

CHAPTER 3

GENERAL REGULATIONS

SECTION 301 GENERAL

301.1 General. *Direct* and *indirect* systems shall comply with this section.

301.2 Building codes. *Systems* shall comply with all applicable codes and regulations in force at the installation site. Electrical equipment and systems shall comply with NFPA 70 or CSA C22.1, as applicable.

301.3 Third-party certification. Products and materials used within *systems* shall be *listed* by a *third-party certification agency* as complying with the referenced standards.

301.4 Pool or spa safety. *Systems* shall not diminish the operation or ability of a pool or spa to function safely, as defined by applicable codes and regulations in force at the installation site and the pool or spa manufacturer's requirements.

301.4.1 Turnover rate. *Systems* shall not reduce the flow-rate within a pool or spa's recirculation *system* during any operational condition, to a level below the turnover rate required by the authority having jurisdiction.

301.5 Protection of structure. *Systems* shall not weaken or impair the safe operation of buildings or structures in accordance with local codes.

301.6 Structural support. Neither wind loading, including uplift, nor the additional weight of filled *collectors* and tanks shall exceed the live or dead load ratings of the building, roof, roof anchorage, foundation or soil. The design load shall be as specified by the codes in force at the installation site and shall include an additional load for snow accumulation for applicable locations.

301.7 Backflow. Means shall be provided to prevent the backflow of nonpotable fluids, solids or gases into the potable water or pool water system through cross-connections or any other piping connections to the *system* in accordance with local codes. Where no local codes exist, backflow protection shall be provided in accordance with the *International Plumbing Code* or the *International Residential Code*, as applicable.

301.8 Discharge and disposal. Where waste water from *systems* installed on swimming pools or spas or backwash from dedicated system filters discharge to the *approved* point of disposal, the discharge shall be through an indirect waste pipe by means of an air gap. All waste fluids associated with *systems* shall be disposed of in accordance with local codes and regulations.

301.9 Protection against auto-ignition of combustibles. Combustible materials used in solar equipment shall be provided with minimum clearance in accordance with the requirements of local codes and the manufacturer's instructions. Where no local codes exist, clearances shall be as pro-

vided in accordance with the *International Mechanical Code* or the *International Residential Code*, as applicable.

SECTION 302 GENERAL SYSTEM DESIGN

302.1 General. *Direct* and *indirect* systems shall be designed in accordance with the requirements of this section.

302.2 Materials. The materials of components, accessories and subassemblies used for *systems* shall be compatible with the environment in which they are installed. The materials shall be capable of fulfilling the design, installation and intended use requirements of this standard.

302.2.1 Protection from ultraviolet radiation. *System* components and materials that are exposed to ultraviolet radiation shall not be adversely affected by this radiation during their *design life*. Components used outdoors shall be *listed* for use in outdoor locations.

302.2.2 Airborne pollutants. *System* components and materials that are exposed to airborne pollutants such as ozone, salt spray, SO₂ or NO_x shall not be adversely affected by these pollutants to the extent that their function will be impaired beyond design specifications during their *design life*.

302.2.3 Material compatibility. Assemblies of different materials shall be chemically and mechanically compatible for their intended use and environment.

302.2.4 Fluid compatibility. Fluids intended for contact with *system* materials shall not corrode or otherwise adversely affect *system* materials to the extent that their function will be impaired beyond design specifications during the *system design life*.

302.2.4.1 Fluid high temperature limit. The maximum no-flow temperature of the *system* shall not exceed the high temperature limit of the heat exchange fluid.

302.2.5 Finish. Materials that come into contact with the pool user shall be finished, so that they do not constitute a cutting, pinching, puncturing or abrasion hazard under casual contact or intended use.

302.2.6 Rated temperature/pressure. Materials that come into contact with the pool water shall be designed to withstand the ambient and anticipated *system* temperature and pressures.

302.3 Contamination. *Systems* shall be designed to prevent the introduction or conveyance of contaminants or foreign materials into the pool or spa during normal, *drainback*, or backflushing operations.

302.4 System isolation. Isolation valves shall be provided with *access* and installed to allow *systems* to be isolated from the pool or spa or other *systems*.

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302.5 Thermal expansion. *Systems*, components and subassemblies shall include adequate provisions for the thermal contraction and expansion that will occur over the manufacturer(s) specified design and ambient temperature ranges.

302.6 Thermosiphon prevention. Means shall be provided to control energy losses caused by thermosiphonage.

302.7 Entrapped air. Means shall be provided for air and gas removal or entrainment down to a *drainback* reservoir from the piping.

Exception: Where allowed by system design, including but not limited to integral collector storage (ICS), direct thermosiphon, or *drainback systems*. For these *systems*, air or gas shall not impede the flow of heat transfer fluid.

302.8 Outlet temperature. Where water supplied by the *system* can come into direct human contact in a pool or spa, the temperature of the water at the outlet shall not exceed 110°F (43°C).

302.8.1 Spa temperature. Water temperature supplied by the *system* to a spa shall not exceed 103°F (39°C) unless a lower value is specified by local codes or manufacturer’s instructions.

302.9 Suction entrapment avoidance. *Systems* shall provide suction entrapment avoidance for pools and spas in accordance with APSP/ICC 7 and APSP/ICC 16.

302.10 Auxiliary heating equipment. Where installed as part of a *system*, *auxiliary heating equipment* shall be listed and labeled by a recognized *third party listing agency*, and shall comply with Section 406.

302.11 Fluid system sizing. Pumps, piping and other components shall be sized to carry the heat transfer fluid at design flow rates over the *design life* without operational impairment, erosion and corrosion.

302.11.1 Maximum water velocity. The continuous water velocity in *solar pool heating system* piping shall not exceed the values provided in Table 302.11.1 or as specified by the manufacturer, whichever is lower, for the purposes of preventing erosion.

Exception: Where the system includes a dedicated suction inlet installed within the pool or spa, the water velocity in the suction piping shall be as required by Section 302.9.

**TABLE 302.11.1
MAXIMUM WATER VELOCITY FOR COPPER PIPING**

MATERIAL	TEMPERATURE RANGE	MAXIMUM WATER VELOCITY
Copper	40 – 110°F (4 – 43°C)	8 feet (2.4 m) per second
Copper	110 – 140°F (43 – 60°C)	5 feet (1.5 m) per second
Copper	140 – 400°F (60 – 204°C)	2 feet (0.6 m) per second

302.12 Operating conditions. Means shall be provided to protect the *system* and all components within the design limits of fluid temperature and pressure and ambient conditions as specified by the manufacturer and the requirements of this section.

302.12.1 Static pressure. Static fluid pressures in the *solar pool heating system* shall not exceed the maximum pressure rating of any component during normal operation or *stagnation* conditions.

302.12.2 Overheating and stagnation. The *system* shall be able to withstand prolonged periods of *stagnation* without damage or degradation of performance with no maintenance, and without endangering the building or its occupants. The expected *stagnation* temperature effects shall include consideration of worst case roof and ambient temperatures and plastic pipe colors and expansion/contraction stresses. This requirement includes conditions that occur during loss of electric power to the *system* or failure of any of the *system* components.

302.12.3 Freeze protection. Protection from freezing temperatures shall be provided for all *system* components subject to damage. If the protection depends on owner intervention, the owner’s manual shall provide precise instructions for freeze protection. These instructions shall specify an ambient temperature requiring the manual intervention. The supplier shall specify a *freeze tolerance limit* for each *system*. A freeze protection mechanism shall be provided on each system. Acceptable mechanisms include but are not limited to *drainback* and closed-loop recirculation.

Exception: *Systems* installed in a location that has no record of an ambient temperature below 41°F (5°C) for one hour in the last 100 years, shall not be required to provide freeze protection mechanisms. The *freeze tolerance* limit shall be specified regardless of whether a freeze protection mechanism is supplied.

302.12.3.1 Manual intervention freeze protection. Where manual intervention is used for freeze protection, the *system* shall have the proper fittings, pipe slope and *collector* design to allow for manual gravity draining and air filling of the affected components and piping. Sagging of any portion of the collector and/or horizontal piping shall not interfere with *collector* draining. *System* components shall be sloped in accordance with the requirements in Table 302.12.3.1 unless a greater slope is specified by the manufacturer.

**TABLE 302.12.3.1
SLOPE REQUIREMENTS FOR MANUAL INTERVENTION**

SYSTEM COMPONENT	SLOPE REQUIREMENTS
<i>Collector</i> headers	Sloped to drain or perfectly level
<i>Collector</i> headers	Sloped to drain or perfectly level
Risers	Minimum one-fourth unit vertical in 12 units horizontal (2-percent slope)
Supply and return piping < 2 inches	Sloped to drain
Supply and return piping ≥ 2 inches	Sloped to drain or perfectly level

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.33 mm/m.

302.12.3.2 Drainback. When a gravity-driven *drainback system* is employed for freeze protection, all heat transfer fluid in *collectors*, piping and components outside of conditioned space shall drain fully and automatically upon deactivation of the *system* pump. An *approved* means of vacuum relief shall be provided for *drainback* systems.

302.12.3.3 Labeling. A conspicuously placed label shall be attached to the *system* explaining how the *system* is protected from freezing and what actions are required to prevent freeze damage and further leakage if rupture occurs. For *systems* that rely on manual intervention for freeze protection, this label shall indicate the *freeze tolerance limit* below which manual intervention is required and the procedure to be followed.

302.13 Pressure relief. Each portion of the *system* where excessive pressures can develop shall have a pressure relief device to ensure that no section can be valved off or otherwise isolated from a relief device.

302.14 Controls. *Systems* shall include features or controls to facilitate installation, startup, operation, shutdown and maintenance of the solar energy system.

302.15 Labels. Where labels are required, they shall comply with the following:

1. Labels shall be permanently affixed.
2. Labels shall not be hand-written.
3. Labels shall have sufficient durability to withstand the environment.

SECTION 303 DIRECT SYSTEM DESIGN

303.1 General. *Direct systems* shall be designed in accordance with the requirements of Section 302.

SECTION 304 INDIRECT SYSTEM DESIGN

304.1 General. *Indirect systems* shall be designed in accordance with the requirements of this section and Section 302.

304.2 Heat exchangers. *Double wall heat exchangers* shall be required for *indirect systems*. *Double-wall heat exchanger* design shall be such that any failure of a barrier will allow the discharge of *heat transfer fluid* or potable water to the atmosphere. The discharge shall be readily observable and in accordance with Section 301.8.

Exception: *Single wall heat exchangers* shall be permitted when in compliance with both of the following:

1. Fluids containing only components that are food grade are used in the *system*.
2. The maximum operating pressure of the nonpotable *heat transfer fluid* within the *heat exchanger* is less than the normal operating pressure of the potable water system.

304.3 Gauges. *Indirect systems* shall incorporate a minimum of one pressure gauge and a minimum of one flow indicator.

The required pressure gauge shall be installed upstream of the *heat exchanger*.

304.4 Heat transfer fluids. *Heat transfer fluids* used within *indirect systems* shall comply with the requirements in this section.

304.4.1 Food grade fluid additives. Any food grade fluid used as a heat transfer fluid containing additives shall be *listed* and *labeled* by a *third-party certification 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.

304.4.2 Combustible and flammable fluids. The storage, piping and handling of combustible and flammable fluids shall conform to the requirements of the *International Fire Code*.

304.4.3 Flash point. The flash point of a *heat transfer fluid* shall exceed by a minimum of 50°F (28°C), the design maximum no-flow temperature to be reached by the fluid in the *collector*. The flash point shall be determined in accordance with the *International Fire Code*. In systems using a gaseous heat transfer fluid, a flammable gas shall not be used.

304.4.4 Toxicity. The use of toxic fluids, as defined by Title 15 of the Federal Hazardous Substances Act or Chapter 60 of the *International Fire Code*, shall be prohibited.

304.4.5 Fluid labeling. *Systems* shall be provided with labels indicating *heat transfer fluid* classes used as defined in Section 202. Fluids shall not be used that change the original classification of the system.

304.4.6 Pressure relief. Automatic pressure relief devices shall be set to open at not greater than the maximum design pressure or as limited by code and shall drain to a *code-approved* point or *heat transfer fluid* vessel.

304.5 Service ports. Suitable connections shall be provided for indirect *solar loops* at readily accessible location(s) for filling, draining and flushing *heat transfer fluids*.