, which corresponds to a mean ultimate tested uplift capacity of at least 520 lbs.

GENERAL STATEMENT FOR CHECKLIST:

If any structural item cannot be checked off, the building official may require the installer to provide structural calculations and/or details, stamped and signed by a design professional, addressing the unchecked item.
ELIGIBILITY CHECKLIST FOR SIMPLIFIED PV PERMITTING

Step 2: Electrical PV System Requirements Checklist
For a simplified PV permit, following are the electrical requirements:

1. Major electrical components including PV modules, dc-to-dc converters, and inverters, are identified for use in PV systems.
2. Array mounting system UL2703 certified for bonding and grounding. Alternatively, the array mounting system may incorporate UL2703 grounding devices to bond separate exposed metal parts together or to the equipment grounding conductor.
3. The PV array consists of no more than 2 series strings per inverter input and no more than 4 series strings in total per inverter.

PV+ESS Permitting Guidelines

Interconnection—No MID

• 120% Option for Small PV and/or ESS
• 100% Option for Larger PV or PV+ESS. Split service into 2 breakers to 2 subpanels (sum of breakers option)
• PV and/or ESS as part of 6-handle Service Disconnecting Means (ESS within load calcs for service or PCS installed to protect service)
• Supply side option for PV (no ESS allowed)
Central/String Inverter Standard Plans

- Use this plan ONLY for central/string inverter systems with or without dc converters on the roof of a one- or two-family dwelling or similar structure.
- The photovoltaic system must interconnect to the load side of a 120/240Vac service panel rated 400A or less (80-amp PV breaker or less).
- Not intended for more than two inverters, or more than one dc combiner per inverter (non-inverter-integrated).

Example 1—7.6kW Central Inverter PV System

PV System Components
- PV Modules
  Qty. 27, 360W, American Solar AS360
- Inverter
  Qty. 1, 7.6 kW, American Inverter AI-7600
- Mounting System
  OmniRack ModMount 5.0; sheathing attached;
- House

Form Fill-Out Demonstration

Compliance Document
Standard Plan—Simplified Central Inverter Structural Criteria—compliant
Microinverter Standard Plans--Scope

- Use this plan ONLY for systems using microinverters or ac modules (ACM), with no more than 4 output circuits, one PV module/microinverter, installed on the roof of a one- or two-family dwelling or similar structure.

- The PV system must interconnect to the load side of a 120/240Vac, service panel rated 400A or less (80-amp breaker or less).
Example 2—7.6kW Microinverter PV System

• PV System Components
  – PV Modules
    • Qty. 26, 360W, American Solar AS360
  – Inverters
    • Qty. 26, 295W, American Inverter AI-295
  – Mounting System
    • OmniRack ModMount 4.0; Maximum span 72”
  – House
    • Roof Pitch 4:12; House built in 1988. Comp shingle roof. [structurally compliant]

Form Fill-Out Demonstration

Compliance Document

Standard Plan—Simplified Microinverter

Structural Criteria (compliant)
Recently released!

New ESS Permitting Guidelines for Residential Energy Storage with PV

Interconnection—MID in Inverter

- 120% Option for Small PV and/or ESS
- 100% Option for Larger PV or PV+ESS. Split service into 2 breakers to 2 subpanels (sum of breakers option)
- PV and/or ESS as part of 6-handle Service Disconnecting Means (ESS within load calcs for service or PCS installed to protect service)
Interconnection at MID

- 120% Option for Small PV or ESS
- 100% Option for Larger PV or PV+ESS. Split service into 2 breakers to 2 subpanels (MID on one of two breakers)
- Feed to MID as part of 6-handle Service Disconnecting Means
- Service disconnect at new MID
Notes for DC-to-DC Converter System

1. **BMF 350**
   - Description: Big Module 350-Watt (See Notes Sheet)

2. **DC-TO-DC CONVERTER**
   - **PART NUMBER**: SE P401
   - **NOTES**: N/A
   - **TWO DC CIRCUITS W/ 13 DC-TO-DC CONVERTERS PER CIRCUIT**
   - **INCLUDED WITH LISTED INVERTER**

3. **JUNCTION BOX**
   - **DESCRIPTION**: Connect to DC DISCO INVERTER

4. **DC DISCONNECT**
   - **DESCRIPTION**: Mid on Load Side with Ac Coupled PV String Inverter and Energy Storage System

5. **DC/AC INVERTER**
   - **DESCRIPTION**: Built-In SolarEdge Backup Interface Microgrid Interconnect Device

6. **BATTERY (IF USED)**
   - **DESCRIPTION**: Backup Panel (If Used)

7. **AC DISCONNECT (IF USED)**
   - **DESCRIPTION**: Service Panel
   - **PART NUMBER**: MLO125
   - **NOTES**: 240VAC, 125-A Main Lug Panel FED by 100-A CB in Main Panel

8. **NONBACKUP PANEL (IF USED)**
   - **DESCRIPTION**: Tesla Powerwall 2, 30-A 13.6 KWH ESS With 120/240VAC Output
   - **PART NUMBER**: 240VAC, 100-AMP Unfused Switch (If Required by Utility)

9. **SERVICE PANEL**
   - **DESCRIPTION**: AC Disconnect (If Used)
   - **PART NUMBER**: SD200SL
   - **NOTES**: 240VAC, 200-A Main, 200-A Bus, W/ 2, 100-A CBs

10. **RESU10HMLO200**
    - **PART NUMBER**: SE BUI
    - **NOTES**: Solaredge Backup Interface Microgrid Interconnect Device

11. **PV ARRAY**
    - **DESCRIPTION**: SolarBright 2688 Washington St.

12. **CONDUIT AND CONDUCTOR SCHEDULE**
    - **TAG**: DESCRIPTION OF CONDUCTOR QUANTITY, SIZE, AND TYPE
      - **QTY. 4**: 12 AWG PV WIRE, 6 AWG BARE COPPER EGC
      - **QTY. 5**: 12 AWG, THWN-2 COND., 2-B, 2-R, 1-G
      - **QTY. 2**: 2 AWG; QTY. 1**: 6AWG, 1-W; QTY.1**: 6AWG, 1-G THWN CONDUCTORS

13. **CONTRACTOR NAME, ADDRESS AND PHONE:**
    - **SolarBright**
    - **Address and Phone:** 2688 Washington St.

14. **SITE NAME:** Joe and Jane Homeowner
    - **SITE ADDRESS:** 2400 Monroe St., Hollywood, FL

15. **SIZE:** 7.6KW NEW SOLAR; 10KW, 27KWH ESS
    - **LOADS:** If Unused Source Circuits

16. **OUTLINE SHEET:**
    - **TITLE:** Notes for DC-to-DC Converter System
    - **CHECKED BY:**
    - **DRAWN BY:**
    - **BILL NOSCALE JULY 2021 1.1d**

17. **NOTES SHEET:**
    - **DESCRIPTION:**

18. **DC TO DC CONVERTERS IN SERIES SOURCE-CIRCUIT**
    - **DESCRIPTION:**

19. **GROUNDING FOR UNUSED SOURCE CIRCUITS**
    - **DESCRIPTION:**

20. **120V N/A VA ELECTRODE**
    - **DESCRIPTION:**

21. **PV SYSTEM (IF ANY)**
    - **DESCRIPTION:**

22. **PANEL AUTOTRANSFORMER FOR PV SYSTEM**
    - **DESCRIPTION:**

23. **BUILDING GROUNDING**
    - **DESCRIPTION:**

24. **ENERGY STORAGE SYSTEM**
    - **DESCRIPTION:**

25. **DC TO DC CONVERTERS IN BUILDING**
    - **DESCRIPTION:**

26. **SERIES SOURCE-CIRCUIT LOADS ESS**
    - **DESCRIPTION:**