

MARINER'S VILLAGE III SOLAR PHOTOVOLTAIC SYSTEM DESIGN GUIDELINES EXHIBIT A

General Requirements

The design of the on-site solar photovoltaic (PV) system will be the responsibility of the Owner; however, the system must be compliant with all applicable state, federal, and city codes plus the Mariner's Village III Architectural Design Guidelines. This Exhibit delineates the minimum technical and installation specifications required by Mariner's Village III (MVIII) for this Project. It is the intent of these design guidelines to ensure that the PV systems installed are consistent with and adheres to any and all Building Codes and standards, local and national electrical codes, applicable utility rules, any and all technical installation specifications and guidelines as developed and established.

Prior to the MVIII Architectural Review Application (Attachment A) submission to the MVIII Board, the Owners, Contractor Bidders, and Contractors/Installers are required to be familiar with this Exhibit, MVIII rules and regulations, requirements and specifications as they pertain to the installation of solar PV systems in the Mariner's Village III community. See checklist in Attachment B.

Owners must retain an installer that is a contractor licensed in the State of Hawaii. The installer must ensure that the system design is in compliance with the MVIII Architectural Guidelines and all applicable codes; electrical and structural. All construction documents must be stamped by a licensed professional engineer(s) and/or architect in good standing with the State of Hawaii.

Approval from the MVIII Board is required prior to procuring any material and starting the construction/installation of the PV system.

Prohibitions

1. No skylights or windows may be installed at the project as solar energy devices.
2. Only an owner may install a solar energy device at the project. No tenant or other resident may install a solar energy device on a living unit at the project except with the written permission of the owner, and the owner must: (i) submit the application form on behalf of the tenant; and (ii) assume all responsibilities imposed by these rules and the law on an owner who installs a solar energy device.
3. No owner may trim any vegetation/landscaping on the common areas in connection with the installation of a solar energy device without the prior written permission of the Board.
4. ***An owner may only install a solar energy device above the owner's living unit or carport.***
5. No solar energy device may be placed on a common area, unless the owner first obtains the written consent of the Board and otherwise meets the requirements of these rules and the law.
6. No water tanks may be installed on the roof, therefore passive solar water heaters are prohibited.

Preconstruction Requirements

1. Inclination (Tilt or Roof Pitch) of Proposed Array Location

- a. The energy output of a solar energy system is optimized by designing the array to be tilted on an incline that approximately matches the degrees of the geographic latitude of the array's location; significant deviations from this tilt can result in system performance losses. Although system arrays (panels or collectors) can be racked up to meet the inclination/tilt needed for optimal system output, this design guideline is based on and limited to the known existing building attributes (roof pitch). For the purpose of this design guideline, building mounted arrays are required to be mounted flush with the existing roof surface found at the proposed array location.

2. Application

Any owner proposing to install a solar energy device must:

- a. Submit a fully completed copy of the Association's solar energy device installation form (attached) and obtain Board consent prior to beginning the installation.
- b. Hire a contractor licensed in the State of Hawaii to install the solar energy device.
- c. Obtain a building permit for the installation of the solar energy device.
- d. Confirm in writing that the solar energy device will be installed in accordance with HEEP Standards, except as otherwise permitted or required by these rules.
- e. Have the owner's contractor confirm in writing that the area on which the solar energy device is to be installed can support the weight of the device (see paragraph entitled "Structural & Safety Requirements" for detailed requirements).
- f. If a roof warranty for materials or labor exists at the time of the proposed installation of the solar energy device, provide written confirmation from the company which issued the roof warranty that installing the solar energy device will not void the warranty. Contact the Board or the Managing Agent for details about the roof warranty.

Infrastructure Requirements

1. Generally

Except as permitted in Paragraph 9 below, an owner installing a solar energy device at MVIII must:

- a. To the maximum extent possible, consistent with the effective functioning of the solar energy device, install the solar energy device flat on the roof immediately above the owner's living unit.
- b. Integrate the solar energy device installation into the architecture and design of the building and make the solar energy device as visually unobtrusive as possible. (For example, no part of the solar energy device installation, including the panels, any piping, or any other exposed part of the installation may be higher than the peak of the roof on which the solar energy device is mounted.)
- c. Ensure that none of the exposed parts of the solar energy device have reflective surfaces and paint all exposed surfaces to match the surface on which the solar energy device is mounted. (Owners shall be responsible for ensuring that the painted surfaces are properly maintained to prevent peeling and cracking of the paint.)
- d. Ensure that any pipes or other part of the solar energy device that must be installed on the walls of the living unit are enclosed with material that is similar in color and texture to the walls.
- e. If a water heater or storage tank will not fit in the existing location of the living unit's water heater: (1) install the tank in the location approved by the Board; and (2) enclose the tank or heater so that it is not visible from outside the owner's living unit.

2. **Micro Inverters**

- a. Micro inverters shall be used in lieu of the larger inverters.

3. **Conduit for the DC Wire Run from the Array to Micro Inverter Locations**

- a. The contractor shall install a 1" (inch) minimum metal conduit from the designated array location to the designated inverter location with the end of the conduit clearly labeled as a component and indicating its purpose and intended use. The conduit run should be identified on electrical and architectural construction documents to be provided to the Owner.
- b. The conduit should:
 - i. Be located in an area that provides sufficient accessibility and clearance for a solar installer to continue the conduit run above the roof deck to the solar array area.
 - ii. Recommend having three or fewer 90-degree turns from the panels/micro inverters to the designated plywood area or provide for accessible pull boxes, as required by the National Electric Code.
 - iii. To facilitate the wiring of the solar PV system at a later date, the contractor should also include a pull line in the conduit, particularly if the overall conduit run is lengthy or has multiple bends.

4. **Conduit for AC Wire Run from Designated Inverter Location to Electrical Service Panel**

- a. The contractor shall install a 1" (inch) minimum metal conduit from the designated inverter location to the main service panel where the system is intended to be tied into the home's electrical service. The conduit should be capped and clearly labeled as a component on the stubbed end near the inverter location. The conduit run should be identified on electrical and architectural construction documents to be provided to the Owner.
- b. To facilitate the wiring of the solar PV system at a later date, the contractor may also want to include a pull line in the conduit, particularly if the conduit run is lengthy or has multiple bends.
- c. The AC unit disconnect must be located no more than 10 feet away from the existing electrical meter.

5. **Conduit Location on Roof**

- a. Designer, Contractor, and PV installer should collaborate during the design phase on location of all exposed conduits on the roof to ensure the heat gain within the conduit does not have a negative impact on the wiring. When possible, exposed conduits should be located under the panels to minimize conduit to direct sun exposure.

6. **Circuit Breaker for Use by PV System in Electrical Service Panel**

- a. The contractor should install and label slots suitable for a 70-amp double pole breaker in the electric service panel for use by the solar PV system or as directed by the solar PV installer.
- b. The contractor should reserve and designate space in the electrical service panel, or an appropriate subpanel, for a double pole circuit breaker. The circuit breaker should be installed and labeled for use by the PV system or as directed by the solar PV installer.

7. **Modules**

- a. PV modules must be listed on the Hawaii Energy Commission's PTC list and must qualify for eligibility under the Hawaii Solar Initiative Program.
- b. System must comply with IEEE 1262 "Recommended Practice for Qualifications of Photovoltaic Modules".

8. Electric Power Requirements:

- a. Power provided must be compatible with the onsite distribution system.
- b. The system must include all the hardware needed for the solar PV.
- c. All systems must be installed in accordance with all applicable code requirements of all local/national electrical codes and standards:
 - i. National Electrical Code (NEC), including but not limited to Article 690, Solar Photovoltaic Systems – NFPA 70 and Article 705 – “Interconnected Electrical Power Production Sources”.
 - ii. Uniform Solar Energy Code - ICC
 - iii. Systems must be designed and installed using UL or ETL listed components, including mounting systems.
 - iv. Modules must be certified to UL 1730 – “Flat-Plate Photovoltaic Modules and Panels”.
- d. Other technical codes that will apply include:
 - i. AMSE PTC 50 (solar PV performance)
 - ii. ANSI Z21.83 (solar PV performance and safety)
 - iii. NFPA 853 (solar PVs near buildings)
 - iv. NEPA 70 (electrical components)
 - v. IEEE 1547 (interconnections)
 - vi. National Electrical Safety Code – ANSI C2 - 1999
 - vii. All applicable State Building Codes and requirements
- e. All balance of systems (wiring, component, wiring, conduits, and connections) must be suited for conditions for which they are to be installed. Micro inverters shall be installed under PV modules.

9. If compliance with the above rules will: (1) render the owner’s solar energy device more than twenty-five per cent less efficient; or (2) increase the cost of installing the device by more than fifteen per cent, the owner may ask the Board for an exemption from those requirements. That exemption may include the right to install the solar energy device or part thereof: (1) in a different location; or (2) at a different angle/elevation. In making the request, however, the owner shall have the burden of proving that compliance with any of the above requirements will either render the solar energy device more than twenty-five per cent less efficient or increase the cost of installing the device by more than fifteen per cent. Note that an owner will not be permitted to install a solar energy device on the roof above any other owner’s living unit.

Structural & Safety Requirements

- 1. All structures and structural elements, including array structures, shall be designed in accordance with all applicable Building Codes and standards pertaining to the erection of such structures.
- 2. The Owner shall provide structural calculations, stamped by a licensed professional structural engineer in good standing with the State of Hawaii.

3. Document the maximum allowable dead and live load ratings of the existing roof:
 - a. The Owner to submit code-compliant documentation of the structural capacity of the existing roof and of the current dead loads on the roof. This documentation should demonstrate that the roof has the capacity to support a minimum of 6 pounds per square foot additional dead load for a future PV system.
 - b. A conventional PV system that includes racking materials will add approximately 6 pounds per square foot of dead load to the roof or structure, though actual weights can vary for different types of systems.
 - c. Wind will add live loads; the magnitude of live loads will depend on the geographic region and the final PV system. It is recommended that the roof has the capacity to support a minimum of 6 pounds additional dead load for a future PV system.
 - d. The Owner shall ensure that these future loads are accounted for in the design of the roof and provide design drawings and/or calculations, prepared in conformance and in a format that is acceptable to the Honolulu City & County Department of Planning & Permitting. At a minimum, these documents must include specific documentation of dead loads, live loads, and wind loads for the existing roof design. These plans will provide important information for the solar designer when the homeowner decides to install a system. Please note that a low sloped roof, a 4:12 pitch or lower, may require additional reinforcement beyond what is typically found in a conventional framing or truss design.
4. Install permanent roof anchor fall safety system on sloped roofs. It is required that the Owner install a fall safety system on roofs with a pitch greater than 3:12.
5. The process of installing a PV system on a sloped roof carries inherent risk. A permanent roof anchor fall safety system is required on roof pitches steeper than 3:12 to provide adequate protection to installers (see Figures 1 & 2). The roof anchor should be installed on a roof subsurface per manufacturer recommendations. Owners to coordinate location of permanent roof anchors so they are installed in a uniform location across all roofs on the building.



Figure 1: Single-D Roof Anchor



Figure 2: Roof Anchor Installed on a Roof Subsurface

6. The permanent roof anchor shall meet the federal requirements of the Occupational Safety and Health Administration (OSHA). The fall safety system shall also be compliant with ANSI standard A10.14: Construction and Demolition Operations—Requirements for Safety Belts, Harnesses, Lanyards, and Lifelines for Construction and Demolition Use. All structural components, including array structures, shall be designed in a manner commensurate with attaining a minimum 25 year design life. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.
7. The structural design should provide for easy and cost effective repair or replacement of the roof. Owners are responsible to remove and replace roof mounted solar systems at their sole expense to allow for major roofing maintenance, including installing a new roof, gutters, and downspouts.
8. Any roof penetrations must be designed and constructed in collaboration with the roofing professional or manufacturer responsible for the roof and roofing material warranty for the specific site, to ensure that the existing roof warranty is not

invalidated by the installation of the PV system. Documentation required from roofing professional acknowledging the warranty is not invalidated with PV design and roof penetrations. A copy to be submitted to the Mariner's Village III Resident Manager prior to starting any procurement of materials and construction.

9. For rooftop installations where there is no parapet or the parapet is less than 42", a 2'-0" safety zone from the roof edge to the PV system must be maintained. A 1'-0" minimum clear path of travel must be maintained to and around all rooftop equipment. All adjacent building setbacks of 1'-0" minimum must be maintained as well to meet the Mariner's Village III Architectural Guidelines.
10. Any modification to the roof that is required under this section (including, but not limited to, roof anchors and roof reinforcement) must be **approved by the Board prior to installation**. An owner who does not comply with this requirement may be required to remove any equipment that the owner installed on the roof at the owner's expense and to restore the roof to its condition prior to the installation.

Architectural Drawings and Riser Diagram Requirements for PV System

1. The designer/contractor should develop architectural drawings and diagrams that summarize the installed system equipment (conduit, etc.). These drawings should accurately represent the installed elements of the system and should be provided to the Owner to secure necessary building permits. Owner shall provide structural and electrical calculations, stamped by a licensed professional engineer(s) in good standing with the State of Hawaii.
2. The contractor should provide a basic architectural drawing or diagram to the Owner summarizing where the equipment is located within the building and/or unit. The contractor should also provide the Owner with a one-line electrical riser diagram of the PV system components. The diagram should have sufficient detail to clearly identify:
 - a. Conduit size and type
 - b. Electrical service panel location and dedicated circuit breaker slots
 - c. Length of conduit from the designated array location to the designated inverter location
 - d. Location and number of necessary pull boxes in line with each conduit run
 - e. Length of conduit from the designated inverter location to the electrical service panel

Operation and Maintenance Requirements

1. Owners shall:
 - a. Within fourteen days of obtaining approval for the installation of the solar energy device, provide the Board with a certificate of insurance from a company admitted to do business in Hawaii, naming the Association as an additional insured on the owner's insurance policy.
 - b. Register the completed solar energy device installation with the Board within thirty days of its installation.
 - c. Confirm in writing that the solar energy device has been installed in accordance with HEEP Standards, except as otherwise permitted or required by these rules.
2. The Owner will be responsible for the operation and all maintenance of the solar PV system at the Owner's own cost.
3. A Mariner's Village III Maintenance Agreement is required to be completed by the Owner as it relates to the requirements.
4. The Owner shall provide notification to the Mariner's Village III Residential Manager as early as practical, but in no event less than ten (10) business days, prior to any planned maintenance and repairs. The Owner will provide a minimum of ten

(10) business days notification to the Mariner's Village III Resident Manager and all Owners in the same townhouse building if any planned repairs or maintenance will result in any disruption to the building's electrical load.

5. If a solar energy device is placed on a common area, the owner and each successive owner of the living unit on which the device is placed shall be responsible for:
 - a. Any costs for damages to: (1) the device; (2) the common areas; or (3) any adjacent living units, arising or resulting from the installation, maintenance, repair, removal, or replacement of the device.
 - b. Any repair, maintenance, removal, and replacement of the solar energy device, for as long as the solar energy device remains on the common area.
 - c. Removing the solar energy device if necessary for the repair, maintenance, or replacement of the common areas. Owners of the solar energy device are responsible for all increase in repair and maintenance costs to the common areas caused by the solar energy device.
6. Because the solar PV system will be privately-owned, Mariner's Village III will not provide any maintenance. All system warranties and workmanship guarantees are the responsibility of the Owner.
7. As part of the acceptance of the solar PV system, the Owner shall ensure the Mariner's Village III Resident Manager is present during the final turnover of the PV system. The PV installer required to give the Owners training on basic operational functions and provide operations manuals to the Mariner's Village III Resident Manager on how to shut down the solar PV system in the event of an emergency. The Owner shall ensure that emergency first responders can easily identify what to do in the event of an emergency and be able to perform these tasks quickly and safely.
8. The Board may require the removal of a solar energy device that threatens the health or safety of project residents.
9. Upon the transfer of ownership of a living unit, the new owner shall be obligated to comply with these rules. The owner and each successive owner shall at all times maintain a policy of insurance covering the obligations of the owner under these rules. The policy shall name the Association as an additional insured under the policy, and the owner shall provide the Board with a certificate of insurance confirming that the policy is in effect.