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 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 provided 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, SO_2 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.
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>
<thead>
<tr>
<th>MATERIAL</th>
<th>TEMPERATURE RANGE</th>
<th>MAXIMUM WATER VELOCITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>40 – 110°F (4 – 43°C)</td>
<td>8 feet (2.4 m) per second</td>
</tr>
<tr>
<td>Copper</td>
<td>110 – 140°F (43 – 60°C)</td>
<td>5 feet (1.5 m) per second</td>
</tr>
<tr>
<td>Copper</td>
<td>140 – 400°F (60 – 204°C)</td>
<td>2 feet (0.6 m) per second</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>SYSTEM COMPONENT</th>
<th>SLOPE REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector headers</td>
<td>Sloped to drain or perfectly level</td>
</tr>
<tr>
<td>Collector headers</td>
<td>Sloped to drain or perfectly level</td>
</tr>
<tr>
<td>Risers</td>
<td>Minimum one-fourth unit vertical in 12 units horizontal (2-percent slope)</td>
</tr>
<tr>
<td>Supply and return piping &lt; 2 inches</td>
<td>Sloped to drain</td>
</tr>
<tr>
<td>Supply and return piping ≥ 2 inches</td>
<td>Sloped to drain or perfectly level</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.33 mm/m.
302.12.3.2 Drainback. When a gravity-driven drain-back 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.