



# Stafford County

## Department of Public Works

### Photovoltaic Submittal Requirements

To ensure that the proposed solar photovoltaic work satisfactorily meets the requirements of Article 690 in the National Electrical Code, in accordance with Virginia Uniform Statewide Building Code section 109, the Building Official of Stafford County requires that the following documents be submitted prior to the issuance of permit.

#### 2012 Virginia Residential Code SECTION M 2302

#### PHOTOVOLTAIC SOLAR ENERGY SYSTEMS

**M2302.1 General.** This section provides for the design, construction, installation, alteration, and repair of photovoltaic equipment and systems.

**M2302.2 Requirements.** The installation, inspection, maintenance, repair and replacement of photovoltaic systems and all system components shall comply with the manufacturer's instructions, Sections M2302.2.1 through M2302.2.3 and NFPA 70.

**M2302.2.1 Roof-mounted panels and modules.** Where photovoltaic panels and modules are installed on roofs, the roof shall be constructed to support the loads imposed by such modules. Roof-mounted photovoltaic panels and modules that serve as roof covering shall conform to the requirements for roof coverings in Chapter 9. Where mounted on or above the roof coverings, the photovoltaic panels and modules and supporting structure shall be constructed of noncombustible materials or fire-retardant treated wood equivalent to that required for the roof construction.

Additional documents, substantiation, or engineering may be required if deemed necessary by the Building Official. To avoid delay please ensure that the proposed submittal includes all of the following:

- UL 1741 or IEEE listed solar panel specifications.
- Listed panel mounting system specifications referencing ASCE 7 or engineered analysis for an unlisted system.
- A complete wiring diagram including all of the elements specified on the attached schematic example (see attached).
- Inverter specification and installation material.
- Combiner box, control center and any other utilization equipment specifications and standards.
- Structures installed to support PV systems must be engineered by a Virginia Certified design professional
  - A structural engineer must provide calculations and certification of the additional dead load and wind uplift of the solar panels on the existing roof trusses or rafters. Calculations shall demonstrate that the primary structure will support the additional vertical and lateral loads from the panels and related equipment.

Attached is a copy of the Stafford County Photovoltaic checklist. This document must be on site for the Stafford County Building Inspector. This document outlines many of the aspects, which must be accounted for with installation. This document may be a helpful guide for field personnel.

Thank You,

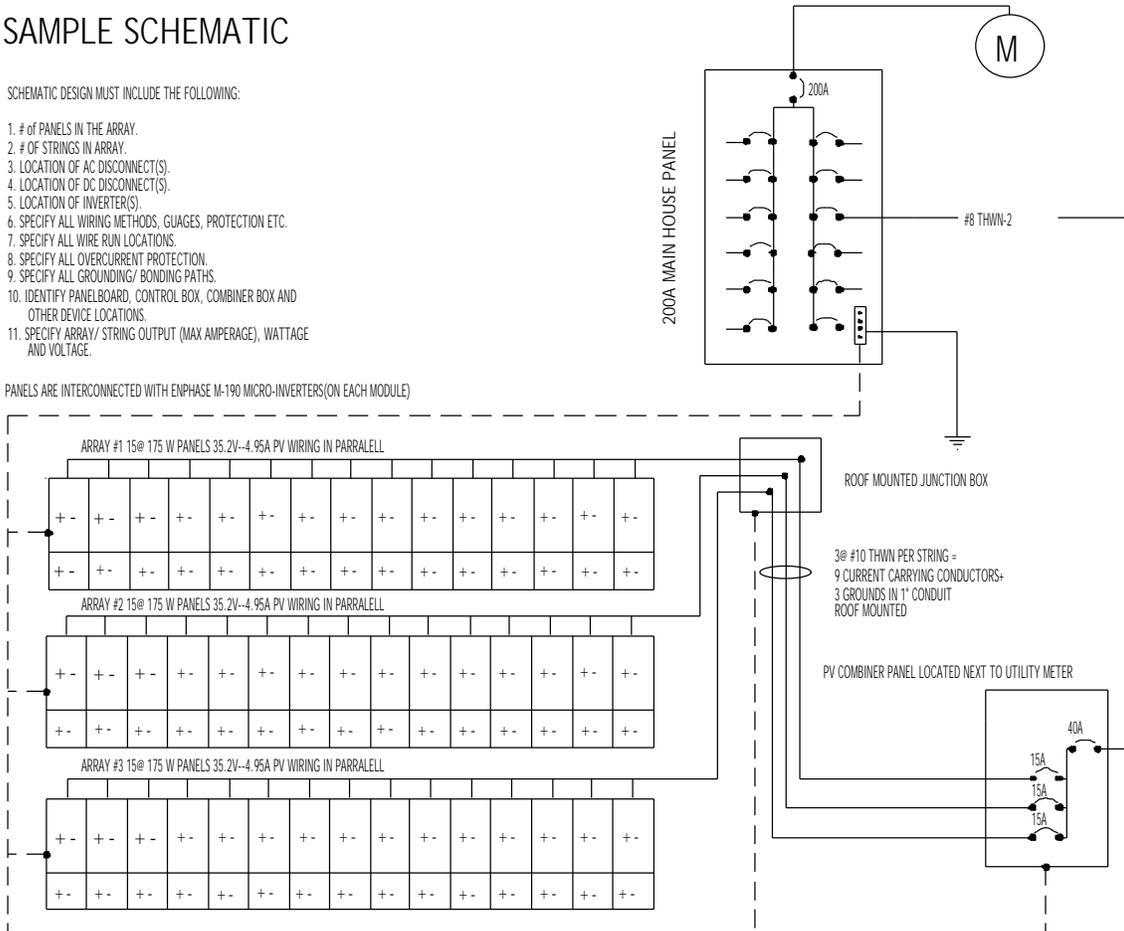
Cary K. Jamison; Stafford County Building Official

# SAMPLE SCHEMATIC

SCHEMATIC DESIGN MUST INCLUDE THE FOLLOWING:

1. # OF PANELS IN THE ARRAY.
2. # OF STRINGS IN ARRAY.
3. LOCATION OF AC DISCONNECT(S).
4. LOCATION OF DC DISCONNECT(S).
5. LOCATION OF INVERTER(S).
6. SPECIFY ALL WIRING METHODS, GAUGES, PROTECTION ETC.
7. SPECIFY ALL WIRE RUN LOCATIONS.
8. SPECIFY ALL OVERCURRENT PROTECTION.
9. SPECIFY ALL GROUNDING/ BONDING PATHS.
10. IDENTIFY PANELBOARD, CONTROL BOX, COMBINER BOX AND OTHER DEVICE LOCATIONS.
11. SPECIFY ARRAY/ STRING OUTPUT (MAX AMPERAGE), WATTAGE AND VOLTAGE.

PANELS ARE INTERCONNECTED WITH ENPHASE M-190 MICRO-INVERTERS(ON EACH MODULE)





# Stafford County

## Department of Public Works

### Photovoltaic Inspection Checklist

PERMIT #: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
INSPECTOR: \_\_\_\_\_

#### **GENERAL**

- THIS INFORMATION PROVIDED IS GENERAL AND INTENDED AS A GUIDE ONLY. EACH PROJECT IS UNIQUE AND ADDITIONAL REQUIREMENTS MAY BE ENFORCED AS APPROPRIATE. (*USBC 109.4*)
- THE PLANS (IN ACCORDANCE WITH THE ATTACHED SAMPLE), PERMIT INSTALLATION INSTRUCTIONS AND ALL OTHER ITEMS ON THE ATTACHED CHECKLIST SHALL BE ON SITE AT TIME OF INSPECTION. (*USBC 109.4*)
- ENSURE THAT INVERTER IS LISTED UL 1741 OR IEEE 1547.
- ENSURE THAT MANUFACTURERS GUIDELINES FOR PANEL INSTALLATION REFERENCE ASCE 7 FOR WIND LOADING.
- FIELD INSTALLATION SHALL BE PER CODE/PLAN (NEC 2005 IRC, USBC, IBC 2006)
- WHERE DC WIRING IS INSTALLED INSIDE THE STRUCTURE A SEPARATE ROUGH INSPECTION MUST BE SCHEDULED AT THE ROUGH IN INSPECTION.
- DC WIRES INSTALLED INSIDE THE STRUCTURE SHALL BE INSTALLED IN A METALLIC RACEWAY. (*NEC 690.31*).
- MARKING IS REQUIRED ON DC CONDUIT, RACEWAYS, ENCLOSURES, CABLE ASSEMBLIES AND JUNCTION BOXES. "CAUTION: SOLAR CIRCUIT". MARKING SHALL BE EVERY 10', AT TURNS AND ABOVE AND/OR BELOW PENETRATIONS AND AT ALL DC COMBINER AND JUNCTION BOXES.
- VERIFY THAT UTILITY COMPANY HAS BEEN NOTIFIED OF INSTALLATION OF AN ALTERNATE ENERGY SYSTEM.
- INSTALLER SHALL PROVIDE A LADDER AND DIRECT ACCESS TO ALL COMPONENTS OF THE PV SYSTEM.
- ALL CONNECTIONS SHALL BE SECURE.
- ALL METALIC RACEWAYS AND EQUIPMENT SHALL BE BONDED AND ELECTRICALLY CONTINUOUS.
- ALL WIRING AND DEVICES MUST BE PROVIDED WITHIN AMPACITY LIMITATIONS AND MANUFACTURERS GUIDELINES.

#### **MAIN ELECTRIC SERVICE**

- THE INSPECTOR SHALL CHECK EXISTING PANEL FOR HOT SPOTS OR UNSAFE CONDITIONS. IF EXISTING PANEL IS FOUND TO BE UNSAFE, IT MAY BE NECESSARY FOR THE PROPERTY OWNER TO HIRE A LICENCED ELECTRICIAN TO MAKE REPAIRS OR REPLACE EQUIPMENT. REPAIRS/ REPLACEMENT SHALL HAPPEN PRIOR TO PHOTOVOLTAIC HOOK UP. IF THE EXISTING PANEL REQUIRES CORRECTION THIS WILL REQUIRE A PERMIT.
- VERIFY UTILITY POINT OF INTERCONNECTION (CIRCUIT BREAKER) IS PER PLAN AND DOES NOT EXCEED 20% OF THE BUS RATING (NEC 690.64 FOR RESIDENTIAL. FOR COMMERCIAL THE BUS RATING SHALL NOT EXCEED 100% OF ITS RATING)
- CIRCUIT BREAKERS SHALL BE OF THE SAME MANUFACTURER AS THE MAIN ELECTRICAL SERVICE (OR COMPATIBLE BY MANUFACTURER).
- WHEN A BACKFED BREAKER IS THE METHOD OF UTILITY INTERCONNECTION, BREAKER **SHALL NOT** READ "LINE AND LOAD"
- VERIFY EXISTING AC GROUNDING ELECTRODE SYSTEM (*NEC 250*).
- IF THERE IS NOT AN EXISTING AC GROUNDING ELECTRODE, PV CONTRACTOR SHALL INSTALL A SECOND GROUND ROD AT THE MAIN ELECTRICAL SERVICE PER *NEC 250.52(5)*.
- VERIFY GROUNDING ELECTRODE SYSTEM FROM INVERTER TO ADDITIONAL GROUND ROD THEN BONDED TO EXISTING AC GROUNDING ELECTRODE OR PROVIDE GROUNDING ELECTRODE CONDUCTOR DIRECTLY FROM INVERTER TO EXISTING GROUNDING ELECTRODE WITH SEPARTATE ATTACHMENT.
- WHERE AN EXISTING GROUNDING ELECTRODE SYSTEM IS A DRIVEN GROUND ROD, AN ADDITIONAL GOUND ROD SHALL BE DRIVEN IF THE SINGLE ROD DOES NOT PROVIDE 25 OHMS OF RESISTANCE. GROUND RODS SHALL BE A MINIMUM OF 6' APART. (*NEC 250.56*)

### **INVERTER LOCATION**

- AC AND DC DISCONNECTS SHALL BE LOCATED AT INVERTER (NEC 690.14 AND 690.17).
- IF ELECTRICAL EQUIPMENT IS LOCATED NEAR THE GAS METER, VERIFY CLEARANCES ARE MET. SEE ASME, DOT AND NFPA 58 INSTALLATION CLEARANCES.

### **ROOF TOP INSPECTION**

- ALL EQUIPMENT ON THE ROOF REQUIRING SERVICING SHALL MEET THE REQUIRED CLEARANCES OF NEC 110.26
- WHEN A NEW ROOF IS BEING INSTALLED OR WHERE THE CONNECTIONS OF THE SUPPORTS WILL BE COVERED UP, AN INSPECTION IS REQUIRED TO VERIFY CONNECTIONS.
- MODULES SHALL BE LISTED AND LABELED.
- VERIFY BONDING MEANS AT MODULES IS A LISTED DEVICE.

- VERIFY GROUNDING LUGS ARE LOCATED WHERE SPECIFIED BY MANUFACTURER.
- MODULE WIRING SHALL BE PROPERLY SECURED AND PROTECTED FROM DAMAGE.
- WHERE THREE OR MORE STRINGS ARE BEING COMBINED, A COMBINER BOX SHALL BE LISTED/ FACTORY ASSEMBLED. 600VDC FUSES ARE REQUIRED.
- WHEN DC WIRING IS INSIDE THE STRUCTURE, A DC DISCONNECT SHALL BE ON THE ROOF AT THE POINT ENTRY OR IN ATTIC DIRECTLY BELOW POINT OF ENTRY. ELECTRICAL EQUIPMENT LOCATED IN THE ATTIC SHALL BE ACCESSIBLE.
- ARRAY CONDUCTORS MUST BE CONNECTED TO THE LINE SIDE INPUT TERMINALS AT THE TOP OF THE MAIN DC DISCONNECT AND CONDUCTORS TO INVERTER INPUT SHALL BE CONNECTED TO THE LOAD SIDE OUTPUT TERMINALS (BOTTOM) OF DC DISCONNECT.

## **SIGNAGE**

### **MAIN ELECTRICAL SERVICE**

- PROVIDE PERMANENT PLAQUE/ DIRECTORY AT THE SERVICE ENTRANCE EQUIPMENT DENOTING ALL ELECTRICAL POWER SOURCES AND LOCATION OF ONSITE EMERGENCY POWER SOURCES (NEC 705.10) **“WARNING 2 SOURCES OF POWER PV/AC DISCONNECT @ ADJACENT LOCATION”**
- BUILDINGS OR STRUCTURES WITH BOTH UTILITY SERVICE AND A PHOTOVOLTAIC SYSTEM SHALL HAVE PERMANENT LETTERING PROVIDING THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS, IF NOT LOCATED AT THE SAME LOCATION. (NEC 690.56).
- PERMANENT LETTERING SHALL BE PLACED AT THE POINT OF INTERCONNECTION STATING THE MAXIMUM AC OUTPUT OPERATING CURRENT AND THE OPERATING AC VOLTAGE. (NEC 690.54)

### **AC DISCONNECT**

- PROVIDE PERMANENT LETTERING AT ALL AC DISCONNECTS (NEC 690.14 ) **“PHOTOVOLTAIC ARRAY AC DISCONNECT SWITCH”**.
- LOAD CENTERS USED AS PHOTOVOLTAIC COMBINER BOXES SHALL BE LABELED **”PHOTOVOLTAIC CIRCUITS ONLY. NO ADDITIONAL CIRCUITS ALLOWED”**.
- IF USING CORD AND PLUG CONNECTED MICROINVERTERS A LOCKOUT DEVICE IS REQUIRED AT THE MAIN PANEL AC DISCONNECT SUPPLYING THE PV SYSTEM.

### **DC DISCONNECT**

- PROVIDE PERMANENT LETTERING AT ALL DC DISCONNECTS (NEC 690.14 C) **“PHOTOVOLTAIC ARRAY DISCONNECT SWITCH”**. ADDITIONAL SIGNAGE IS REQUIRED AT DC DISCONNECTS PROVIDING OPERATING CURRENT AND

VOLTAGE, MAXIMUM SYSTEM VOLTAGE AND SHORT-CIRCUIT CURRENT. (NEC 690.53)

**INVERTERS**

- WHERE INVERTERS ARE LOCATED OTHER THAN AT THE MAIN ELECTRICAL SERVICE LOCATIONS, PERMANENT LETTERING DENOTING ALL ELECTRICAL POWER SOURCES SHALL BE INSTALLED. (NEC 690.14, 705.10).

Updated April, 2015