

RESIDENTIAL SOLAR ENERGY SYSTEMS



This handout is based on RCW 19.27, known as the "Washington State Residential Code". The handout includes portions of the International Residential Code (IRC), and may include portions of other codes adopted by statute, publications, as well as Klickitat County Ordinance and policies. Any portion of this document presuming to give authority to violate, ignore or cancel the provisions of codes adopted by Klickitat County shall not be valid.

If your property is located in the National Scenic Area, the Columbia River Gorge Commission requires you to comply with all National Scenic Area regulations. They can be contacted at (509) 493-3323.

Definitions

ALTERATION. Any construction, retrofit or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that require a permit.

BUILDING-INTEGRATED PHOTOVOLTAIC PRODUCT. A building product that incorporates photovoltaic modules and functions as a component of the building envelope.

BUILDING-INTEGRATED PHOTOVOLTAIC ROOF PANEL (BIPV Roof Panel). A photovoltaic panel that functions as a component of the building envelope.

ENERGY STORAGE SYSTEMS (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

PHOTOVOLTAIC MODULE. A complete, environmentally protected unit consisting of solar cells, optics and other components, exclusive of a tracker, designed to generate DC power where exposed to sunlight.

PHOTOVOLTAIC PANEL. A collection of photovoltaic modules mechanically fastened together, wired, and designed to provide a field-installable unit.

PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete photovoltaic panels that convert solar radiation into electricity, including rack support systems.

PHOTOVOLTAIC SHINGLES. A roof covering that resembles shingles and that incorporates photovoltaic modules.

SOLAR ENERGY SYSTEM. A system that converts solar radiation to usable energy, including photovoltaic panel systems and solar thermal systems.

SOLAR THERMAL COLLECTOR. Components in a solar thermal system that collect and convert solar radiation to thermal energy.

SOLAR THERMAL SYSTEM. A system that converts solar radiation to thermal energy for use in heating or cooling.

STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages that constitute an automatically-operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

SOLAR ENERGY SYSTEMS

R324.1 General. Solar energy systems shall comply with the provisions of this section.

R324.2 Solar thermal systems. Solar thermal systems shall be designed and installed in accordance with Chapter 23 and the International Fire Code.

R324.3 Photovoltaic systems. Installation, modification, or alteration of solar photovoltaic power systems shall comply with this section and the International Fire Code. Section R104.11 shall be considered when approving the installation of solar photovoltaic power systems. Photovoltaic systems shall be designed and installed in accordance with Section R324.3.1 through R324.6 and Chapter 19.28 RCW. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

R324.3.1 Equipment listings. Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

R324.4 Rooftop-mounted photovoltaic systems. Rooftop-mounted photovoltaic panel systems installed on or above the roof covering shall be designed and installed in accordance with Section R907.

Exception: The roof structure shall be deemed adequate to support the load of the rooftop solar photovoltaic system if all of the following requirements are met:

1. The solar photovoltaic panel system shall be designed for the wind speed of the local area, and shall be installed per the manufacturer's specifications.
2. The ground snow load does not exceed 70 pounds per square foot.
3. The total dead load of modules, supports, mounting, raceways, and all other appurtenances weigh no more than 4 pounds per square foot.
4. Photovoltaic modules are not mounted higher than 18" above the surface of the roofing to which they are affixed.
5. Supports for solar modules are to be installed to spread the dead load across as many roof-framing members as needed, so that no point load exceeds 50 pounds.

R324.4.1 Structural requirements. Rooftop-mounted photovoltaic panel systems shall be designed to structurally support the system and withstand applicable gravity loads in accordance with Chapter 3. The roof on which these systems are installed shall be designed and constructed to support the loads imposed by such systems in accordance with Chapter 8.

R324.4.1.1 Roof load. Portions of roof structures not covered with photovoltaic panel systems shall be designed for dead loads and live loads. Portions of roof structures covered with photovoltaic panel systems shall be designed for the following load cases:

1. Dead load (including photovoltaic panel weight) plus snow load.
2. Dead load (excluding photovoltaic panel weight) plus roof live load or snow load, whichever is greater.

R324.4.1.2 Wind load. Rooftop-mounted photovoltaic panel or module systems and their supports shall be designed and installed to resist the components and cladding loads as specified in the code.

R324.4.2 Fire classification. Rooftop-mounted photovoltaic panel systems shall have the same fire classification as the roof assembly required.

R324.4.3 Roof penetrations. Roof penetrations shall be flashed and sealed.

R324.5 Building-integrated photovoltaic systems. Building-integrated photovoltaic systems that serve as roof-coverings shall be designed and installed in accordance with Section R905.

R324.6 Roof access and pathways. Roof access, pathways and setback requirements shall be provided. Access and minimum spacing shall be required to provide emergency access to the roof, to provide pathways to specific areas of the roof, provide for smoke ventilation opportunity areas, and to provide emergency egress from the roof.

Exceptions:

1. Detached, nonhabitable structures, including but not limited to detached garages, parking shade structures, carports, solar trellises and similar structures, shall not be required to provide roof access.
2. Roof access, pathways and setbacks need not be provided where the code official has determined that rooftop operations will not be employed.
3. These requirements shall not apply to roofs with slopes of two units vertical in 12 units horizontal (17% slope) or less.

R324.6.2.2 Emergency escape and rescue opening. Panels and modules installed on dwellings shall not be placed on the portion of a roof that is below an emergency escape and rescue opening. A pathway not less than 36" wide shall be provided to the emergency escape and rescue opening.

R324.7 Ground-mounted photovoltaic systems. Ground-mounted photovoltaic systems shall be designed and installed in accordance with applicable design criteria.

R324.7.1 Fire separation distances. Ground-mounted photovoltaic systems shall be subject to the fire separation distance requirements determined by the local jurisdiction.

R324.6.2 Setback at ridge. For photovoltaic arrays occupying not more than 33% of the plan view total roof area, not less than an 18" clear setback is required on both sides of a horizontal ridge. For photovoltaic arrays occupying more than 33% of the plan view total roof area, not less than a 36" clear setback is required on both sides of a horizontal ridge.



R324.6.1 Pathways. Not fewer than two pathways, on separate roof planes from lowest roof edge to ridge and not less than 36" wide, shall be provided on all buildings. Not fewer than one pathway shall be provided on the street or driveway side of the roof. For each roof plane with a photovoltaic array, a pathway not less than 36" wide shall be provided from the lowest roof edge to ridge on the same roof plane as the photovoltaic array, on an adjacent roof plane, or straddling the same and adjacent roof planes. Pathways shall be over areas capable of supporting fire fighters accessing the roof. Pathways shall be located in areas with minimal obstructions such as vent pipes, conduit, or mechanical equipment.



R902.4 Rooftop-mounted photovoltaic panel systems. Rooftop-mounted photovoltaic panel systems installed on or above the roof covering shall be tested, listed and identified with a fire classification in accordance with UL 1703 and UL 2703. Class A, B or C photovoltaic panel systems and modules shall be installed in jurisdictions designated by law as requiring their use or where the edge of the roof is less than 3' from a lot line.

Panels and modules installed on dwellings shall not be placed on the portion of a roof that is below an emergency escape and rescue opening. A pathway not less than 36" wide shall be provided to the emergency escape and rescue opening.



Ground-mounted systems shall meet required fire-separation distances.

Maintain a clear area of 10' around panels

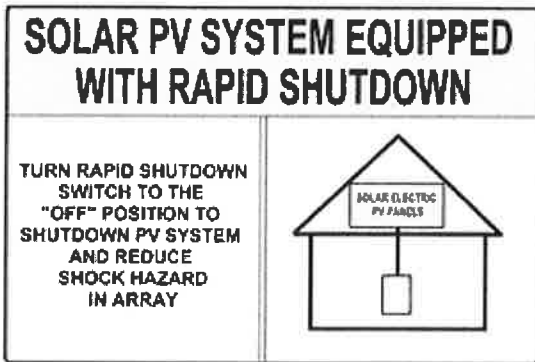
SOLAR THERMAL ENERGY SYSTEMS

Systems using thermal solar energy shall require stamped and signed engineering from an engineer licensed in the State of Washington. The installation shall comply with the manufacturer's instructions, **which shall be available at the time of inspection**. The system shall be designed to all applicable design criteria for the location of installation, and with all applicable requirements of Chapter 23 of the International Residential Code, with Washington State Amendments.

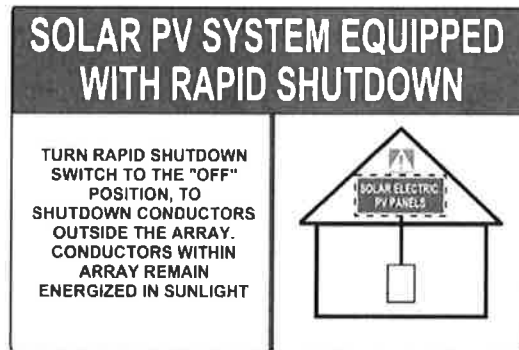
RAPID SHUTDOWN

IFC 1204.5.1 Rapid shutdown type. The type of solar photovoltaic system rapid shutdown shall be labeled with one of the following:

1. For solar photovoltaic systems that shut down the array and the conductors leaving the array, a label shall be provided. The first two lines of the label shall be uppercase characters with a minimum height of $\frac{3}{8}$ " in black on a yellow background. The remaining characters shall be uppercase with a minimum height of $\frac{3}{16}$ " in black on a white background. See example 1.
2. For photovoltaic systems that only shut down conductors leaving the array, a label shall be provided. The first two lines of the label shall be uppercase characters with a minimum height of $\frac{3}{8}$ " in white on a red background and the remaining characters shall be capitalized with a minimum height of $\frac{3}{16}$ " in black on a white background. See example 2.



Example 1

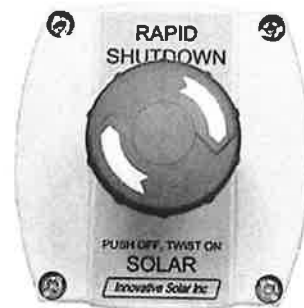
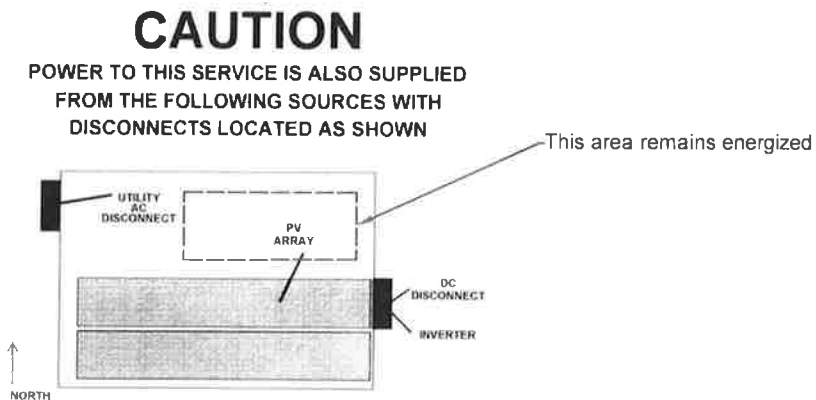


Example 2

The labels shall include a simple diagram of a building with a roof. Diagram sections in red signify sections of the solar photovoltaic system that are not shut down when the rapid shutdown switch is turned off. The label shall be located not greater than 3' from the service disconnect means to which the photovoltaic systems are connected, and shall indicate the location of all identified rapid shutdown switches if not at the same location.

Solar photovoltaic systems that contain rapid shutdown in accordance with both items 1 and 2, or solar photovoltaic systems where only portions of the systems on the building contain rapid shutdown, shall provide a detailed plan view diagram of the roof showing each different photovoltaic system and a dotted line around areas that remain energized after the rapid shutdown switch is operated.

A rapid shutdown switch shall have a label located not greater than 3' from the switch that states the following: **RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**



**RAPID SHUTDOWN SWITCH
FOR SOLAR PV SYSTEM**

RESIDENTIAL SOLAR ENERGY SYSTEMS

Purpose: This information provides for the design, construction, installation, alteration and repair of equipment and systems using thermal solar energy.

Scope: This information shall only be applicable to detached one or two family dwellings or townhouses not more than three stories above grade or detached accessory structures as defined in the International Residential Code (IRC) as adopted by the State of Washington and Klickitat County. Structure(s) shall be code compliant with required setbacks and height restrictions.

General Requirements:

- A permit is required for the installation or alteration of equipment and systems using thermal solar energy as well as photovoltaic equipment and systems installed on roofs or ground mounted. Applications can be found at: www.klickitatcounty.org>Building Inspection & Compliance Department>Applications > Building Permit.
- If any of the numbered items listed under R324.4 cannot be documented by the applicant, stamped and signed engineering by an engineer licensed in the State of Washington shall be required.
- In the case of equipment and systems using thermal solar energy, engineering from a professional engineer licensed in the State of Washington shall be required.
- The installation shall comply with the manufacturer's instructions. **Installation instructions shall be available on site at time of inspection.**
- The system shall be designed for the wind speed of the proposed site, and will be installed per the manufacturer's specifications.
- An electrical permit from Washington State Department of Labor and Industries is required. Contact information: www.Lni.wa.gov . Proof of final approval from the above agency is required prior to Klickitat County approving installation.
- Ground mounted systems shall require engineering from a professional engineer licensed in the State of Washington.

Construction Requirements:

- Installation shall be in compliance with Section 324 and Chapter 23 of the International Residential Code (IRC), (attached).
- Installation shall be in compliance with applicable provisions of the International Fire Code (IFC), Section 605.11 (attached, with figures), as amended by the State of Washington and Klickitat County.
- Installation shall be in compliance with applicable provisions of Chapter 9 of the International Residential Code (IRC), (attached).
- Please contact Klickitat County for any required reference from the IRC (except NFPA 70).

Permit Fees: Permit fees shall be based on project valuation and established per the Current Fee Schedule.

- Valuation shall include: structural components and labor, but shall **not** include the value of the electrical components, including the solar modules and inverters.
- Plan review fees shall be per the Current Fee Schedule.
- A Washington State Code fee shall also be included.

ENGINEERING EXCEPTION FORM

(For Roof Mounted Photovoltaic Equipment and Systems Only)

Permit Application # _____

I, _____, hereby certify that all of the following are true and correct:

1. The solar photovoltaic panel system shall be designed for the wind speed of the local area, and shall be installed per the manufacturer's installation specifications.
2. The ground snow load does not exceed 70 pounds per square foot.
3. The total dead load of modules, supports, mountings, raceways, and all other appurtenances weigh no more than 4 pounds per square foot.
4. Photovoltaic modules are not mounted higher than 18 inches above the surface of the roofing to which they are affixed.
5. Supports for solar modules are to be installed to spread the dead load across as many roof-framing members as needed, so that no point load exceeds 50 pounds.

Applicant Signature

Date

Printed Name