

CHAPTER 14

SOLAR THERMAL SYSTEMS

User note:

About this chapter: Chapter 14 addresses solar thermal systems, not photovoltaic systems. The provisions are intended to protect property and life from the hazards associated with high-temperature liquids, pressurized systems and toxic fluids. There are also provisions to protect the building structure and the solar thermal system components from damage.

SECTION 1401 GENERAL

[S] **1401.1 Scope.** This chapter shall govern the design, construction, installation, *alteration* and repair of solar thermal systems, *equipment* and *appliances* intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating. Photovoltaic solar systems shall be installed in accordance with the *International Building Code* and Article 690 of the *Seattle Electrical Code*. Systems interconnected to the electric grid shall comply with additional requirements of Seattle City Light.

Note: See the *Seattle Boiler and Pressure Vessel Code* for regulations applicable to boilers and pressure vessels, and the *Seattle Plumbing Code* for regulations applicable to water heaters.

[S] **1401.2 Potable water supply.** Potable water supplies to solar systems shall be protected against contamination in accordance with the (~~*International*~~) *Seattle Plumbing Code*.

Exception: Where all solar system piping is a part of the potable water distribution system, in accordance with the requirements of the (~~*International*~~) *Seattle Plumbing Code*, and all components of the piping system are *listed* for potable water use, cross-connection protection measures shall not be required.

1401.3 Heat exchangers. Heat exchangers used in domestic water-heating systems shall be *approved* for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded.

1401.4 Solar thermal equipment and appliances. Solar thermal *equipment* and *appliances* shall conform to the requirements of this chapter and ICC 900/SRCC 300. Solar thermal systems shall be *listed* and *labeled* in accordance with ICC 900/SRCC 300 and shall be installed in accordance with the manufacturer's instructions and ICC 900/SRCC 300.

1401.4.1 Collectors and panels. Solar thermal collectors and panels shall be *listed* and *labeled* in accordance with ICC 901/SRCC 100.

SECTION 1402 DESIGN AND INSTALLATION

1402.1 General. The design and installation of solar thermal systems shall comply with Sections 1402.1 through 1402.8. Solar thermal systems shall be *listed* and *labeled* in accordance with ICC 900/SRCC 300 and shall be installed in accordance with the manufacturer's instructions and ICC 900/SRCC 300.

1402.2 Access. Access shall be provided to solar thermal *equipment* for maintenance. Solar thermal systems and appurtenances shall not obstruct or interfere with the operation of any doors, windows or other building components requiring operation or access. Roof-mounted solar thermal *equipment* shall not obstruct or interfere with the operation of roof-mounted *equipment*, *appliances*, chimneys, roof hatches, smoke vents, skylights and other roof penetrations and openings.

1402.3 Pressure and temperature. Solar thermal system components containing pressurized fluids shall be protected against pressures and temperatures exceeding design limitations with pressure and temperature relief valves or pressure relief valves. System components shall have a working pressure rating of not less than the setting of the pressure relief device.

[S] **1402.3.1 Relief device.** Each section of the system in which excessive pressures are capable of developing shall have a relief device located so that a section cannot be valved off or otherwise isolated from a relief device. Relief valves shall comply with the requirements of (~~Section 1006.6~~) the *Seattle Boiler and Pressure Vessel Code*. For indirect solar systems, pressure relief valves in solar loops shall also comply with ICC 900/SRCC 300.

1402.3.2 Vacuum. System components that might be subjected to a vacuum while in operation or during shutdown shall be designed to withstand such vacuum or shall be protected with vacuum relief valves.

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1402.4 Protection from freezing. System components shall be protected from damage by freezing of heat transfer liquids at the lowest ambient temperatures that will be encountered during the operation of the system. Freeze protection shall be provided in accordance with ICC 900/SRCC 300. Drain-back systems shall be installed in compliance with Section 1402.4.1 and systems utilizing freeze-protection valves shall comply with Section 1402.4.2.

1402.4.1 Drain-back systems. Drain-back systems shall be designed and installed to allow for manual gravity draining of fluids from areas subject to freezing to locations not subject to freezing, and air filling of the components and piping. Such piping and components shall maintain a horizontal slope in the direction of flow of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope). Piping and components subject to manual gravity draining shall permit subsequent air filling upon drainage and air storage or venting upon refilling.

1402.4.2 Freeze-protection valves. Freeze-protection valves shall discharge in a manner that does not create a hazard or structural damage.

1402.5 Protection of potable water. Where a solar thermal system heats potable water to supply a potable hot water distribution or any other type of heating system, the solar thermal system shall be in accordance with Sections 1402.5.1 through 1402.5.3 as applicable.

1402.5.1 Indirect systems. Water supplies of any type shall not be connected to the solar heating loop of an indirect solar thermal hot water heating system. This requirement shall not prohibit the presence of inlets or outlets on the solar heating loop for the purposes of servicing the fluid in the solar heating loop.

1402.5.2 Direct systems for potable water distribution systems. Where a solar thermal system directly heats potable water for a potable water distribution system, the pipe, fittings, valves and other components that are in contact with the potable water in the system shall comply with the requirements of the *International Plumbing Code*.

1402.5.3 Direct systems for other than potable water distribution systems. Where a solar thermal system directly heats water for a system other than a potable water distribution system, a potable water supply connected to such system shall be protected against backflow in accordance with the *International Plumbing Code*.

1402.6 Protection of equipment. Solar thermal *equipment* exposed to vehicular traffic shall be installed not less than 6 feet (1829 mm) above the finished floor.

Exception: This section shall not apply where the *equipment* is protected from motor vehicle impact.

1402.7 Protection of structure. In the process of installing or repairing any part of a solar thermal system, the building or structure shall be left in a safe structural condition in accordance with Sections 302, 1402.7.1 and 1402.7.2.

1402.7.1 Controlling condensation. Where attics or structural spaces are part of a passive solar system, ventilation of such spaces, as required by Section 406, is not required where other *approved* means of controlling condensation are provided.

1402.7.2 Penetrations. Roof and wall penetrations shall be flashed and sealed to prevent entry of water, rodents and insects in accordance with Section 302.

1402.8 Equipment. The solar thermal system shall be equipped in accordance with the requirements of Sections 1402.8.1 through 1402.8.5.3.

1402.8.1 Collectors and panels. Solar collectors and panels shall comply with Sections 1402.8.1.1 through 1402.8.1.4.

1402.8.1.1 Design. Solar thermal collectors and panels shall be *listed* and *labeled* in accordance with ICC 901/SRCC 100.

1402.8.1.2 Rooftop-mounted solar thermal collectors and systems. The roof shall be constructed to support the loads imposed by roof-mounted solar collectors. Where mounted on or above the roof covering, the collector array, mounting systems and their attachments to the roof shall be constructed of noncombustible materials or fire-retardant-treated wood conforming to the *International Building Code* to the extent required for the type of roof construction of the building to which the collectors are accessory.

1402.8.1.3 Collectors as roof covering. Roof-mounted solar collectors that also serve as a roof covering shall conform to the requirements for roof coverings in accordance with the *International Building Code*.

Exception: The use of plastic solar collector covers shall be limited to those *approved* light-transmitting plastics meeting the requirements for plastic roof panels in Section 2609 of the *International Building Code*.

1402.8.1.4 Collector sensors. Collector sensor installation, sensor location and the protection of exposed sensor wires from degradation shall be in accordance with ICC 900/SRCC 300, NFPA 70 and the collector manufacturer's instructions.

1402.8.2 Ducts. Ducts utilized in solar heating and cooling systems shall be constructed and installed in accordance with Chapter 6.

1402.8.2.1 Filtering. Air transported to occupied spaces through dust-producing materials by means other than natural convection shall be filtered before entering the occupied space in accordance with Section 605.

[S] **1402.8.3 Piping.** Potable piping shall be installed in accordance with the *International Plumbing Code*. Hydronic piping shall be installed in accordance with Chapter ((+0)) 12 of this code. Mechanical system piping shall be supported in accordance with Section 305.

1402.8.3.1 Piping insulation. Piping shall be insulated in accordance with the requirements of the *International Energy Conservation Code*. Exterior insulation shall be protected from degradation. The entire solar loop shall be insulated. Where split-style insulation is used, the seam shall be sealed. Fittings shall be fully insulated. Insulation shall comply with Section 1204.1.

Exceptions:

1. Those portions of the piping that are used to help prevent the system from overheating shall not be required to be insulated.
2. Those portions of piping that are exposed to solar radiation, made of the same material as the solar collector absorber plate and covered in the same manner as the solar collector absorber, or that are used to collect additional solar energy, shall not be required to be insulated.
3. Piping in solar thermal systems using unglazed solar collectors to heat a swimming pool shall not be required to be insulated.

1402.8.4 Heat exchangers. Heat exchangers used in domestic water-heating systems shall be approved for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded.

1402.8.4.1 Double-wall heat exchangers. Heat exchangers utilizing a nonfood-grade fluid shall be separated from the potable water by double-wall construction. An air gap open to the atmosphere shall be provided between the two walls. The discharge location from the double-wall heat exchanger shall be visible.

1402.8.4.2 Single-wall heat exchangers. Food-grade fluids shall be used as the heat transfer fluid in singlewall heat exchangers.

1402.8.5 Water heaters and hot water storage tanks. Auxiliary water heaters, boilers and water storage tanks associated with solar thermal systems shall comply with Chapter 10 and ICC 900/SRCC 300.

1402.8.5.1 Hot water storage tank insulation. Hot water storage tanks shall be insulated and such insulation shall have an *R*-value of not less than R-12.5.

1402.8.5.2 Outdoor locations. Storage tanks and heating *equipment* installed in outdoor locations shall be designed for outdoor installation.

1402.8.5.3 Storage tank sensors. Storage tank sensors shall comply with ICC 900/SRCC 300.

1402.8.6 Solar loop. Solar loops shall be in accordance with Sections 1402.8.6.1 and 1402.8.6.2.

1402.8.6.1 Solar loop isolation. Valves shall be installed to allow the solar loop to be isolated from the remainder of the system.

1402.8.6.2 Drain and fill valve caps. Drain caps shall be installed on drain and fill valves.

[S] **1402.8.7 Expansion tanks.** Liquid single-phase solar energy systems shall be equipped with expansion tanks sized in accordance with ((Section 1009)) *the Seattle Boiler and Pressure Vessel Code*, except that additional expansion tank acceptance volume equal to the total volume of liquid contained in the installed solar collectors and piping above the collectors shall be included.

SECTION 1403 HEAT TRANSFER FLUIDS

1403.1 Flash point. The flash point of the heat transfer fluid utilized in a solar system shall be not less than 50°F (28°C) above the design maximum nonoperating (no-flow) temperature of the fluid attained in the collector.

1403.2 Heat transfer fluids. Heat transfer gases and liquids shall be rated to withstand the system's maximum design temperature under operating conditions without degradation. Heat transfer fluids shall be in accordance with ICC 900/SRCC 300.

1403.3 Food-grade additives. Any food-grade fluid used as a heat transfer fluid containing additives shall be third-party listed by an approved agency to the appropriate section of the Code of Federal Regulations, Title 21, Food and Drugs, Chapter 1, Food and Drug Administration, Parts 174–186.

1403.4 Toxicity. The use of toxic fluids shall comply with Title 15 of the Federal Hazardous Substances Act and Chapter 60 of the *International Fire Code*.

1403.5 Flammable gases and liquids. A flammable liquid or gas shall not be utilized as a heat transfer fluid. The flash point of liquids used in *occupancies* classified in Group H or F shall not be lower unless *approved*.

SECTION 1404 LABELING

1404.1 Collectors. Factory-built solar thermal collectors shall bear a label showing the manufacturer's name and serial number or certification number.

1404.2 Water storage tanks. Pressurized water storage tanks shall bear a label showing the manufacturer's name and address, model number, serial number, storage unit maximum and minimum allowable operating temperatures, and storage unit maximum and minimum allowable operating pressures. The label shall clarify that these specifications apply only to the water storage tanks.

1404.3 Fluid safety labeling. Drain and fill valves shall be labeled with a description and warning that identifies the fluid in that loop as "Potable Water," "Food-Grade Fluid," "Nonfood-Grade Fluid" or "Toxic." Labeling shall also be provided that reads as follows: "Fluid could be discharged at high temperature or pressure or both. Unauthorized alterations to this system could result in a health hazard or a hazardous condition."

1404.4 Heat exchangers. Heat exchangers shall be labeled to indicate the heat exchanger type with one of the following:

1. "Single-wall without leak protection."
2. "Double-wall without leak protection."
3. "Double-wall with leak protection."