



Solar Pool Heating Installation Requirements

Adapted by Energy Trust of Oregon

from The Bright Way to Heat Water™ technical requirements

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Revisions

Energy Trust updates the installation requirements annually. Many thanks to the industry members and inspectors who have invested their time to help keep this document current. 2013 revisions include removing or streamlining much of the commentary language throughout the document. Additional substantial changes are described in the table below.

June, 2013 Revisions

Section	Revision
2.1 General	<ul style="list-style-type: none"> Removed Zone 1 backup heater exception effectively expanding the policy to all zones.
2.3 Equipment / Installation	<ul style="list-style-type: none"> Removed all pool cover requirements and related sizing limitations
2.4 Collector Mounting	<ul style="list-style-type: none"> Allowed limited series connection in collector plumbing
4.1 System Labeling	<ul style="list-style-type: none"> Labeling requirements were clarified with a list of specific components requiring labels.
4.2 Customer Manual	<ul style="list-style-type: none"> Revised Customer Manual to simplify requirement and allow more flexibility on content

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1.0 Purpose

The following document outlines the minimum criteria for a solar pool heating (“SPH”) system (“System”) installed by a Solar Water Heating Program trade ally under Energy Trust of Oregon’s Solar Water Heating Program (“Program”).

The purpose of these installation requirements is to help promote the performance and longevity of systems that receive Energy Trust incentive funding. Energy Trust reserves the right to require compliance with installation specifications that may exceed those of a manufacturer or applicable codes. Any variations from the Program’s installation requirements shall receive prior approval from Energy Trust.

2.0 Requirements for All Systems

2.1 *General*

- 2.1.1 System shall be installed on real property within Energy Trust service territories and offset energy consumption from Portland General Electric, Pacific Power, NW Natural (including Washington) or Cascade Natural Gas. Installations on pools without a backup heating source are allowed if the system is installed instead of or in addition to a new backup heater.
- 2.1.2 The installation shall be of industry standard and workmanlike quality.
- 2.1.3 System shall be optimized for annual performance without sacrificing good aesthetics. See **Section 2.5: Solar Access**.
- 2.1.4 System design shall be documented with a schematic diagram that accurately describes all components installed, plumbing design, and relative location of valves and monitoring devices.
- 2.1.5 Equipment, materials, and installation shall comply with equipment manufacturers’ specifications.
- 2.1.6 The system shall be properly permitted, inspected and in compliance with all relevant local building, plumbing, mechanical, and electrical codes.
- 2.1.7 System equipment installers shall be working for a contractor that is licensed according to the Oregon Construction and Contractors Board and / or the Washington State department of Labor and Industries.
- 2.1.8 Monitoring/maintenance instructions per Energy Trust specifications shall be plainly displayed. See **Section 5.0: Customer Manual**.

2.2 *Materials*

- 2.2.1 Materials used outdoors shall be sunlight/UV-resistant and listed for outdoor locations.
- 2.2.2 Materials shall be designed to withstand the temperatures to which they are exposed.
- 2.2.3 Aluminum shall not be placed in direct contact with concrete materials.
- 2.2.4 Only stainless steel fasteners should be used to secure collectors. Stainless steel bolts shall be coated with an anti-seize lubricant to prevent galling and allow for removal during system maintenance or repair.
- 2.2.5 Structural members shall be either:

- Aluminum
- Hot-dip galvanized steel per ASTM A123 equivalent or better.
- Coated or painted steel (not allowed in marine environments)
- Stainless steel (recommended for marine environments)
- Pressure treated lumber or outdoor rated laminated beams:
 - Shall be installed using roofing flashing methods to prevent water pooling and UV exposure on top surface.
 - Shall not be installed in direct contact with roofing material, soil or where exposed to extended periods of pooled water.

2.3 ***Equipment and Installation***

2.3.1 All installed system components shall be new.

2.3.2 Solar pool heating collectors shall have Solar Rating and Certification Corporation (SRCC) OG-100 certification or Florida Solar Energy Center certification, and shall carry a minimum 10-year full warranty.

Note: systems that utilize glazed (non-polymer) collectors shall be required to meet all appropriate specifications in the ***Solar Water Heating Installation Requirements*** document.

2.3.3 All system components located outdoors shall be listed for outdoor exposure. that are not rated for outdoor exposure shall be protected from overhead precipitation and direct sunlight

2.3.4 Monitoring devices shall be installed in an easily visible location.

2.3.5 Any building insulation (attic, floor, wall), disturbed due to system installation, shall be restored to previous condition.

2.3.6 All penetrations to building shell shall be sealed and fire resistance maintained.

2.4 ***Collector Mounting***

2.4.1 If roof-mounted, the roofing material shall have at least 10 years of useful life remaining. If in question, evidence of this requirement may be met by providing either a copy of a recent roof inspection or a receipt showing the date of the most recent roof replacement.

2.4.2 If roof-mounted, the roof system shall be capable of handling additional load of the system. Augmentation of the structure may be required by building codes.

2.4.3 Collectors and mounting systems shall be designed and installed to meet local wind, snow and seismic loads.

2.4.4 All roof penetrations shall be made watertight using roofing industry-standard methods of flashing that protect the warranty of the roof. Sealant compounds used shall be appropriate for the roofing material and application and shall not be the sole method of waterproofing.

2.4.5 Collector headers shall be horizontal or slightly tilted toward the inlet to allow for proper drainage.

2.4.6 Collector rows shall be plumbed so pool water enters a lower corner and exits the opposite upper corner of each row.

- 2.4.7 If system has multiple rows of collectors mounted on one or more sloped surfaces, all rows shall be plumbed in parallel and the plumbing from all the individual rows shall return to a common high point before the final return to the pool.

Note: Series connections shall also be allowed with the following limitations:

- a) No more than two arrays are allowed in a series feed.
 - b) No more than 8 collectors are allowed in each array.
 - c) Array run with series connections may not be combined with other arrays.
- 2.4.8 Multiple rows of collectors, with dissimilar numbers of collectors in each row, shall be plumbed with balancing valves on the inlet piping and thermometers on the outlet plumbing. The flow to rows with fewer collectors should be reduced until the outlet temperatures of all collector groups are approximately equal.
- 2.4.9 Collector mounting shall be per manufacturer's specifications.
- 2.4.10 Collectors that use a protruding flange connection at the headers shall have flashing installed between each flange and roof surface.

2.5 **Solar Access**

- 2.5.1 Solar resource shall be measured with an Energy Trust sun chart or approved shading analysis tool from the point on the collector(s) where shading is most significant. Details on using sun charts and a list of approved shading analysis tools are available via the [Energy Trust Trade Ally Forms & Resources web page](http://energytrust.org/trade-ally/forms-resources)¹.
- 2.5.2 Total Solar Resource Fraction ("TSRF") shall be 75% or greater at all points on the collectors. For a seasonal-use pool, TSRF may be calculated based on only the months of usage. See **Program Guide for Solar Water Heating Trade Allies** for TSRF calculation.

2.6 **Plumbing**

- 2.6.1 Piping between collectors and the pool mechanical system shall be schedule 40 PVC material with a minimum diameter 1.5 inches up to 40 gallons/minute or 2 inches up to 80 gallons/minute.
- 2.6.2 System flow rate shall be compatible with total number and size of collector panels. Follow manufacturer's guidelines, or the recommended flow rates per panel in Table 2 below.

Table 2. Recommended flow rates per collector.

Collector Size	Minimum Rate	Maximum Rate
4' x 12'	3.0 gpm	10.0 gpm
4' x 10'	2.5 gpm	10.0 gpm
4' x 8'	2.5 gpm	10.0 gpm

- 2.6.3 Piping runs shall be adequately supported.
- 2.6.4 Dielectric unions shall be used between dissimilar metals.

¹ <http://energytrust.org/trade-ally/programs/solar/resources/>

2.7 **Valves, Controls, and Instrumentation**

- 2.7.1 A ball valve shall be installed in the collector supply piping and a check valve is installed in the collector return piping to enable bypass of the solar system.
- 2.7.2 Drain valves shall be installed at the lowest point in the system on the collector inlet and outlet piping.
- 2.7.3 Vacuum relief valves shall be installed if required by collector manufacturer's specifications. Multiple vacuum relief valves may be required for systems with multiple rows of collectors.
- 2.7.4 A motorized three-way valve operated by a differential temperature controller shall be installed after the pool filter in the supply piping to ensure flow is only diverted through the solar collectors when there is energy to be collected from the array.
- 2.7.5 A check valve shall be installed between the filter and 3-way valve to prevent backwash from the filter to the pool when the solar collectors drain. Clear plastic check valves are preferred.
- 2.7.6 Controller shall be set for desired pool temperature, mounted in a readily accessible location and hard-wired or plugged into an outlet with the wiring securely attached. If plugged into an outlet, the plug shall be labeled with a warning that the controller should not be unplugged.
- 2.7.7 Sensors shall be placed correctly and attached securely.
- 2.7.8 Sensor wiring shall be rated for exterior use and protected from damage. Connections shall be made using crimp-type connectors listed for wet locations.
- 2.7.9 Means of flow detection shall be provided by one of the following two methods:
1. Flow meter method
A flow meter shall be installed per manufacturer's specifications in an easily visible location. To minimize the need to maintain or replace the flow meter, it is acceptable to provide a means of removing the flow meter and plugging its port in the piping when it is not in use to monitor the flow rate. If this is done, the plug in the piping shall be water tight and able to withstand system operating pressures.
 2. Flow confirmation method
Written and laminated instructions explaining how the homeowner can verify sufficient flow using one of the following techniques are present at the site. 1) Filter pressure sensor will show a 2-10psi pressure rise when the solar loop is engaged. 2) The flow diverter rotates 180 degrees when the controller engages the collector loop. 3) The temperature gauge will show large rise (10+°F) when the solar loop is initially engaged.
- 2.7.10 A thermometer shall be installed in the return line from the collectors and prior to the backup pool heater.

3.0 **Requirements for Large Non-residential or Multifamily Systems**

Non-residential and multifamily residential systems shall meet the applicable eligibility and installation requirements in the other sections of this document. In addition, systems heating non-residential and multifamily residential pools larger than 1000 ft² or used year-round shall be documented to allow for Energy Trust or third-party review, as detailed in **Section 3.1**.

Note: Pool heating systems that utilize glazed (non-polymer) collectors shall be subject to all appropriate sections of the ***Solar Water Heating Installation Requirements***.

3.1 ***System Design and Savings Estimate***

- 3.1.1 Estimate of annual energy savings from the system shall be calculated using F-Chart, RETScreen or other approved software. The energy savings estimate shall be referenced to baseline consumption calculated using pool size and environmental conditions, pool season of use, and the rated efficiency of the backup heater to be used with the solar system.
- 3.1.2 System design shall be documented with a drawing of the system including calculations showing developed head. An elevation drawing may be requested. This drawing may be a supplement to the schematic in ***Section 2.1.4*** or may replace the schematic if all components and plumbing design are shown.
- 3.1.3 System design shall be documented with specifications for all key components, including: pump(s), controls, heat exchanger(s), valves and backup heaters. Pipe, pump, or heat exchanger sizing calculations may be requested.

4.0 **System Documentation**

4.1 ***System Labeling***

- 4.1.1 For pools larger than 1000 ft², or operated year-round, all valves, gauges and instruments shall be labeled using one of the two following methods:
 - 1. Permanent tags attached to the valves, gauges and instruments with the following descriptions:
 - a) Name/identification of the valve, gauge, or instrument.
 - b) Purpose and operation of the valve, gauge, or instrument including whether a valve is normally open or normally closed.
 - 2. Permanent individually numbered tags along with a valve chart mounted within six feet of the three way valve. The valve chart shall include the descriptions described in (a) and (b) above as well as the location of components located more than six feet from the valve chart.

Note: Tag templates are available on the [Solar Trade Ally Forms & Resources webpage](http://energytrust.org/trade-ally/programs/solar/resources/)².

4.2 ***Customer Manual***

- 4.2.1 Upon completion of installation, contractor shall provide the Program participant with a system owner's manual (the "Customer Manual") and instruction on proper system operation and maintenance. The Customer Manual shall be bound in a durable binder, and shall contain, at minimum, the following:
 - The manufacturer's installation and/or owner's manual

² <http://energytrust.org/trade-ally/programs/solar/resources/>

- Operation & Maintenance Instructions including summer start-up and winter shutdown procedure, troubleshooting guidelines and recommended routine maintenance. This may be from the manufacturer's installation or owner's manual
- Plumbing As-built Diagram that accurately depicts all components installed. This may be the manufacturer's system schematic if the installation was installed accordingly.
- Program trade ally's 2-year minimum full system warranty for materials and workmanship.
- Parts List. This may be from the manufacturer's installation or owner's manual
- Manufacturer's manual for the controller.

The following *optional* items are recommended to be included in the Custom Manual and/or provided to the customer in digital format (PDF):

- Written manufacturers' warranties and product registration instructions for collectors and controls.(may be part of manufacturers manual)
- Manufacturer data sheets for collectors, controls, temperature sensors and valves
- Energy Trust Incentive Application