

# PHOTOVOLTAIC SYSTEMS

From The Office of the Iowa State Fire Marshal Electrical Bureau



## PHOTOVOLTAIC WORKSHEET

Solar photovoltaic (PV) systems have widely gained acceptance as an alternative energy source, and installations range from the small array supplying a bus stop luminaire to a large array that covers acres. Since each installation comes with its own characteristics, this worksheet has been provided for the installer to complete and submit to their electrical inspector prior to the inspection date. With this information in advance, the inspector can get a good idea of what the project entails and perhaps warn the installer of an electrical code issue before the installation is complete. The entire PV system installation must comply with Article 690, 691, and 705 of the 2017 National Electrical Code (NEC).

**Prior** to the electrical inspection, the electrical contractor must provide the following documentation to their electrical inspector:

1. Pages 2 and 3 of this document (completed)
2. Equipment spec/cut sheets for grounding/bonding fittings, modules, inverters, micro inverters, DC to DC converters, disconnects, panels, lugs (lug kits/tap boxes) and any other electrical equipment associated with the Photovoltaic installation.
3. A one-line diagram of the PV system including raceways, boxes, electrical equipment, conductors, service interconnection, and tie to an existing /adding of a "Grounding Electrode System".
4. A site plan showing the relative location of the array and the PV equipment on the property. Also provide location of service and distance from array.

To avoid additional inspection costs please be sure to check over all of the above required information and paperwork, making sure it is complete and all-inclusive before you submit it to your local State Inspector for inspection. Missing information can cause delays in the inspection and approval process and can cause additional unforeseen inspection fees for the project.

**Note in reference to Stamped Engineered Drawings:** The Electrical Bureau Inspectors reserve the right to request Engineered Stamped Drawings Per Iowa Code 542A and 544B to be submitted and inspected prior to a requested inspection.

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## NOTICE

**Please be sure to consult with the local utility company supplying power to the site before the installation commences. This will help insure their requirements are met.**

## **PV SYSTEM INFORMATION**

\_\_\_\_ Number of Arrays to be installed for this project. \_\_\_\_ State Electrical Permit Number

- Standard String Array       Micro-Invertor Array  
 Roof Mount       Ground Mount       Combination of both  
 Yes    No - Is Rapid Shutdown Required for this project per NEC 2017 690.12.

<b>PV SYSTEM OVERVIEW</b>	
Maximum System Voltage	
Maximum Circuit Current	
Number of Inverters	
Battery Storage    Y or N	
Min. PV Overcurrent Device	
DC to DC Converters	

<b>INTERCONNECTIONS</b>	
Lineside Connect 705.12(A)	
*Loadside Connect 705.12(B)	
Service Voltage Rating	
Service Amperage Rating	
Service Buss Rating	
Service Conductor Size	

\* Loadside Interconnection: If the interconnection is to be made on the “Loadside” of the Service Over Current Protection Device (NEC 2017 705.12(B)) Please indicate the Code Section below used to determine the interconnection that has been installed.

<b>LOADSIDE CONNECTIONS</b>	
NEC 705.12(B)(2)(1)(a)	<i>Feeders</i>
NEC 705.12(B)(2)(1)(b)	“
NEC 705.12(B)(2)(2)	<i>Taps</i>
NEC 705.12(B)(2)(3)(a)	<i>Busbars</i>
NEC 705.12(B)(2)(3)(b)	“
NEC 705.12(B)(2)(3)(c)	”
NEC 705.12(B)(2)(3)(d)	”
NEC 705.12(B)(2)(3)(e)	”

## **CALCULATION SHEET**

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Please provide the calculations for this project as required by the 2017 NEC articles 690.7, 690.8, and 690.9

The 2017 NEC sets the maximum DC circuit voltage requirement please indicate where the PV system is located.

	On or in a One or Two-Family Dwelling Project (600V or Less)
	On or in all other building types (1000v or Less)
	Not Located on or in buildings (1500v or Less)

**Part A: 2017 NEC 690.7 Maximum Voltage.** Please indicate the Code Section used and provide the calculations. \*If DC to DC Converters are installed, 690.7(B)(1or2) are to be used to calculate.

	690.7(A)(1) – Listing and Labeling Calculation
	690.7(A)(2) – Crystalline and Multicrystalline Calculation
	690.7(A)(3) – PV Systems of 100 KW or Larger Calculation
	*690.7(B)(1) – Single DC-to-DC Converter Calculation
	*690.7(B)(2) – 2 or More Series Connected DC-to-DC Converters

Show calculations here:

**Part B: 2017 NEC 690.8 Circuit Sizing & Current.** Please indicate the Code Section used and provide the calculations.

	690.8(A)(1) – Photovoltaic Source		<b>*DC to DC Converters ONLY</b>
	690.8(A)(2) – Photovoltaic Output		*690.8(A)(5) – DC to DC Converter Source
	690.8(A)(3) – Inverter Output		*690.8(A)(6) – DC to DC Converter Output
	690.8(A)(4) – Stand-Alone Inverter Input		

Show calculations here:

**Part C: 2017 NEC 690.9 Overcurrent Protection.** Please indicate the Code Section used and provide the calculations.

	2017 NEC 690.9(B) Overcurrent Device Ratings
	2017 NEC 690.9(C) Photovoltaic Source and Output Circuits
	2017 NEC 690.9(D) Power Transformers

Show calculations here:

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## **FINAL PV SUBMITTAL CHECKLIST**

Please use the following checklist provided to verify that all information required by the State of Iowa Electrical Bureau for this Photovoltaic Systems Installation is complete and ready to be submitted. State Inspectors are not able to schedule or perform any inspections related to a Photovoltaic Systems without **all** of the required documentation submitted first. These drawings are inspected to verify that the installation appears to meet the minimum standards of the 2017 National Electrical Code as adopted by the State of Iowa.

Incomplete submitted documentation can lead to additional re-inspection fees for the project so please review your documents carefully before submitting.

Verify that all of the following information is contained in the information you are about to submit to the Local State Inspector.

1. \_\_\_\_ Type of Installation (Roof or Ground Mount)
2. \_\_\_\_ Rapid Shutdown Required
3. \_\_\_\_ "PV System" Page #2 is filled out completely and accurately.
4. \_\_\_\_ "PV Calculations" Page #3 is filled out completely and accurately.
5. \_\_\_\_ All specification sheets for PV/Electrical Equipment to be installed are included.
6. \_\_\_\_ An accurate One-line Diagram as described in item #3 on page #1.
7. \_\_\_\_ An accurate Site Plan as described in item #4 on page #1.
8. \_\_\_\_ Verify requirements for "Point of Connection" (705.12 (A or B)
9. \_\_\_\_ Verify requirements for the Grounding Electrode System. (690.47)
10. \_\_\_\_ Verify the accuracy of all calculations.

### **PV and Electrical Contractors Reminder:**

#### **PV Installers are allowed to:**

A PV installer is allowed to construct the support system, mount the modules, inverters or optimizers, and connect the factory provided module wiring harness (plug and play only).

#### **Responsible Electrical Contractor:**

The remainder of the installation such as panelboards, raceways, boxes, fittings, breakers, and building wire shall be sized and installed by a licensed electrical contractor, who shall obtain the appropriate permit(s) along with corresponding inspections prior to the commencement of work.