



### Solar Water Heating and Photovoltaic Electric Generators Installed on Commercial Buildings

Category: Commercial Construction

Revised: December 1, 2010 [Paul L. Scarlett], Director

Responsible Bureau Section: Development Services Center

1900 SW Fourth Avenue Portland, OR 97201 503-823-7310

#### I. BACKGROUND

Incorporating solar energy into commercial buildings is an increasingly common way for businesses to display environmental stewardship. With large financial incentives available at the local, state and federal level, it can be a sound business investment.

This program guide outlines the application and review procedures for obtaining the necessary permits to install a solar energy system on a new or existing commercial building.

#### II. SOLAR ENERGY SYSTEM DESCRIPTION

For the purpose of this program guide a solar energy system is defined as a solar water heating or solar electric (also known as a photovoltaic or PV) system.

#### A. Solar Water Heating

A solar water heating system reduces a business' energy consumption by preheating water so that the water heater or boiler does less work. The system consists of two primary components:

- 1. Solar collectors, which are commonly installed on the roof; and
- **2.** A storage tank, which is typically co-located with the water heater and in which potable water is preheated by the solar collectors via a heat exchanger.

#### B. Solar Electric

A solar electric system produces electricity that is distributed to the building via an electrical panel, offsetting electric energy that would otherwise be purchased from the utility. It consists of two primary components: Bureau of Development Services

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- 1. Photovoltaic panels, which are commonly installed on the roof; and
- 2. One or more inverters, which convert the direct current electricity produced by the panels into alternating current electricity that can be used by the building.

#### C. Commercial Solar Pool Heating

A commercial solar pool heating system consists of light-weight unglazed polymer (plastic) solar collectors, typically mounted on a roof, through which swimming pool water is circulated during the summer months to capture the sun's heat. This type of system is not subject to the requirements of this Program Guide, and may be installed by obtaining a mechanical permit. In some cases an electrical permit may also be necessary to install the control system for the solar collectors.

#### III. SCOPE

This program guide is designed to provide guidelines and permitting requirements to those interested in solar hot water heaters or photovoltaic solar electric panels on commercial construction. This may include adding a solar system on to an existing structure by addition or alteration, or incorporating a solar system into new building construction. The intent of these guidelines is to streamline the permitting process for solar energy systems. The Bureau of Development Services (BDS) may require additional information be submitted to ensure proper compliance with code requirements.

#### IV. INSTALLATION REQUIREMENTS

#### A. Land Use

Solar installations must comply with the Zoning Code. Specific zoning information regarding a site can be obtained from the BDS Planning and Zoning Section by calling 503-823-7526.

#### 1. Height

In all instances, installations of solar equipment, including the rails and panels, are subject to the height limitations of the specific zone where they are being installed.

Roof-mounted solar panels are not included in height calculations, and may exceed the maximum height of the zone if the following are met:

- **a.** For flat roofs or the horizontal portion of mansard roofs, the panels may extend up to 5 feet above the highest point of the roof.
- **b.** For pitched, hipped, or gambrel roofs, the panels must be mounted no more than 12 inches from the surface of the roof at any point, and may not

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extend above the ridgeline of the roof. The 12 inches is measured from the upper side of the solar panel.

#### 2. Setbacks

Installations that are 6 feet or less in height are allowed to be placed in the setbacks of the individual lot. Installations taller than 6 feet are not allowed in this area unless they are placed on the roof of a building or approved through a land use review adjustment process.

#### 3. Design and Historic Review

Projects in design overlay zones, historic districts, conservation districts, or individual historic or conservation landmarks may require Design Review. Design Review analyzes the aesthetics of a project, in order to conserve or enhance special scenic, architectural or cultural areas of the City. It is a discretionary review that requires a public notice and generally takes about 8 weeks to complete. The design review fee for a solar installation will be based on the current Land Use Services Fee Schedule for a 'Minor C' review. In some design overlay zones or historic districts, design review may not be required if the project is eligible to use the Community Design Standards.

In the Central City and Gateway plan districts, roof-mounted solar panels on existing buildings are exempt from Design Review if specified standards are met (see Zoning Code Section 33.420.045.Y). Roof-mounted solar panels are also exempt from Historic Design Review in historic design districts if specified standards are met (see Zoning Code Section 33.445.320.B.8).

Please contact BDS Planning and Zoning Section at 503-823-7526, if you are unsure if the project is located in a design or historic zone or is eligible to use the Community Design Standards.

#### 4. Upgrades to Non-conforming Development

Upgrades to non-conforming development will only be required as part of the solar installation when other modifications to the building are made (such as increasing the structural capacity of the roof system), and the valuation of the building permit for those modifications excluding the valuation of the solar system exceeds the dollar threshold of Section 33.258.070.D.2.a of the Zoning Code.

#### B. Structural

The solar collectors and underlying substructure (mounts, rails, etc.) must be designed and installed in accordance with the requirements of the latest version of the Oregon Solar Installation Specialty Code (OSISC). The prescriptive requirements as described in section 305.4 of OSISC are assumed to meet the

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requirements of the Oregon Structural Specialty Code and therefore will not require the system be designed by a registered Oregon engineer. Use the checklist attached to the back of this code guide to determine if your system would qualify for the prescriptive path. All other systems that do not meet the prescriptive requirements are required to be designed by an engineer registered in Oregon.

#### C. Plumbing and Electrical

#### 1. General

All portions of the installation of solar systems governed by the plumbing or electrical code shall comply with the respective requirements of each code at the time of completion of the project.

#### 2. Plan review

In general, plumbing or electrical plan review is not required for the installation of solar systems in commercial buildings. Plumbing and electrical plan review is only required for those solar systems that are being added to complex systems as defined by the State of Oregon in Administrative Rules OAR 918-780-0040 and OAR 918-311-0040 (1), cert ef. 10-01-06. In all instances, field inspection is required to verify code compliance.

#### V. PERMITS

#### A. General

When a solar system is added to an existing building, the installation is considered an "alteration". Solar panels that are part of new construction will be processed in conjunction with the new commercial construction permit. Under the provisions of the Oregon Structural Specialty Code, all alterations must meet the requirements for new construction. All necessary permits shall be obtained prior to installation of the system. Where plumbing and electrical permits are required as noted below, they must be obtained as separate permits.

#### **B.** Specific Permits required

- **1. Building Permits** A building permit is required for all solar systems including support structures and collector panels.
- **2. Electric Permits** A separate electrical permit is required for the connection of a photovoltaic system to the building's electrical system.
- **3. Plumbing Permits** A separate plumbing permit is required for all systems that exchange energy with and are attached to the building's potable water system.

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#### C. Application Process

All permit applications for solar installations shall be submitted for review at the BDS Development Services Center (DSC) located at 1900 SW 4<sup>th</sup> Avenue, Portland, Oregon on the first floor. At that time, DSC staff will determine if the project needs to be taken in for review or if the solar system can be reviewed over the counter.

Where a solar system is installed under another program such as the Facility Permit Program (FPP), the application process for that program shall be followed.

#### D. Permit Submittal Requirements

#### 1. General

In all cases, solar systems being installed in commercial buildings need the following reviews:

- a. Planning and Zoning; and
- **b.** Structural.

In addition, all permit applications shall clearly indicate the type of solar system to be installed. The information noted in items 2 through 4 shall be submitted for each permit.

#### 2. Construction Drawings

Construction drawings are required as indicated below. Structural drawings and calculations may be required to bear the stamp and signature of an Oregon registered engineer.

#### a. Structural

1) Prescriptive system If the system meets all the prescriptive requirements of the OSISC, no structural calculations will be required. However, a simple structural plan showing the roof framing and system racking attachment details are required. See figures 1 through 4 for sample drawings. In addition, complete and attach the checklist for prescriptive installations found at the end of this document

#### 2) Designed system

(a) If the system does not qualify for the prescriptive path, then structural calculations prepared by an Oregon registered engineer are required. At a minimum, structural calculations verifying adequacy of the structure's roof framing, strut or frame supporting the rails (where used), attachment of the rail to the support /strut frame and the attachment to the building's roof

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framing are required. Calculations must be based on the latest version of the Oregon Structural Specialty Code. In some cases, manufacturer's information and installation details may be substituted for required calculations and details.

- (b) Drawings shall include a roof framing plan (member size, type, span and spacing) and any additional framing required to reinforce the existing framing. The plans should include the layout of the module system and its mounting points. Drawings should also provide information on any support strut or frame that supports the rails including frame member sizes, lateral bracing where required and their attachments. Details and information on the attachment of the system to the building structure are also required.
- **(c)** When S5 clips or similar clips are used at standing seam metal roof decks, the following guidelines shall be followed:

#### Allowable Loads

Subject to the limitations noted below, the allowable uplift design loads for S-5-U Mini Clips shall not be taken greater than:

- (i) 75 lbs per clip when the clips are spaced at 24"o.c. or more but less than 48"o.c. along the seam of the standing seam deck OR
- (ii) 115 lbs per clip when the spacing along the seam of the deck is 48"o.c. or more.

#### Limitations

- **1.** The S-5-U Mini Clips shall be spaced a minimum of 24" o.c.
- 2. The minimum roof framing size shall be 2x4 (nominal). Maximum framing spacing shall be 24 inches. Roof sheathing shall be a minimum of ½" nominal plywood with minimum prescriptive nailing (8d at 6" o.c. edge nailing, 12" o.c. field nailing)
- **3.** The standing seam metal roofing shall be one of the following types (or similar)
  - Bruce & Dana Snap-Lock (12-inch panel width, 24 gage)
  - Taylor Metal Products Easy Lock (12-inch panel width, 24 gage)

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- ASC Metal Products Skyline Roofing (16-inch panel width, 26 gage)
- AEP Span Design Span HP (18-inch panel width, 24 gage)
- AEP Span Span-Lok HP (16-inch panel width, 24 gage)
- 4. Metal roofing shall be fastened to the roof framing per the manufacturer's instructions and at 24"o.c. maximum with a minimum of #10 pancake head screws. For roofing systems installed with clips (AEP span systems) clip spacing shall be 24-inches maximum and clips shall be installed with a minimum of two #10 pan head screws.

#### **Submittal Requirements**

In addition to requirements for standard installations, solar installation permits utilizing S-5-U Mini Clips shall contain the following additional information:

- Roof framing plan indicating framing member size and spacing, type of roofing, roofing attachment of metal roofing to framing, location and spacing of S-5-U Mini Clips.
- 2. Structural calculations demonstrating that uplift demand on the S-5-U Mini Clip is less than allowable uplift load.

#### 3. Other Drawings

- a. Site plan A site plan is required showing building footprints, property lines, location and dimensions of solar collectors, ridgeline of roof, Fire fighter access and a description of the solar system. System must be shown in sufficient detail to assess whether requirements of section 304.9 or one of the exceptions of OSISC have been met.
- **b. Elevation** An elevation drawing must show the height of the building and the height of the solar installation above the roof, but does not need to show other building details, unless Design Review is required.
- **c. Details** Roof penetration detail including water proofing, curbs, flashing, etc.

#### 4. Electrical and Plumbing Plans

Plumbing or electrical plans are only required for those installations that fall under the definition of complex structure as defined by the State of Oregon in

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OAR 918-780-0040 and OAR 918-311-0040 respectively. Plumbing or electrical plans are not required for other solar system installations.

After all plans and necessary information has been approved by all reviewers, and applicable permit fees have been paid, the permits shall be issued.

#### **VI. INSPECTIONS**

Inspections are required for all permits issued for solar systems as indicated below:

#### A. Building

Building inspections will be determined based upon the scope of the entire project on a project by project basis.

#### **B. Plumbing**

Plumbing inspections are required where the solar apparatus attaches to the potable water system, usually a water heater. The inspections will verify that the collection system is properly attached, so that no contamination of the potable system can occur. Two plumbing inspections, listed in order, are required to verify that the system has been installed properly:

- 1. IVR Code 340: Water Heater
- 2. IVR Code 399: Final Plumbing.

#### C. Electrical

Electrical inspections are required to verify the circuits and feeders have been installed properly and the system has been connected properly. Three electrical inspections, listed in order, are required to verify that the system has been installed properly:

- 1. IVR Code 145: Circuits/Feeders
- 2. IVR Code 120: Permanent Electrical Service/ Reconnect
- 3. IVR Code 199: Final Electrical.

#### VII. FEES

Fees for all required building, plumbing or electrical permits will be calculated using the current and applicable BDS fee schedules available online at http://www.portlandoregon.gov/bds or in the BDS Development Services Center at 1900 SW 4<sup>th</sup> Avenue, Portland, Oregon.

#### A. General

In general, building permit fees will be based on the valuation of the structural elements for the solar panels, including the mounting brackets and rails and the

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cost of labor to install them. Excluded from the permit valuation is the cost of the solar equipment, including the solar collector panels, inverters and preheat tanks.

Valuation of Project = Total Project Price – Solar Equipment Value

#### **B.** Design Review

Where Design Review is required, the fee will be for a 'Minor C' Design Review, based on the current Land Use Services Fee Schedule.

#### VIII. ENFORCEMENT

All code requirements shall be in accordance with applicable permitting and inspection procedures established by BDS.

Updates April 26, 2010 edition Updates April 24, 2009 edition New May 1, 2008 Bureau of Development Services
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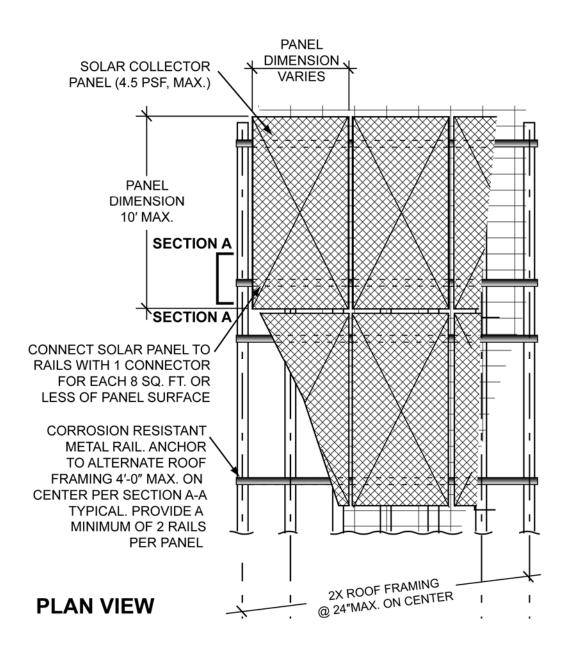


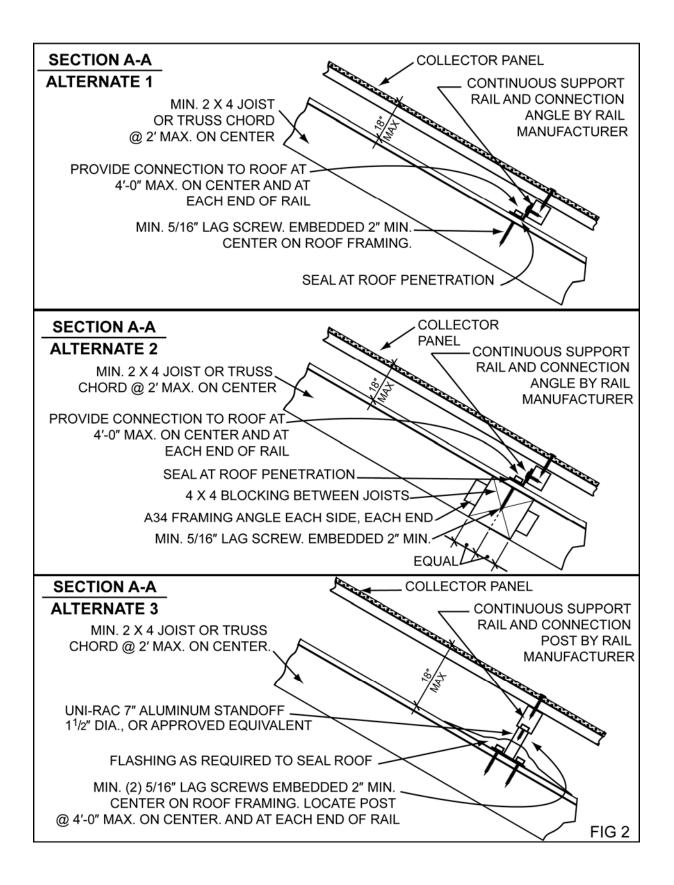
FIG. 1

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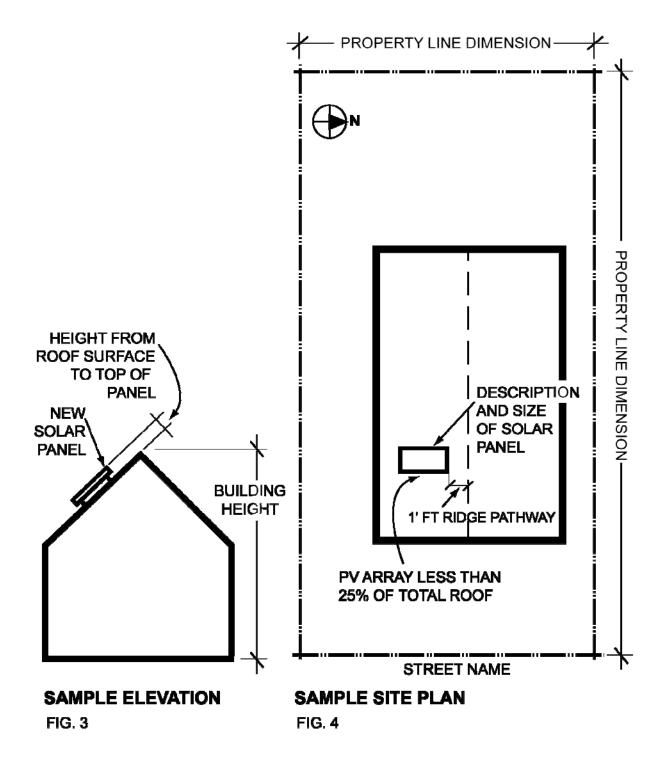
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## Checklist and Submittal Requirements for Prescriptive Installations of Solar Photovoltaic and Solar Water Heating Systems in accordance with Oregon Solar Installation Specialty Code (OSISC)

#### Instructions

Complete the following with all the information requested. This form must be submitted along with the application for installation.

Property	y Owner	Information
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Property Owner Name: _		Installation Address:			
Day Phone: _		Evening Phone:	Email:		
Contractor:		CCB#	:		
Day Phone: _		Evening Phone:	Email:	_	
PV Modul	es or Solar	Water Heating Collect	ors	_	
Manufacturer:		Model Number:	Listing Agency:		
Site Plan	and Struct	ural Plan			
	11000 1000	howing the location of the PV or so as applicable, flood hazard areas.	olar water heating system in relation to buildings, struc-		
attachmen		shown in sufficient detail to asses	er size, type and spacing) and PV module system racki ss whether the requirements of section 304.9 of OSISC		
<ul> <li>Attach sim</li> </ul>	ple building elev	ration.			
<ul> <li>The plans</li> </ul>	must be on 8.5	x 11 or larger paper.			
Structura	I Information	on			
Roof De	sign and Att	achment			
• Roof r	after size:	x inches OR Manufactured	Trusses		
<ul> <li>Rafter</li> </ul>	or manufacture	d roof truss spacing inches	s o.c.		
Specia	alty Code (OSIS		305.4.1 (Appendix "B") of the Oregon Solar Installation /solar/solar_code/100110_OSISC.pdf) for the size and		
Checklis	st to determi	ne if your installation quali	fies for prescriptive path		
☐ Yes ☐	No Is this co	nventional light framed wood cons	struction?		
☐ Yes ☐	No Does the	structure have pre-engineered tru	isses?		
	OR				
	Does stru	acture have roof framing members	spaced at 24" o.c. maximum AND comply with the		

applicable allowable span in table 305.4.1 (Appendix "B") of the Oregon Solar Installation Spe-

cialty Code (OSISC)?

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☐ Yes	□ No	Is the roofing material metal, single layer wood shingle, or not more than two layers of composition shingle?		
☐ Yes	□ No	Is the weight of the modules and racking less than 4.5 pounds per square foot?		
☐ Yes	□ No	Is the module height less than 18 inches above the roof in accordance with section 305.4?		
		For Standing Seam Metal Roofs Only (If not applicable please skip this section)		
☐ Yes	□ No	Is the metal gauge 26 or heavier?		
☐ Yes	□ No	Clamp design: Are clamps designed to withstand uplift of at least 115 pounds for clamps spaced at 60 inches on center or less or at least 75 pounds for clamps spaced at 48 inches on center or less?		
☐ Yes	□ No	Is the spacing of the clamps as measured along the seam greater than or equal to 24" o.c. and less than 60" o.c. AND the spacing perpendicular to the seam not greater than 24" o.c.?		
☐ Yes	□ No	Is the roofing panel width 18-inches or greater?		
☐ Yes	□ No	Is the roofing panel attached with at least #10 screws at 24" o.c.?		
☐ Yes	□ No	Is the roofing panels installed over minimum 1/2-inch nominal wood structural panels attached to framing with 8d nails at 6" o.c. at panel edges and 12" o.c. field nailing?		
If you have indicated "No" on any of these requirements above, the project may not be submitted using the prescriptive path.				
Fire Fig	jhter A	access and Escape		
		pathways are not required when the array is located on a non-occupied accessory structures that ccupied structures by a 6 foot minimum separation distance or by a minimum two-hour fire rated		
<b>General Requirements:</b> For all other roof mounted systems, a minimum 36" wide pathway is required along three sides of the solar roof, located over a structurally supported area. Any roof with a slope greater than 2:12 can not use the bottom roof edge as a pathway. Pathways and solar panels shall be located outside 12" of the low point of a valley.				
If the array is greater than 150 feet in length or width, additional 36" wide intermediate pathways and cutouts are required. See code for details.				
If the roof has smoke and/or heat vents, a 36" pathway shall be provided to and around each vent.				
Exceptions to General Requirements:				
☐ Yes 〔	⊇No Is	the roof slope greater than 2:12?		
☐ Yes 〔	⊇No Is	the array area 1,000 sq ft or less?		
☐ Yes 〔	⊇No Is	the array 150 feet or less in length or width?		
		ed "No" to any of the items above, exceptions do not apply, provide a simple plan conforming quirements.		
		ed "Yes" to all of the items above, see below for reduced access and escape pathway require-		
Is the arra	ay 25% or	less of the roof area?  \( \) Yes \( \) No		
<ul> <li>If Ye</li> </ul>	s, a 12" p	athway along each side of any horizontal ridge is required.		
	<ul> <li>If No, a 12" pathway along each side of any horizontal ridge is required and a minimum of one 36" pathway is required from ridge to eave over a structurally supported area.</li> </ul>			
Provide a simple plan showing conformance to the reduced access pathway requirements.				
		vner or authorized representative of the above listed property, I certify that I have verified the ed above and that the roof rafters (if applicable to the project), meet the span requirements of		

Applicant name (please print) \_\_\_

Table 305.4.1 (Appendix B) of the Oregon Solar Installation Specialty Code.

\_Date\_\_\_

\_\_Signature \_\_\_\_\_