

National Standard of Canada

CAN/CSA-F383-87

Installation Code for Solar Domestic Hot Water Systems

Prepared by
Canadian Standards Association



Approved by
Standards Council of Canada



ISSN 0317-5669

Published in December 1987 by Canadian Standards Association, 178 Rexdale Boulevard, Rexdale (Toronto), Ontario, Canada M9W 1R3.

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General Instruction No. 1

CAN/CSA-F383-87

December 1987

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This Standard, like all CSA Standards, is subject to periodic review, and amendments in the form of replacement pages may be issued from time to time; such pages will be mailed automatically to those purchasers who complete and return the attached card.* Some Standards require frequent revision between editions, whereas others require none at all. It is planned to issue new editions of the Standard, regardless of the amount of revision, at intervals not greater than 5 years. Except in unusual circumstances, replacement pages will not be issued during the last year of that edition.

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Contents

Technical Committee on Installation Code for Solar Domestic Hot Water Systems 6

Preface 7

1. Scope 9

2. Definitions 9

3. Reference Publications 10

4. General Requirements 11

4.1 Acceptable Equipment 11

4.2 Application 11

4.3 Responsibility 11

4.4 Workmanship 12

4.5 Permits 12

4.6 Access 12

4.7 Electrical Wiring 12

4.8 Auxiliary Heating Equipment 13

4.9 Plumbing 13

4.9.1 Potable Water Systems 13

4.9.2 Nonpotable Water Systems 13

4.10 Structural Features 13

4.11 High Temperature Considerations 13

4.12 Zoning 14

4.13 Posting of Instructions 14

4.14 System Commissioning 14

4.15 Compliance With Building Codes 14

5. Collector Mounting 14

5.1 Electrical Wire Clearance 14

5.2 Structural Support 14

5.3 Sealing of Mounting Penetration 14

5.4 Roof Mount 14

5.4.1 Collector-to-Roof Fastening 14

5.4.2 Parallel Mount 15

5.4.3 Flush Mount 15

5.4.4 Angle Mount 15

5.5 Wall Mount 15

5.5.1 Collector-to-Wall Fastening 15

5.5.2 Parallel Mount 15

5.5.3 Angle Mount 15

5.5.4 Wall-to-Ground Mount 15

5.6 Ground Mount 15

5.6.1 Ground Clearance 15

6. Storage Tanks 16

6.1 Tank Support 16

- 6.2 Tank Position 16
- 6.3 Access 16
- 6.4 Clearance 16
- 6.5 Relief Valves 16
- 6.6 Liquid Level Indication 16
- 7. Plumbing 16**
 - 7.1 General 16
 - 7.2 Supply and Disposal 17
 - 7.3 Pressure Relief 17
 - 7.4 Protection from Scalding 17
 - 7.5 Cross Connections 17
 - 7.6 Expansion Provisions 17
 - 7.6.1 Expansion Provision for Backflow Preventers 17
 - 7.6.2 Expansion Tanks for Closed Piping Loops 17
 - 7.7 Self Actuating Drip Valves 18
 - 7.8 Pumps 18
- 8. Heat Transfer Liquids and Heat Exchangers 18**
- 9. Building Envelope Penetrations 18**
 - 9.1 Roof Penetrations 18
 - 9.2 Wall Penetrations 18
- 10. Insulation 18**
 - 10.1 General 18
 - 10.2 Materials 18
 - 10.3 Insulation Requirements 19
 - 10.4 Installation 20
- 11. Controls 20**
 - 11.1 Location of Electrical Components 20
 - 11.2 Grounding of Electrical Devices 20
 - 11.3 Fluid Valve and Port Location 20
 - 11.4 Electronic Controller Mounting 20
 - 11.5 Controller Electrical Connections 20
 - 11.5.1 General 20
 - 11.5.2 Sensor (Low-Voltage) Connections 20
 - 11.5.3 Line-Voltage Connections 20
 - 11.6 Sensors 21
 - 11.6.1 Temperature Sensors 21
 - 11.6.2 Collector Temperature Sensors 21
 - 11.6.3 Storage Temperature Sensors 21
 - 11.6.4 Storage Overheating Sensors 21
 - 11.6.5 Freeze Protection Sensors 21
 - 11.7 Sensor Wiring Runs 21
- 12. Safety Devices 21**
 - 12.1 Scalding Prevention 21
 - 12.2 Pressure and Temperature Relief 21
 - 12.2.1 Location of P/T Relief Valves 21
 - 12.2.2 Closed-Loop Pressure Relief 21
 - 12.3 Relief Valve Pipe Discharge 22
- 13. Instruments 22**
 - 13.1 Flow Indicating Equipment 22

- 13.1.1 Installation 22
- 13.1.2 Reverse Flow 22
- 13.2 Sight Glasses 22
 - 13.2.1 Installation 22
- 13.3 Pressure Indicators 22
 - 13.3.1 Installation 22
- 13.4 Thermometers 22
 - 13.4.1 Installation 22
- 14. System, Site Tests 22**
 - 14.1 Flow Verification Test 22
 - 14.2 Pressure Leakage Tests 22
 - 14.2.1 Pressurized Tanks and Piping 22
 - 14.2.2 Unpressurized Tanks and Piping 23
 - 14.3 Freeze Protection Tests 23
 - 14.4 System Visual Inspection 23

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Preface

This is the first edition of F383, *Installation Code for Solar Domestic Hot Water Systems*. It is written in SI (Metric) Units.

This Code is one of a number of Standards which deal with equipment designed to convert solar energy for residential heating requirements. In the first stages of commercial development the emphasis has been on heating of household potable water.

The preparation of a Code on installation of solar domestic water heaters is the result of the need to demonstrate to the authorities and householders that it is possible to install solar heating systems in such a way as to meet the requirements of existing electrical, plumbing and building codes, and to ensure the safety of persons and property without detracting from housing values. In addition, the publication and use of this Code is designed to encourage consumers, builders, designers, manufacturers and installers to apply solar technology for water heating purposes in order to supplement or replace conventional means.

Reference is made to existing relevant Code provisions, and provisions to be considered for incorporation into existing Codes are recommended.

The Code does not address matters of durability, life expectancy or performance of equipment since these are dealt with in other related CSA Standards to which equipment shall comply.

This Code was prepared by the Technical Committee on the Installation Code for Solar Domestic Hot Water Systems under the jurisdiction of the CSA Standards Steering Committee on Solar and Wind Energy, and was formally approved by these Committees. It has been approved as a National Standard of Canada by the Standards Council of Canada.

December 1987

Notes:

- (1) Use of the masculine gender in this Standard is not meant to exclude the feminine gender when applied to persons. Similarly, use of the singular does not exclude the plural (and vice versa) when the sense allows.
- (2) Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the user of the Standard to judge its suitability for his particular purpose.
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- (4) All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, Standards Division, 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3.

Requests for interpretation should

- (a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;
- (b) provide an explanation of circumstances surrounding the actual field condition; and
- (c) be phrased where possible to permit a specific "yes" or "no" answer.

Interpretations are published in "CSA Information Update". For subscription details and a free sample copy, write to CSA Marketing or telephone (416) 747-2292.

CAN/CSA-F383-87

Installation Code for Solar Domestic Hot Water Systems

1. Scope

1.1

This Code covers the minimum requirements for the installation of solar domestic hot water systems.

1.2

This Code applies to the installation of packaged solar domestic hot water systems supplied for year-round or seasonal heating of domestic hot water in residential buildings and vacation homes.

1.3

For the purpose of this Code, solar domestic hot water systems shall include those designed to provide hot water in the absence of an auxiliary water heater, those designed to preheat water for a stand-alone gas, propane, electric, or oil water heater, and those designed to use gas, propane, electricity, solid fuels or oil for auxiliary water heating in an integrated fashion.

1.4

For the purposes of this Code, solar domestic hot water systems shall include those which use liquid/liquid, or boiling/condensing heat transfer between the solar collectors and potable water.

1.5

This Code does not apply to the installation of any space heating equipment, or collectors which form part of a building's structure.

2. Definitions

The following definitions apply in this Code:

Angle mount—a collector mounted above a roof in a plane other than that formed by the roof surface.

Authority having jurisdiction—the governmental body responsible for the enforcement of any part of this Code or the official or agent designated by that body to exercise such a feature.

Auxiliary water heater—a water heating device powered by a source of thermal energy other than solar energy, such as electrical or fossil fuel energy.

Building penetration—a piercing through the elements of a building that separate the interior space from the outdoors.

Combustible material—such material fails to conform to ULC Standard CAN4-S114-78, *Standard Method of Test for Determination of Non-Combustibility in Building Materials*.

Domestic—for use in residential buildings.

Factory-built collector—collectors requiring no site assembly of the individual collectors.

Flashing—the sheet metal work or other weatherproofing used to cover joints in order to prevent water entry through the building structure.

Flush mount—a collector mounted in the same plane as the roof surface and flashed so that the collector surface forms a portion of the roof surface.

Heat tape freezing protection—the protection from freezing of water in pipes provided by the use of electrically heated cable or tape applied to the outside of exposed pipes.

Packaged system—a predesigned system that is complete with all major system components and material and is supplied and warranted by a single manufacturer.

Parallel mount—a collector mounted in a plane parallel to the roof surface with a clear space separating the back of the collector from the roof surface.

Recirculation freeze protection—the protection from freezing of water in pipes by the moving of the water in exposed portions of the piping by means of a pump, bleed valve or other device.

Safety hazard—a situation where risk of personal injury or property damage exists.

Site built solar collectors—collectors where field assembly of individual collector components are required to produce complete collectors.

Space heating equipment—a heating device used to provide thermal energy for heating the interior of a building.

3. Reference Publications

This Code refers to the following Publications, and where such reference is made it shall be to the edition listed below, including all revisions published thereto:

National Building Code-1985;

Canadian Plumbing Code-1985;

CSA Standards

B64 Series-1976,

Vacuum Breakers and Backflow Preventers;

CAN3-B125-M1985,

Plumbing Fittings;

B139-1976,

Installation Code for Oil Burning Equipment;

CAN/CSA-B365-M87,

Installation Code for Solid Fuel Burning Appliances and Equipment;

C22.1-1986,

Canadian Electrical Code, Part I;

C309-1977,

Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service;

F378-M1982,

Solar Collectors;

F379.1-M1987,

Solar Domestic Hot Water Systems (Liquid to Liquid Heat Transfer);

pF379.2-M1984,
Seasonal Solar Domestic Hot Water Systems.

CGA* Standards

CAN1-B149.1,
Installation Code for Natural Gas Burning Appliances and Equipment;
CAN1-B149.2,
Installation Code for Propane Burning Appliances and Equipment;
CAN1-4.4,
Pressure Relief Valves, and Pressure and Temperature Relief Valves.

ULC† Standards

CAN4-S102-M83,
Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies;
CAN4-S114-78,
Standard Method of Test for Determination of Non-Combustibility in Building Materials.

*Canadian Gas Association

†Underwriters' Laboratories of Canada.

4. General Requirements

4.1 Acceptable Equipment

Solar domestic hot water systems shall meet the requirements of CSA Standard F379.1, and the requirements of the authority having jurisdiction.

4.2 Application

Deviations from the requirements of this Code because of practical difficulty, novel design or unnecessary hardship shall be permitted only where it is evident that reasonable safety and performance is assured, and only with the written permission of the authority having jurisdiction. This permission shall apply only to the particular installation for which it is given.

4.3 Responsibility

4.3.1

The installation of solar domestic water heaters shall be made by installers experienced in such services, and shall be carried out in accordance with the instructions of the manufacturer.

4.3.2

When required by the authority having jurisdiction, such installers shall be licensed to perform this service.

4.3.3

Where installation of a solar hot water heating system constitutes a conversion from some other form of energy it shall be the responsibility of the installer to ensure that the other equipment has been removed or left safe and secure in accordance with the Codes and regulations governing that particular energy product.

4.3.4

The installer shall determine that

- (a) the solar water heating equipment is in satisfactory condition and suitable for installation; and
- (b) the solar water heating equipment can be installed according to the manufacturer's instructions.

4.3.5

After installation of the solar domestic water heating equipment, the installer shall make certain that such equipment is operating as recommended in the instructions supplied by the manufacturer, and that all safety devices are functioning properly. The installer shall instruct the user in the safe and correct operation of the system. The manufacturer's written instructions, as supplied with the system shall be given to the user. The installer shall verify in writing the compliance of the system with all regulations and with the manufacturer's instructions.

4.3.6 Interconnection with Existing Equipment

When interconnecting with existing equipment the installer shall take reasonable care to ensure that the existing equipment continues to adequately meet safety standards.

4.4 Workmanship

Careful attention shall be paid to the execution of the work in connection with any solar domestic hot water system. Any installation that has been badly arranged or poorly executed, either generally or in any particular way, shall not be accepted by the authority having jurisdiction.

4.5 Permits

4.5.1

Permits, when required by the authority having jurisdiction, shall be obtained for the installation of solar domestic hot water systems.

4.6 Access

4.6.1

All solar domestic water heating equipment shall be so installed as to provide reasonable accessibility for cleaning, adjusting, replacement or maintenance of equipment as routinely required.

4.6.2

The solar hot water system shall be installed in such a manner as not to obstruct existing electrical or mechanical equipment.

4.6.3

Solar energy equipment shall be located so as not to interfere with the operation of doors, windows or other building components.

4.7 Electrical Wiring

Electrical wiring and equipment shall be installed in accordance with provincial regulations, or in the absence of such regulations, in accordance with the *Canadian Electrical Code, Part I*.

4.8 Auxiliary Heating Equipment

4.8.1

Where an auxiliary method of heating domestic water such as gas, propane, oil, electricity or solid fuel is installed as part of, or with a solar hot water heater; or where an existing auxiliary system installation is modified by the addition of a solar water heater, the installation shall be in accordance with CGA Standards CAN1-B149.1, CAN1-B149.2 and CSA Standards B139, CAN/CSA-B365, and C22.1.

4.8.2

The interconnections between stand-alone auxiliary energy equipment and the solar energy equipment shall be made in a manner that will not result in temperatures or pressures exceeding the allowable design of either system (operational or nonoperational mode). The interconnections shall not compromise or bypass the safety devices.

4.9 Plumbing

4.9.1 Potable Water Systems

Piping, fittings, valves, fixtures and tanks, whether or not supplied by the solar Domestic Hot Water (DHW) system manufacturer and used in potable water plumbing installations, shall be in accordance with provincial or municipal regulations, or in the absence of such regulations, in accordance with CSA Standard B64 Series, CAN3-B125, C309, and CGA Standard CAN1-4.4 where applicable.

4.9.2 Nonpotable Water Systems

Piping, fittings, valves and tanks used in nonpotable water plumbing installations shall be in accordance with the manufacturer's instructions, and be acceptable to the authority having jurisdiction.

4.10 Structural Features

4.10.1

The collector (and integral storage if applicable), and supporting structure, including building components, shall be designed and constructed or modified to support the following:

- (a) dead load of the collector, components, storage (if applicable) and transfer liquids;
- (b) live loads;
- (c) snow loads;
- (d) wind loads;
- (e) expansion and contraction loads resulting from temperature changes; and
- (f) combinations of any or all the above.

4.10.2

Holes or notches in structural members shall be made in such a manner as to retain the structural integrity of the members. All building penetrations shall be sealed against water penetration.

4.11 High Temperature Considerations

Care shall be taken in the selection of materials and components which may be exposed to high temperatures during stagnation of the system.

4.11.1

Combustible materials in the residence shall not be exposed to solar heating equipment having operating temperatures which can cause ignition. Proper clearances shall be specified and maintained.

4.11.2

Solar collectors located above or upon a roof shall not reduce the required fire resistance classification of the roof covering material.

4.12 Zoning

Solar energy equipment shall be subject to local zoning requirements.

4.13 Posting of Instructions

4.13.1

The installer shall record his or her name, address and telephone number on a portion of the solar hot water system in a readily visible location.

4.13.2

The installer shall ensure that the marking and labelling requirements as defined in CSA Standard F378 or F379.1 have been met.

4.13.3 Manufacturer's Instructions and Documents to be Supplied

A manual or manuals shall be provided with each Solar Domestic Hot Water (SDHW) system in English or French, or both, as required by the end user. The manual shall contain the name and address of the seller, the system model name or number, and shall describe the operation of the system and the components, and the procedures for installation, operation, and maintenance.

The manual may consist in part of a series of instruction sheets provided by the various subsystems and component manufacturers. It may be a single manual. Installation instructions may be separate from operation and maintenance instructions. Its size and complexity should be consistent with the need for descriptive information.

4.14 System Commissioning

System commissioning is required following the manufacturer commissioning instructions and the requirements in Clause 14 of this Code.

4.15 Compliance with Building Codes

The installation of all solar water heating equipment shall comply with the local building code, or in its absence, with the National Building Code.

5. Collector Mounting

5.1 Electrical Wire Clearance

A minimum of 3 m between portions of the solar collector array and electrical wiring shall be observed when installing solar collectors in the vicinity of building power connecting cables. Consideration shall be given to wind-induced sway in the cables which will reduce clearances.

5.2 Structural Support

Collectors, collector supports and piping shall not be connected to, or supported by other roofing elements such as chimneys, vent pipes or eaves troughing.

5.3 Sealing of Mounting Penetration

Building envelope penetrations shall be sealed with silicone sealant or approved alternate.

5.4 Roof Mount

5.4.1 Collector-to-Roof Fastening

Collectors or collector racking systems shall be fastened to the structural members of the roof using adequately sized fasteners to support the anticipated loads (see Clause 4.10.1).

5.4.2 Parallel Mount

- (a) Collectors and the collector support structure shall be mounted so as to ensure a minimum clearance of 40 mm above the roof surface to allow for adequate drainage.
- (b) The requirement of Item (a) may be dropped if the array has been adequately mounted and flashed into the roof membrane.

5.4.3 Flush Mount

Flashing shall be installed under the roof membrane at the highest point of array. The flashing shall extend beyond the collector array a minimum of 40 mm. Flashing on the sides of the array shall butt the top flashing. Side flashing shall be stepped and integrated into the roofing material. Continuous flashing may be used if it is adequately sealed. Side flashing shall extend at least 40 mm below the bottom of the collectors.

Bottom flashing shall butt the side flashings and shall be installed over the roofing membrane.

Both top and bottom flashings shall be made from a continuous sheet spanning the array.

Flashing shall be installed spanning the gap between collectors in an array.

All flashings shall be adequately sealed at the collector and roofing membrane with a silicone sealant or approved equivalent. All flashings shall be securely fastened.

5.4.4 Angle Mount

All collector arrays mounted at an angle to the roof surface shall not induce wind and snow loads in the structural members of the roof beyond the design limits identified in the National Building Code of Canada.

5.5 Wall Mount

5.5.1 Collector-to-Wall Fastening

Collectors mounted on frame walls may be fastened into the stud framing of a building provided the design load limits are not exceeded.

5.5.2 Parallel Mount

Collectors shall not be mounted on vertical walls with masonry sidings of brick work, stone work or concrete blocks unless the method of mounting is designed by a structural engineer.

5.5.3 Angle Mount

Wall-mounted arrays which are not vertical with the base of the collectors supported by a structural member extending from the wall, shall have the structural member secured to the wall in compliance with Clause 5.5.1.

5.5.4 Wall-to-Ground Mount

Wall-mounted arrays which are not vertical with the base of the collectors supported by a structural member extending to the ground, shall comply with Clauses 5.6 and 5.6.1.

5.6 Ground Mount

All ground-mounted collector arrays must be fastened so that any supporting columns shall be extended below the depth of expected frost penetration.

5.6.1 Ground Clearance

The lowest portion of a ground-mounted array shall be a minimum of 1 m above ground level.

6. Storage Tanks

6.1 Tank Support

Storage tanks shall be installed so as not to exceed the structural design load limits of the floor or other supporting members.

6.2 Tank Position

Storage tanks shall be installed in the vertical or horizontal position in accordance with the manufacturer's instructions.

6.3 Access

Storage tanks shall be installed so that the access ports and plumbing connections can be easily inspected.

6.4 Clearance

Storage tanks shall be installed without impeding passage through doors, hallways or emergency exits, or reducing accessibility to appliances, plumbing, electrical heating or ventilating controls or connections.

6.5 Relief Valves

Pressurized tanks shall be equipped with pressure/temperature relief valves designed to limit tank fluid temperatures and pressures to safe levels as required.

6.6 Liquid Level Indication

Storage tanks vented to the atmosphere shall have a means of indicating the level of liquid in the tank.

7. Plumbing

7.1 General

7.1.1

Piping materials, joints, support spacing, expansion joint spacing, and clearances shall be suitable for the contained fluid at the maximum temperatures and pressures encountered in that part of the solar water heating system, and shall meet all plumbing Code requirements for these conditions.

7.1.2

Solar energy equipment and piping shall be capable of being drained and vented, and of being filled without the entrapment of air.

7.1.3

Solar water heating equipment and piping located inside the residence in an accessible area shall be located so that it cannot be accidentally damaged and shall not pose a safety hazard to the occupants.

7.1.4

Refrigerant piping must be installed according to standard refrigeration practice.

7.1.5

Piping on systems which require draining in normal operation shall have a minimum slope of 1 in 50.

7.2 Supply and Disposal

7.2.1

Shut off valves shall be provided on the supply piping to water storage tanks.

7.2.2

Hot water storage tanks and piping containing potable water shall be capable of being emptied into an approved drain through an air gap in accordance with plumbing Codes.

7.2.3

Make up water from potable water systems to nonpressurized storage tanks shall be connected to provide an air gap in accordance with plumbing Codes. An overflow shall be provided from the tank to an approved drain.

7.2.4

Disposal pipes from pressure relief valves, over-temperature relief devices, draindown valves, overflows, and fill/drain connections shall be located so as not to pose a safety hazard, damage the building structure or contaminate potable water. Disposal pipes which might contain nonpotable fluids shall be appropriately labelled and shall be discharged into an appropriate container.

7.2.5

Storage tanks and piping containing nonpotable fluids shall be capable of being emptied into an approved container.

7.3 Pressure Relief

Adequately sized and approved pressure relief devices shall be provided in pressurized solar energy equipment and piping. Where a portion of the system or piping can be isolated by valving, each portion shall be provided with a pressure relief device. Devices shall be set to relieve the pressure at or below the maximum allowable pressure encountered in the system.

7.4 Protection from Scalding

A means shall be provided to maintain hot water delivered by the solar water heating equipment to the user at or below 60°C. (See also Clause 12.1).

7.5 Cross Connections

Connections to potable water systems shall be such that nonpotable water, foreign matter, foreign chemicals or substances that may render the water nonpotable, cannot enter the system.

7.6 Expansion Provisions

7.6.1 Expansion Provisions for Backflow Preventers

Provision shall be made for expansion of the domestic water in cases where back-flow preventers are required by the authorities having jurisdiction.

7.6.2 Expansion Tanks for Closed Piping Loops

Solar domestic water heating systems which utilize a closed pressurized piping loop to transfer heat from the solar collector shall have an expansion tank installed in the piping loop. Only expansion tanks with EPDM diaphragms or a material compatible with the heat transfer liquid specified by the manufacturer shall be used.

7.7 Self Actuating Drip Valves

If a self actuating drip valve is to be used for freeze protection, it shall be located at the lowest point of the external piping that is to be protected, and adjacent to a building envelope penetration. Provision shall be made to protect the roof and roof membrane from any damage due to the discharge from a drip valve.

7.8 Pumps

Where applicable, pumps or pump motors, or both, shall be CSA certified and installed:

- (a) to the requirements of the *Canadian Electrical Code, Part I*;
- (b) so that they are easily serviced;
- (c) so that the net positive suction head requirements as defined by the pump manufacturer are met; and
- (d) pumps shall not be installed in a location where the electrical components or connections may come in contact with fluid from a tank overflow or the outlet of a pressure/temperature relief valve.

8. Heat Transfer Liquids and Heat Exchangers

Heat transfer liquids and heat exchangers shall comply with the requirements of CSA Standard F379.1.

9. Building Envelope Penetrations

9.1 Roof Penetrations

The roof penetration shall be sealed using a rubber or aluminum flange or boot with a neoprene or similar gasket sized to seal against the piping.

9.2 Wall Penetrations

All penetrations shall be sloped at a minimum of 1 in 50. The wall penetration shall be sealed.

10. Insulation

10.1 General

10.1.1

Insulation shall be installed only after the system has been tested for leaks. (See Clause 14.2.1.)

10.1.2

Piping tanks intended for hot fluid storage or transfer shall be insulated.

10.1.3

Insulation shall not be applied to the housings of pump motors, or to tempering valves, relief valves, the tops of air vents or the openings of vacuum breakers.

10.2 Materials

10.2.1 Insulation Materials

Insulation materials shall be suitable for operation at temperatures above 105°C in all parts of the systems involving the transfer of heated fluids. Insulation materials not supplied or specified by the manufacturer of a certified system, for use within 2 m of the solar collector absorber plate shall have a minimum temperature rating of 170°C. Insulation materials for

interior use shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with ULC Standard CAN4-S102 as a composite product.

10.2.2

Insulation for exterior application shall preferably be of molded rigid foam materials, and shall be finished with a suitable jacket or facing with all surfaces and laps sealed. Jacketing, facing and tapes used for exterior application shall be of materials known to be durable for service such as aluminum and ultraviolet (UV) stable PVC.

If flexible insulations are used they shall be wrapped and sealed against water penetration. The exterior wrapping shall be of materials known to be durable.

10.2.3

Materials for exterior use shall be resistant to environmental temperature extremes, UV exposure and moisture.

10.3 Insulation Requirements

The minimum thermal resistance of insulation shall be specified by the manufacturer, or the following thermal resistances shall apply:

Minimum Thermal Resistances

Piping insulation	
Exterior piping	RSI 1.0 (R6)
Interior piping	RSI 0.5 (R3)

Exterior Storage Tank Insulation	
Minimum system operating temperature	Minimum required thermal resistance
5°C	RSI 1.0 (R6)
0°C	RSI 1.0 (R6)
-10°C or below	RSI 2.0 (R12)

Notes:

- (1) If fibreglass insulation is used on the exterior piping it is essential that it be properly sealed from the elements according to the fibreglass manufacturer's recommendations.
- (2) Currently available elastomers have not performed well under UV light, even with protective coatings. Moisture resistance is good and insulation qualities satisfactory.
- (3) Low temperature polyethylene insulation may not be used adjacent to any surfaces which might exceed 70°C since it may melt at this temperature.
- (4) Urethane and Isocyanurate foams are similar chemically but may vary in thermal resistance value depending on the mode of manufacture. Both have excellent resistance to moisture absorption.

10.4 Installation

10.4.1

Insulation jacket seams shall be on the underside of the piping and overlap at least 50 mm.

10.4.2

Joints and seams shall be sealed with silicone sealant or an approved equivalent or an approved tape. If used outside, the tape shall be UV stable (masking and electrical tapes shall be not acceptable).

10.4.3

Pipe insulation shall be well sealed at the interface with the collector using silicone sealant or an approved equivalent.

10.4.4

Moisture sensitive insulations shall be installed with a continuous vapour barrier outermost.

10.4.5

Performed, foamed, or other insulations shall be mitred at corners.

11. Controls

11.1 Location of Electrical Components

Electrical components shall be installed in such a location as to avoid any contact with water or any other fluid.

11.2 Grounding of Electrical Devices

Metallic portions of electrically operated devices located to allow human contact shall be suitably bonded to the household electrical ground system.

11.3 Fluid Valve and Port Location

No pressure relief, temperature relief, pressure-temperature relief, drain or overflow valve shall be mounted in such a position as to allow electrical devices to come in contact with water or any other fluid in the event of fluid discharge.

11.4 Electronic Controller Mounting

Control devices, including electronic thermostats, temperature sensors, timers, etc, shall be solidly mounted.

11.5 Controller Electrical Connections

11.5.1 General

Electrical connections to the controller shall be made in a workmanlike manner and shall meet the requirements of the *Canadian Electrical Code, Part I* where applicable.

11.5.2 Sensor (Low-Voltage) Connections

Wire-to-wire low-voltage sensor connections shall be made with rat-tail splices, and soldered with resin-core type solder, or as specified by the system manufacturer. Exterior connections shall be weather-proofed.

11.5.3 Line-Voltage Connections

Electrical connections from the building electrical service to the controller, or from the controller to the fluid circulating device, shall be made in accordance with the *Canadian Electrical Code, Part I*.

11.6 Sensors

11.6.1 Temperature Sensors

Temperature sensing devices shall be mechanically attached, and shall be in good thermal contact with that portion of the system where the temperature is to be sensed and shall be insulated from ambient temperatures.

11.6.2 Collector Temperature Sensors

If the collector outlet temperature sensor location is not specified by the manufacturer, the sensor shall be installed either on the collector absorber plate or on the collector array outlet pipe within 40 mm of the collector.

11.6.3 Storage Temperature Sensors

Storage temperature sensors shall be located as per the manufacturer's specifications.

11.6.4 Storage Overheating Sensors

Storage overheating sensors shall be installed according to the manufacturer's instructions.

11.6.5 Freeze Protection Sensors

Extreme care shall be taken to ensure compliance with the system manufacturer's specifications in the placement and installation of freeze protection sensors.

11.7 Sensor Wiring Runs

Sensor wiring runs shall be adequately attached to a rigid structure. When sensor wiring is strapped on the outside of piping insulation, the strapping shall be of a suitable material for the application and straps shall be placed at least every metre to prevent the movement of the wiring. Sensor wiring shall not be run in contact with fluid piping.

12. Safety Devices

Appropriate safety devices as outlined in CSA Standard F379.1 shall be installed on all SDHW systems.

12.1 Scalding Prevention

All SDHW systems must have a means to prevent hot water delivered to the household from exceeding 60°C. This can be accomplished through an overheating sensor installed on the electronic controller, or by using a mechanical tempering valve on the outlet of the system.

12.2 Pressure and Temperature Relief

Suitably sized and approved pressure and temperature relief valves shall be installed on all pressurized storage units.

12.2.1 Location of Pressure and Temperature Relief Valves

All pressure and temperature relief valves shall be installed at the highest point on the tank.

12.2.2 Closed-Loop Pressure Relief

SDHW systems which contain a plumbing loop that is closed to the atmosphere shall have a pressure relief valve installed at a point in the loop specified by the manufacturer.

12.2.3

Parts of a SDHW system which can be isolated by valves and which can be heated directly or indirectly shall be protected against excessive pressure by suitably rated pressure relief valves.

12.3 Relief Valve Pipe Discharge

Every pipe that conveys water from a temperature relief, pressure relief or a combined temperature and pressure relief valve shall

- (a) have a size at least equal to the size of the outlet of the valve;
- (b) terminate above a floor drain, sump, fixture or other approved safe location; and
- (c) no shut-off valve shall be installed on the pipe between the tank and the relief valves or on the discharge lines from such relief valves.

13. Instruments

13.1 Flow Indicating Equipment

13.1.1 Installation

Flow indicating equipment installed in the fluid lines of a solar system shall be constructed of materials and components capable of withstanding the maximum temperatures and pressures expected in the system without degradation.

13.1.2 Reverse Flow

Flow measurement devices installed in systems using drainback freeze protection shall be capable of allowing flow in the reverse direction.

13.2 Sight Glasses

Sight glasses shall be installed on all nonpressurized systems.

13.2.1 Installation

Sight glasses shall be installed in clear view, protected from damage and with the required level of the fluid clearly indicated.

13.3 Pressure Indicators

Pressurized loops shall have a pressure gauge.

13.3.1 Installation

All pressure indicating equipment shall be installed to ensure readability.

13.4 Thermometers

13.4.1 Installation

Thermometers shall be installed so as to be visible to the system operator.

14. System, Site Tests

14.1 Flow Verification Test

The establishment of fluid flow in the collector loop shall be verified by

- (a) an indicating flow device;
- (b) temperature increase in the storage tank;
- (c) measurement of pump pressure characteristics;
- (d) a temperature change between the supply and return piping measured a minimum of 2 m from the collector array; or
- (e) a method specified by the manufacturer and acceptable to the inspection authority.

14.2 Pressure Leakage Tests

14.2.1 Pressurized Tanks and Piping

All liquid plumbing systems shall be pressure tested prior to system startup, and prior to insulating the system piping. The pressure test may be performed using air, water or the

system working fluid. Freezing weather conditions may necessitate the use of air or a glycol/water mixture for the testing of closed piping not connected to a potable water supply.

Note: *Air-pressure testing offers an advantage when locating leaks if an ultrasonic air leak detector is available.*

(a) All relief valves, expansion tanks, and other special components shall be removed, plugged, or bypassed before pressure testing.

(b) Closed solar heating system piping not directly connected to a potable water supply shall be tested for pressures not less than 1.5 times the maximum design operating pressure.

(c) Solar heating system piping connected to a potable water supply shall be tested to the maximum mains pressure experienced in that location using only potable water as the test fluid.

(d) Tanks and piping shall remain pressurized and proved tight and leak-free for at least 30 min.

14.2.2 Unpressurized Tanks and Piping

Unpressurized tanks and piping shall be visibly tested for leaks by filling to overflow.

14.3 Freeze Protection Tests

14.3.1

Solar water heating systems which use drainback or draindown as a means of freeze protection shall be tested as follows:

(a) If the system is operating manually, stop operation either by shutting off the power to the system or by switching off the controller. The system must drain the fluid from the collectors and all exterior piping in 3 min or less.

(b) If the system is not operating, and when climatic conditions permit manual activation, allow the system to operate until complete circulation has been established. Shut off the system and ensure that the system drains entirely within 3 min.

14.3.2 Recirculation and Heat Trace Freeze Protection

Solar water heating systems which use recirculation or heating tape freeze protection shall be subjected to a test to ensure that the means of protection is operable. The following procedure shall be used:

(a) Cool the freeze protection sensor below 7°C, and record the temperature at which the collector loop pump starts to operate or heating tapes are actuated.

(b) The heating tape shall warm all external piping and other components not directly exposed to the sun.

(c) Actuation of the circulation pump or heating tape shall occur above a minimum of 5°C.

14.3.3 Controller Test

Solar heating systems shall have the controller operation verified by the method described in the manual supplied by the system manufacturer.

14.4 System Visual Inspection

The installer shall carry out a general check to ensure that the system is complete and that all components have been properly installed. This visual inspection shall include a check

(a) of all plumbing connections to ensure that collectors, pumps, heat exchangers, and other components have been connected properly, and not in a reverse direction;

(b) to ensure that all safety equipment such as temperature and pressure relief valves are present and installed in the correct manner. For systems requiring a nontoxic working

fluid, check to ensure that an appropriate label has been affixed to the fill valve, warning that only nontoxic fluid must be added;

(c) to ensure that all pipes are adequately sloped to ensure complete draining of the system. This check is particularly important for drainback systems, but applies to all solar systems;

(d) of all pipe insulation to ensure that the correct amount has been installed and that it is adequately secured and protected against water damage;

(e) to ensure that all roof penetrations are adequately sealed;

(f) of all wiring, both 110–220 V and control wiring, to ensure that it meets applicable electrical codes and that it is properly fastened to protect it against mechanical damage;

(g) to ensure that any instrumentation and test points supplied with the system are installed properly;

(h) to ensure relief valves are plumbed to drains or catch basins;

(i) to ensure that the system controller is properly located and in the automatic position; and

(j) to ensure that all labels are visible and completed as required in CSA Standard F379.1.

Proposition de modification

N'hésitez pas à nous faire part de vos suggestions et de vos commentaires. Prière d'utiliser le formulaire qui suit pour formuler les propositions de modification aux normes CSA et autres publications CSA. Il est recommandé d'inclure

- le numéro de la norme/publication
- le numéro de l'article, du tableau ou de la figure visé
- la formulation proposée
- la raison de cette modification.

Proposal for change

CSA welcomes your suggestions and comments.

Please use the following form to submit your proposals for changes to CSA Standards and other CSA publications. Be sure to include the

- Standard/publication number
- relevant Clause, Table, and/or Figure number(s)
- wording of the proposed change
- rationale for the change.

Nom/Name: _____

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Téléphone/Telephone: _____ **Télécopieur/Fax:** _____

Date: _____

Proposition de modification/Proposed change:

(Si l'espace est insuffisant, utiliser le verso et des feuilles volantes/Use reverse and additional pages as required.)