

# Electrical Plan Review Submittal Guide



## Introduction

This guide outlines the information and documents required for electrical plan review submittal. It will help you assemble an accurate and complete set of electrical plans for your proposed design.

This submittal guide includes:

- The City of Kirkland's criteria for electrical plan review, along with RCW, WAC and Kirkland Electrical Code requirements for electrical plan review.
- An electrical plan review checklist. This is the form that will be used by the electrical plans examiner when performing the electrical plan review.
- A list of equipment required to be on the emergency or legally required systems.
- Smoke control guidelines
- Examples of typical items included in electrical plans

Our goal is to provide you with the quickest turnaround time possible. Providing complete submittal information will help to achieve this goal.

All applicants for a City of Kirkland electrical permit are required to complete an electrical permit application online at [MyBuildingPermit.com](http://MyBuildingPermit.com). Please provide a specific description of the work to be completed.

Although your electrical plans will be checked for compliance with many sections of the National Electrical Code, the focus of our review will be the load on the electrical system and life-safety issues. Your review will begin at the individual branch circuit and will investigate all equipment and conductors in the load path back to the service point.

## Forms

The [fault current calculation form](#) must be completed and submitted prior to plan review approval. The following forms are available for use in your submittal or you may create your own forms, provided they are in accordance with our requirements.

- Sample One-Line Diagram (attached)
- [Sample Panel Schedules](#) (single-phase and 3-phase)
- [Generator Load Summary](#) Calculation form
- Residential Small-Scale PV System Standard Electrical Diagram, Notes and Site Plan (attached)
- [Micro-Inverter Electrical Diagram](#)

# Electrical Plan Review Submittal Guide



## Requirements for Electrical Plan Review

Submit electrical plans for the following installations:

- Multifamily (three units and larger).
- All work on electrical systems operating at over 600 volts.
- All educational, institutional and health or personal care occupancies classified or defined in WAC 296-46B-010(14).
- All commercial generator or UPS installations.
- Energy Storage Systems.
- All wind, solar or fuel cell installations for commercial or residential occupancies.
- All work in areas determined to be a hazardous (classified) location by the NEC.
- Existing tenant alteration, where the load is increased by 100 amperes or greater, or the service is altered. This will include sub panels, transformers, UPS systems and generators.
- 20% or more of lighting fixtures change, WSEC C503.7.2.
- Temporary Services 401 amps and larger 120/208 volts.
- Temporary Services – 277/480 volts

Under WAC 296-46B-900, electrical plans for specific occupancies must be prepared by, or under the direction of a consulting engineer registered under chapter 18.43 RCW, and stamped with the engineer's mark and signature.

**Mandatory Facilities:** All electrical plans for educational facilities, hospitals, and nursing homes require professional engineering.

**Complex Projects:** Projects with services/feeders rated 1600 amperes or larger, or as required by the building official for complex/hazardous installations, require a PE.

**Emergency/Standby Systems:** Proper design of emergency and standby systems (per NEC 700) typically requires professional engineering oversight.

**Installations that require engineering supervision by the NEC.**

## Electrical Plan Review Checklist

The intent of this list is to provide a general guideline for electrical plan review. The list may not include all items to be verified for every plan review encountered or it may include more items than a specific set of electrical plans encompasses. Please tailor this list for the electrical plans submitted and the scope of your job.

Owner/Renter/Lessee Affidavit to be provided when the property owner, renter, or lessee chooses to purchase a permit to do an electrical installation on his/her own or qualified leased property under the conditions as described in RCW 19.28.261.

# Electrical Plan Review Submittal Guide



## Submittal Items

- Floor plan or site layout to show the area where the electrical work is to occur.
- North arrow indicating the direction north.
- Electrical plans showing the location of all controlled receptacles for each floor (where required). Washington State Energy Code C405.10
- Electrical panel schedules showing individual loads in VA or KVA and the A.I.C. rating.
- A riser or one-line diagram with wire and raceway size, type and grounding methods.
- Electrical load calculations, including a load summary showing connected loads and all demand/diversity factors.
- Fault current calculations through the sub-panelboard level.
- Lighting budget calculations per the 2021 [Washington State Energy Code](#).
- Selective coordination information for emergency, legally required and elevator systems.
- Arc flash hazard calculations, where required (see [Arc Flash Calculations](#)).
- PV system one-line and module description sheet.

## Electrical Load Calculations

- Breakdown of connected loads into proper NEC categories (lighting, receptacles, motors, HVAC, kitchen equipment, appliances, etc.).
- NEC demand factors applied to each category of load.
- Total connected load in VA or KVA.
- Total calculated load in amps and KVA.
- Panel schedule worksheet completed for all panelboards.
- Starting loads for the worst case (max. starting loads with everything starting that is required to start at the same time) and any starting variables (soft start, variable frequency drives, etc.) for the emergency, legally required and optional standby systems.

## Fault Current Calculations on the Riser Diagram

- Submit on the [Fault Current Calculations form](#) with enough information on the riser diagram to verify the calculations.
- Submit a Fault Current Summary (page 3 of the [Fault Current Calculations form](#)). A Fault Current Summary must include the following:
  - The starting fault current at the beginning of each conductor.
  - The ending fault current at the ending of the conductor.

# Electrical Plan Review Submittal Guide



- The conductor's impedance, size and length.
- The date when the study was performed
- The conduit type (metallic or non-metallic)
- The A.I.C. rating of the service, panelboards and overcurrent devices.
- Include utility transformer size in KVA, impedance (%Z), and available fault current.
- Complete fault current information through the subpanel board level or provide calculations to below the minimum AIC rating of the electrical equipment and overcurrent devices.
- Show available fault current on the one-line diagram for all nodes.
- Series rated systems - Circuit breaker model numbers for every panel or switchboard involving a series rated system are indicated on the one-line or the panel schedules. Please provide corresponding series rating charts from the manufacturer (with arrows indicating the breaker types) so the series rated system can be verified. This information should be provided in a systematic way as it relates to the one-line diagram, down to the point in the system that the fault current is less than the fully rated or series rated overcurrent protective device and gear

## Riser Diagram (one-line)

- Clearly identify the service point.
- Identify voltages and number of phases.
- Identify the service conduit(s) size and type, number of parallel runs, conductor(s) size and type, insulation type and number of conductors.
- Indicate the service equipment ampacity, A.I.C. rating and the A.I.C. ratings of the overcurrent protection.
- Indicate points (nodes) at line and load points along the one-line diagram. The nodes should state the AIC levels at key points of terminations of electrical equipment.
- Indicate the ground fault protection of equipment when required.
- Indicate the size of the grounded service conductor for the maximum unbalanced load.
- Identify the grounding electrode system, including concrete encased electrode, the sizing of the grounding electrode conductor and main bonding jumper for the service equipment.
- Identify the feeder conduit(s) size and type, conductor size and type and number of conductors.
- Type of equipment grounding conductor and equipment bonding jumper for feeder(s), size if applicable.

# Electrical Plan Review Submittal Guide



- Panelboard(s) ampacity, A.I.C. rating and overcurrent protection.
- Transformer(s) secondary tap conductor length to overcurrent protective device.
- Grounding electrode system and grounding electrode conductor for transformer(s).
- Size of equipment bonding jumper and system bonding jumper for the transformer(s).
- Overcurrent protection of transformer(s) complies with NEC 450-3 and overcurrent protection of secondary taps per 240.21.
- Identify all fuse types (class type).

## Floor Plan (Lighting)

- Indicate the type and location of all lighting fixtures on the electrical plans.
- Indicate all required switch locations on the electrical plans.
- Home-run conduit(s) show the size, type and number of conductors.
- Branch circuit(s) are properly sized for the load.
- Clearly note emergency lighting on plans.
- Unit equipment used for egress lighting complies with NEC 700-12(e).

## Energy Code Compliance

- Electrical plans correspond to the lighting summary; including number and wattage of the lighting fixtures, type of lighting fixture, the occupancy type and the watts per square foot allowed specifically based on the building area. Use the [space by space method or the building area method](#).
- Lighting control complies with the 2021 [Washington State Energy Code](#).
- Complete a [lighting summary form](#).

## Floor Plan (Power)

- Indicate the location of all switchboards, panelboards and transformers on plans.
- All electrical equipment has working clearance shown, as required by NEC Article 110.
- Receptacle outlet locations. Receptacles required by local amendments, for rooftops, show windows, etc., and as required by NEC 210.52 and Kirkland Electrical Code.
- Submit an electrical equipment schedule with the electrical plans.

# Electrical Plan Review Submittal Guide



- Indicate locations for all motors, compressors, heaters, stationary appliances, etc., on electrical plans.
- Branch circuit(s) are properly sized for the load.
- Transformers over 112.5 KVA require 1 hour rated construction surrounding them.
- Diagram of any transformer vaults including drain pipes, curbing, venting and fire ratings.

## Panel Schedules

- Panelboard(s) are identified by naming convention and consistent throughout the plans.
- Show panelboard busbar rating in amps.
- Show panelboard voltage rating.
- Show main breaker size or main lug only.
- Note double lugs or feed-through lugs on the panel schedule.
- Provide a description or coding for each branch circuit (motors, lighting, general-use receptacles, etc.).
- Show the connected load of each branch circuit is in VA or KVA.
- Show the total connected load in VA or KVA.
- Demand load totals with each branch circuit are denoted with a designator as to what kind of load it is (lighting, motor, general-use receptacle, specific-use receptacle, etc.).
- Note the A.I.C. rating of the panelboard and overcurrent devices.
- Time/current curves showing compliance with the selective coordination requirements for elevators and escalators, emergency, legally required systems, and essential electrical systems in health care facilities are included.
  - Provided for both the normal power and emergency/legally required standby sides of the automatic transfer switch(es).
  - For elevators and escalators, this shall be shown to the next common overcurrent device (common to more than one driving machine) above the elevator overcurrent device to the level of .01-time line, for emergency and legally required systems to the .01 timeline and for essential electrical systems in health care facilities to beyond the .1 timeline.
- Indicate [Arc flash hazard calculations](#) where required.

# Electrical Plan Review Submittal Guide



## Emergency, Legally Required Standby or Optional Standby Systems

- Indicate generator capacity and voltage, including starting and running capacity.
- Indicate UPS capacity and voltage.
- System is properly sized for the load.
- Indicate that the room housing the emergency generating system has a 2-hour fire rating (NFPA 20) and the emergency system is totally separate from all other systems.
- Individual transfer switches are required.
- The grounding electrode conductor is properly sized (when required for separately derived systems). State the number of poles in the transfer switch.
- Note signage as required by NEC.
- Selective coordination of overcurrent protective devices for emergency and legally required systems down to the .01 timeline – overlaid time/current curves for each branch from each power source to each branch circuit overcurrent protective device on one sheet.
  - 2-hour protection of the pressurization fan circuit(s) from the emergency generator to the fan is provided.
- Provide separation of the pressurization circuits from other electrical system components.
- On a high-rise building with electrical fire pumps - calculate into the generator load calculation and service load calculation if fed through the service.
- Provide 2-hour protection for feeders from emergency generator to fire service elevators.

## Peak Demand Records (NEC 220.87 or WCEC 220.87(1) exception)

- Show starting and ending dates of the metering.
- Clearly show the highest reading of the metering period.
- Show calculation per 220.87.
- Show the power factor adjustment, when necessary.
- Explain the details of seasonal and occupancy adjustment factors.
- Include utility demand records or recordings of demand metering for the peak period with submittal.
- Include the signature of the administrator or engineer who took the readings.

# Electrical Plan Review Submittal Guide



## Healthcare Facilities

- Clearly define the area use (dental, medical, chiropractic, etc.).
- Indicate the ceiling height as it pertains to a patient care area.
- Clearly define the rooms uses (patient room, nurses' station, critical care, general care, etc.).
- One-line showing separate transfer switches for equipment, life safety and critical branches.
- Show ground fault protection where required and at the next level as required.
- Show wiring methods in patient care areas.
- Selective coordination of overcurrent protective devices for the emergency and essential electrical system and sub-feeds (where required).

## Hazardous Locations

- Clearly define the area use and where the classified location starts and stops.
- Show the wiring methods (type of conduit).
- Identify the location of sealing fittings, where required (class 1, div.1, etc.).
- Indicate the depth of buried conduit.
- Diagram of sump pump showing motors, drainpipes and all chambers.

## Smoke Control Systems

High rises, places of assembly of 1,000 or more persons and other building types, where required

- Panel schedule (industry standard type) for the emergency panel with connected and demand loads.
- Provide a schedule of smoke control components showing the equipment, the load in amps or volt-amps, the conduit type and size, conductor type and size, and breaker type and size.
- Provide floor plans showing the location of the smoke control components.
- Show all emergency system wiring methods pertaining to smoke control.
- Provide a schedule of individual smoke control components running loads.
- Show the total combined loads of smoke control components for start-up and run (start-up and run shown separately).
- Identify the color marking, protection and routing of the conduit from the generator to the pressurization fan(s).

# Electrical Plan Review Submittal Guide



## Arc Flash Hazard Calculation

Provide: (1) the incident energy level calculation in cal/cm squared at 18" from the flash hazard; (2) the flash hazard category; (3) the flash hazard boundary for each service, distribution board and panel; and (4) the date the arc flash calculation was done. Provide this in a cascading format relating to the one-line or riser showing:

- the device rating and identification
- the voltage
- the arc duration
- the bolted fault current or the available fault current

The nomenclature used must match the one-line diagram for panel/ distribution identification. Refer to Kirkland Electrical Code 110.16. Equipment labeling shall be per the requirements in 2018 NFPA 70E, 130.5(H).

Verification of the calculation will not be required where it is stamped and signed by an electrical engineer currently licensed in the State of Washington.

A deferred submittal of the required Arc Flash Hazard Calculation may be approved only when the manufacturer of the Electrical Distribution Equipment has not been determined at the time of your electrical plan submittal, and you meet the following conditions.

- A note must be included on the one-line diagram stating that you are choosing this option.
- An Arc Flash Hazard Calculation must be submitted as a post issuance revision to your approved plans and approved before the installation of your electrical distribution equipment begins.

Provide the arc flash values stated above on the one-line for each service, distribution board and panel.

## Electric Vehicle Charging Systems

- Provide the level of the supply equipment.
- Provide a site or floor plan with location of the system including physical protection specifics, if required.
- Conduit and conductor sizes to the outlets or equipment.
- Show ratings of the equipment.
- Panel schedule with demand and connected load.

## Photovoltaic Systems – NEC and WAC 51-54A-0605

- One-line diagram of the system showing conduit and conductor sizes, connection to the

# Electrical Plan Review Submittal Guide



existing service, overcurrent size(s) (see examples below).

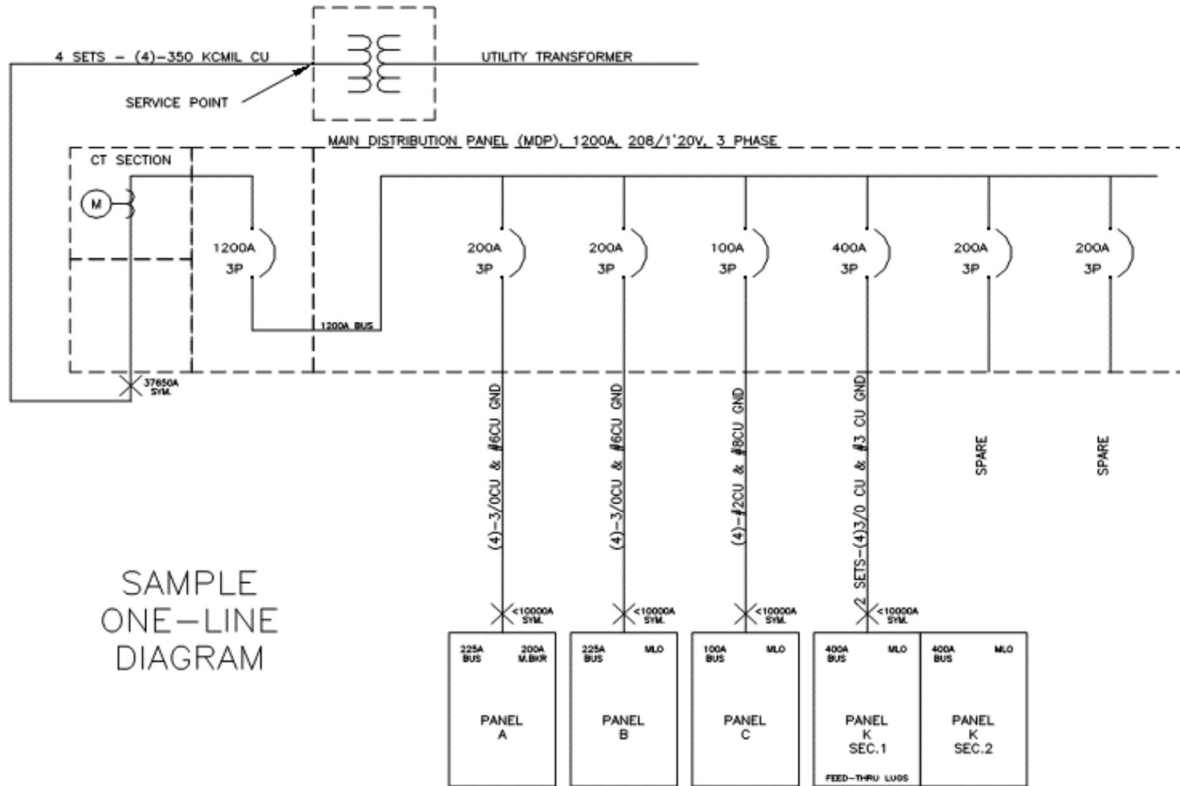
- Grounding electrode conductor sizes and location of connection(s) to the system.
- Physical location of the inverter.
- Plan view of the array layout on the roof (clearly showing setbacks from the roof edge and peak).
- Spec sheet showing the power ratings, etc.
- Penetration location of the conductors into the house or attic.
- Derating calculation of the conductors on the roof and/or in the attic.
- Panels/modules installed on residential buildings with roof hips and valleys shall be located no closer than 18 inches (457mm) to a hip or valley where panels/modules are to be placed on both sides of a hip or valley.
- Panels/modules installed on residential buildings shall be located no higher than 18 inches (457mm) below the ridge.
- Pathways: Not fewer than two pathways, on separate roof planes from lowest roof edge to ridge and not less than 36 inches (914 mm) wide, shall be provided on all buildings.
- Setback at ridge: For photovoltaic arrays occupying not more than 33 percent of the plan view total roof area, no less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge. For photovoltaic arrays occupying more than 33 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.
- Fire Classification: Rooftop-mounted photovoltaic panel systems shall have the same fire classification as the roof assembly required in Section R902.
- Panel schedule(s) showing loads in demand and connected KVA.
- Show method of the connection per NEC article 705.12.

## Questions

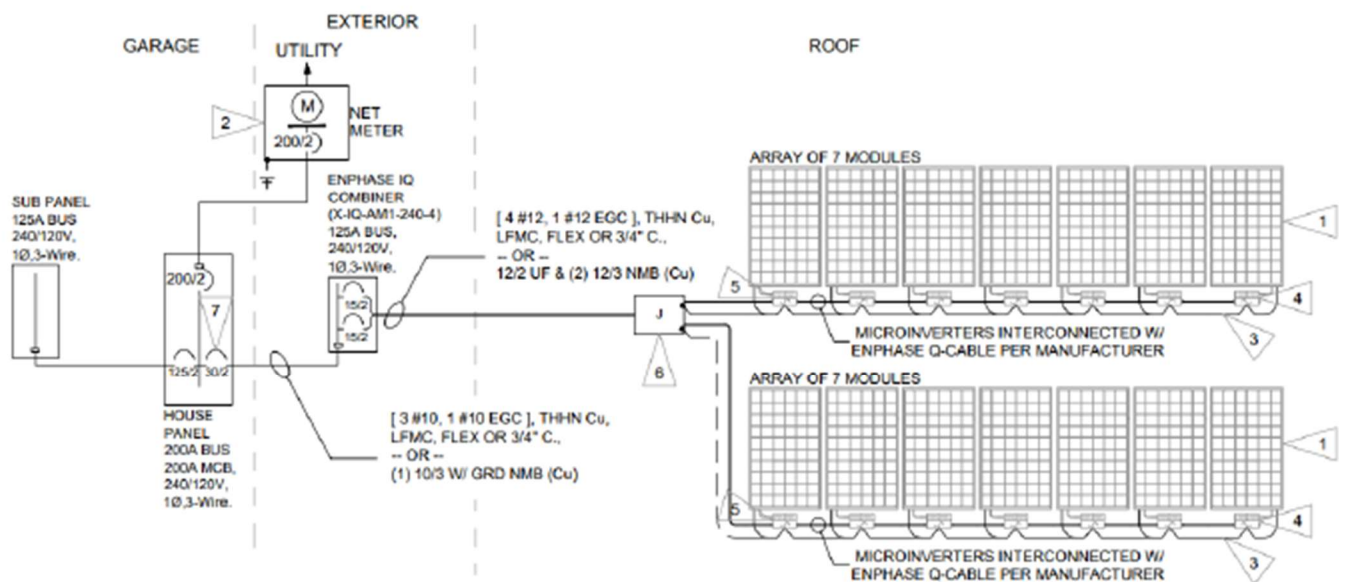
If you have comments, questions or concerns about the City of Kirkland's electrical plan review program, please contact:

Laszlo Farkas  
Sr. Electrical Plan Examiner  
Planning & Building Department  
425-587-3648 – Desk  
lfarkas@kirklandwa.gov

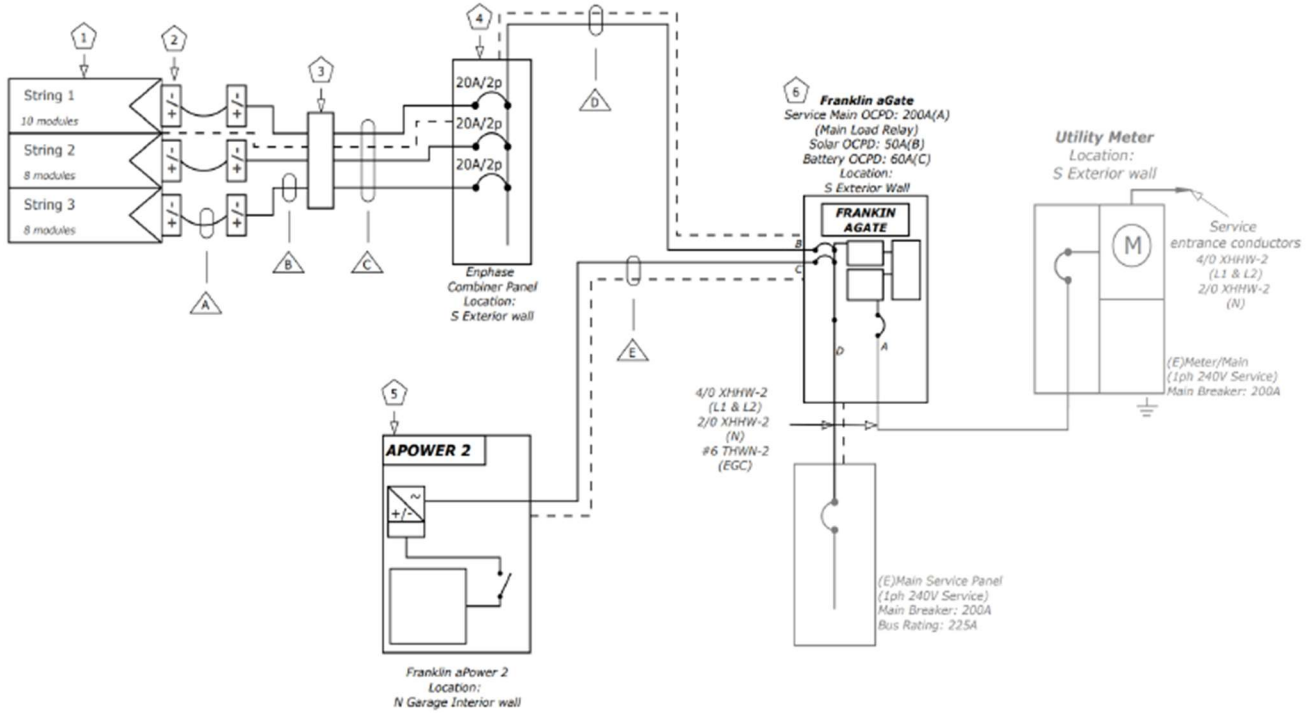
# Electrical Plan Review Submittal Guide



SAMPLE ONE-LINE DIAGRAM



# Electrical Plan Review Submittal Guide



**NOTES for Residential Small Scale PV System Electrical Diagram**

Permit #: \_\_\_\_\_ Date: \_\_\_\_\_

Contractor: \_\_\_\_\_

Job Address: \_\_\_\_\_

Contact Name: \_\_\_\_\_

Contact Phone: \_\_\_\_\_

**SIGNS**

**SIGN FOR DC DISCONNECT**

PHOTOVOLTAIC POWER SOURCE

RATED MPP CURRENT	A
RATED MPP VOLTAGE	V
MAX SYSTEM VOLTAGE	V
MAX CIRCUIT CURRENT	A

WARNING: ELECTRICAL SHOCK HAZARD—LINE AND LOAD MAY BE ENERGIZED IN OPEN POSITION

**SIGN FOR INVERTER OCPD AND AC DISCONNECT (IF USED)**

SOLAR PV SYSTEM  
AC POINT OF CONNECTION

AC OUTPUT CURRENT	A
NOMINAL AC VOLTAGE	V

THIS PANEL FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)

**PV MODULE RATINGS**

MODULE MAKE	
MODULE MODEL	
MAX POWER-POINT CURRENT ( $I_{mp}$ )	A
MAX POWER-POINT VOLTAGE ( $V_{mp}$ )	V
OPEN-CIRCUIT VOLTAGE ( $V_{oc}$ )	V
SHORT-CIRCUIT CURRENT ( $I_{sc}$ )	A
MAX SERIES FUSE (OCPD)	A
MAXIMUM POWER ( $P_{max}$ )	W
MAX VOLTAGE (TYP 600V <sub>DC</sub> )	V
VOC TEMP COEFF (mV/°C □ or %/°C □)	
IF COEFF SUPPLIED, CIRCLE UNITS	

**INVERTER RATINGS**

INVERTER MAKE	
INVERTER MODEL	
MAX DC VOLT RATING	V
MAX POWER @ 40°C	W
NOMINAL AC VOLTAGE	V
MAX AC CURRENT	A
MAX OCPD RATING	A

LOWEST EXPECTED AMBIENT TEMP: \_\_\_\_\_ °C

HIGHEST CONTINUOUS TEMPERATURE: \_\_\_\_\_ °C

NEC 690.8(B) Photovoltaic system currents shall be considered continuous.

NEC 690.8(B)(1) The circuit conductors and overcurrent devices shall be sized to carry not less than 125 percent of the maximum currents calculated in 690.8(A).

Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be utilized at 100 percent of its rating.

All signage and markings shall be a phenolic or metallic plate or other similar material in block letters 1/4 inch or greater in height, and suitable for the environment. Letters and background shall be in contrasting colors. Screws, rivets or other approved means shall be used to affix plates to equipment.

INVERTER Maximum Current	OCPD Size	PANELBOARD	
		Main Bus	Main OCPD
56 amps	70 amps	225 amps	200 amps
36 amps	45 amps	225 amps	225 amps
33 amps	40 amps	200 amps	200 amps
24 amps	30 amps	150 amps	150 amps
20 amps	25 amps	125 amps	125 amps
16 amps	20 amps	100 amps	100 amps