

Australian/New Zealand Standard™

Solar and heat pump water heaters— Design and construction



AS/NZS 2712:2007

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CS-028, Solar Water Heaters. It was approved on behalf of the Council of Standards Australia on 20 June 2007 and on behalf of the Council of Standards New Zealand on 8 June 2007.

This Standard was published on 12 September 2007.

The following are represented on Committee CS-028:

Australian Chamber of Commerce and Industry
Australian Electrical and Electronic Manufacturers Association
Australian Industry Group
Australian and New Zealand Solar Energy Society
Department of Energy, Utilities and Sustainability (NSW)
Energy Efficiency and Conservation Authority of New Zealand
Institution of Professional Engineers New Zealand
James Cook University
Master Plumbers, Gasfitters and Drainlayers New Zealand
Office of the Renewable Energy Regulator
Plastics and Chemicals Industries Association
Solar Industries Association (New Zealand)
Sustainability Victoria
University of New South Wales

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR 06573.

Australian/New Zealand Standard™

Solar and heat pump water heaters— Design and construction

Originated as AS 2712—1984.
Second edition 1993.
Jointly revised and designated as AS/NZS 2712:2000.
Second edition 2007.
Reissued incorporating Amendment No. 1 (May 2011).
Reissued incorporating Amendment No. 2 (November 2011).
Reissued incorporating Amendment No. 3 (November 2014).

COPYRIGHT

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

ISBN 0 7337 8385 6

PREFACE

This Standard was prepared by the Standards Australia Committee CS-028, Solar Water Heaters, to supersede AS/NZS 2712—2002, *Solar and heat pump water heaters—Design and construction*.

This Standard incorporates Amendment No. 1 (May 2011), Amendment No. 2 (November 2011) and Amendment No. 3 (November 2014). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to provide designers, manufacturers, installers and interested parties with performance-based design and construction requirements for solar hot water supply systems and heat pump hot water supply systems.

This Standard necessarily deals with existing types of systems, but is not intended to discourage innovation or to exclude material, equipment and methods that may be developed in the future. Revisions will be made from time to time in view of such developments, and amendments to this edition will be made when necessary.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	5
1.2 APPLICATION	5
1.3 SYSTEMS COVERED BY THIS STANDARD	6
1.4 REFERENCED DOCUMENTS.....	7
1.5 DEFINITIONS.....	9
SECTION 2 GENERAL DESIGN REQUIREMENTS	
2.1 SCOPE OF SECTION	11
2.2 MATERIALS IN CONTACT WITH DRINKING WATER	11
2.3 FACILITIES FOR INSTALLATION	11
2.4 FACILITIES FOR MAINTENANCE	11
2.5 PIPES.....	11
2.6 PRESSURE AND TEMPERATURE PROTECTION.....	12
2.7 OVER-TEMPERATURE PROTECTION DEVICE	12
2.8 SUPPLEMENTARY HEATING UNIT	12
2.9 INSTRUCTIONS.....	13
SECTION 3 CONTAINERS	
3.1 SCOPE OF SECTION	15
3.2 CONSTRUCTION AND PERFORMANCE.....	15
3.3 MARKING	15
SECTION 4 COLLECTORS	
4.1 SCOPE OF SECTION	16
4.2 ABSORBERS	16
4.3 COLLECTOR MATERIALS AND CONSTRUCTION	16
4.4 GLAZING OF COLLECTORS.....	17
4.5 RESISTANCE TO STAGNATION CONDITIONS	18
4.6 IMPACT RESISTANCE.....	19
4.7 PROTECTION AGAINST INGRESS OF WATER.....	20
4.8 PROTECTION AGAINST FREEZING.....	20
4.9 STRUCTURAL REQUIREMENTS	20
4.10 MARKING	21
SECTION 5 HEAT EXCHANGERS	
5.1 SCOPE OF SECTION	22
5.2 GENERAL.....	22
5.3 HEAT TRANSFER FLUID	22
5.4 DESIGN AND CONSTRUCTION	23
5.5 INSTRUCTIONS AND MARKING.....	23
SECTION 6 PUMPS AND CONTROLLERS	
6.1 SCOPE OF SECTION	25
6.2 CIRCULATING PUMP.....	25
6.3 CONTROLLERS FOR PUMPS AND SUPPLEMENTARY HEATING	25

SECTION 7 SOLAR WATER HEATER SYSTEMS

7.1	SCOPE OF SECTION	27
7.2	SOLAR HOT WATER SYSTEMS	27
7.3	AIR VENT.....	27
7.4	SYSTEM PERFORMANCE.....	27

SECTION 8 HEAT PUMP WATER HEATERS

8.1	SCOPE OF SECTION	29
8.2	SYSTEM PERFORMANCE.....	29
8.3	REFRIGERANT	30
8.4	DESIGN AND CONSTRUCTION	30
8.5	INSTRUCTIONS AND MARKING.....	32

APPENDICES

A	MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD.....	33
B	STAGNATION TEST FOR COLLECTOR AND INTEGRAL COLLECTOR AND CONTAINER.....	38
C	IMPACT TESTS.....	44
D	TEST FOR WATER INGRESS AND RETENTION IN COLLECTOR	47
E	TEST FOR PROTECTION AGAINST FREEZING	50
F	NO-LOAD SYSTEM OPERATION TEST.....	53
G	TEST METHOD FOR SOLAR ENERGY TRANSMITTANCE OF SHEET MATERIALS.....	58

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Solar and heat pump water heaters—Design and construction**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies performance-based requirements for the design and construction of both components of solar and heat pump hot water supply systems, and complete systems, for household premises and for commercial and industrial installations comparable with household installations, intended to deliver drinking water of acceptable quality.

Systems may be supplied as packaged systems comprised of a complete set of matched components supplied from one source, or may be custom-built by assembling components from various sources on-site.

NOTES:

- 1 Systems may transfer solar energy directly to the heated water or may use water or other heat exchange fluid for the transfer of heat.
- 2 Some aspects of this Standard may be used for solar water heaters that use plastics as the primary material in the construction of the absorber plate but additional test requirements outside this Standard may be necessary for the evaluation of the durability of such appliances.
- 3 The requirements of this Standard are based on systems with fixed solar orientation and inclination, but they may be applied to tracking systems.
- 4 Requirements for the installation of household solar heated water supply systems are given in AS/NZS 3500.4 and also in AS/NZS 3500.5.
- 5 For the purposes of calculating the thermal performance of solar and heat pump water heaters, refer to Clauses 7.4.2 and 8.2.2 respectively.
- 6 In addition to complying with this Standard, solar and heat pump water heaters may be required to comply with the following Standards.
 - (a) AS/NZS 60335.1
 - (b) AS/NZS 60335.2.21
 - (c) AS/NZS 60335.2.40
 - (d) AS/NZS CISPR 14.1
 - (e) AS 4552
 - (f) NZS/AS 3645.1 and NZS/AS 3645.2
 - (g) AS 3498
 - (h) AS/NZS 4692.1
- 7 Manufacturers making a statement of compliance with a Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

1.2 APPLICATION

Means for demonstrating compliance with this Standard shall be in accordance with Appendix A.

1.3 SYSTEMS COVERED BY THIS STANDARD

1.3.1 System types

System types may include—

- (a) systems with the solar collector remote from the heated water container with primary circuit piping arranged to suit site conditions;
- (b) close-coupled solar water heaters;
- (c) integral solar water heaters; and
- (d) solar-boosted and air-source heat pump water heaters.

1.3.2 System configurations

Systems may be configured as—

- (a) open circuit systems, where the water in the primary circuit flow is directly heated in the collector; or
- (b) closed circuit systems, where a heat transfer fluid (often other than water) is used in the primary circuit between the collector/evaporator and the water, and the heat from the fluid is transferred to the water through a heat exchanger that may be part of the container.

1.3.3 System components

Components may be supplied as separate items to be retrofitted to existing heated water installations to provide energy input to those systems.

Components and equipment include—

- (a) solar collectors containing absorbers, that may be assembled in an array connected to the same storage container;
- (b) heated water storage containers that may have additional means of heating to supplement the solar input together with a controller for that heating;
- (c) pumps and controllers for circulation of the water or other heat transfer fluid between the collector/heat pump and the container.
- (d) heat pumps for energy collection or energy transfer; and
- (e) heat exchangers

1.3.4 Packaged or factory made systems

Solar water heating systems may be supplied as packaged systems comprised of a complete set of matched components supplied from one source, or may be customized by assembling components from various sources on site.

Packaged or factory-made solar water heating systems are batch products with one trade name, sold as complete and ready to install kits, with fixed configurations. Systems of this category are considered as a single product and assessed as a whole. If a packaged system is modified by changing its configuration or by changing one or more components, the modified system is considered a new system for which a new conformance report will be necessary.

Customized or custom-built solar water heating systems are either uniquely built or assembled by choosing from an assortment of components. The components are separately tested and the test results are integrated to give an assessment of the whole system.

Where systems are to be customized, the individual components shall meet the appropriate tests of this Standard, and the customized system as a whole shall meet any claimed system performance levels by having demonstrated similarity of performance to a representative product that meets the requirements of this Standard.

NOTE: Compliance may be established by reference to a representative product that meets the requirements of this Standard.

1.4 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1145 Determination of tensile properties of plastics materials

1145.3 Part 3: Test conditions for films and sheets

1288 Glass in buildings—Selection and installation

1432 Copper tubes for plumbing, gasfitting and drainage applications

1580 Paints and related materials—Methods of test

1580.408.4 Method 408.4: Adhesion (crosscut)

1769 Welded stainless steel tubes for plumbing applications

A3 | 2984 Solar water heaters—Methods of test for thermal performance—Outdoor test method

3498 Authorization requirements for plumbing products—Water heaters and hot water storage tanks

A3 | 4055 Wind loads for housing

4552 Gas fired water heaters for hot water supply and/or central heating

A3 | ATS

5200 Plumbing and drainage products

5200.053 Part 0.53: Stainless steel pipes and tubes for pressure applications

AS/NZS

CISPR 14.1 Electromagnetic compatibility—Requirements for household appliances, electric tools and similar apparatus—Emission

1677 Refrigeration systems

1677.1 Part 1: Refrigerant classification

1677.2 Part 2: Safety requirements for fixed applications

A1 | 2208 Safety glazing materials in buildings

2535 Test methods for solar collectors

2535.1 Part 1: Thermal performance of glazed liquid heating collectors including pressure drop (ISO 9806-1:1994,MOD)

3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)

A3 | 'Text deleted'

3500 Plumbing and drainage

3500.1 Part 1: Water services

3500.4 Part 4: Heated water services

3500.5 Part 5: Domestic installations

	AS/NZS	
	3820	Essential safety requirements for low voltage electrical equipment
	4020	Testing of products for use in contact with drinking water
	4234	Solar water heaters—Domestic and heat pump—Calculation of energy consumption
	4445	Solar heating—Domestic water heating systems
	4445.1	Part 1: Performance rating procedure using indoor test methods
	4692	Electric water heaters
	4692.1	Part 1: Energy consumption, performance and general requirements
A1	5125	Heat pump water heaters—Performance assessment
	5125.1	Part 1: Air source heat pump water heaters
	60335	Household and similar electrical appliances
	60335.1	Part 1: General requirements
	60335.2.21	Part 2.21: Safety—Particular requirements for storage water heaters
A3	60335.2.40	Part 2.40: Safety—Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers
	NZS/AS	
	3645	Essential requirements for gas equipment
	3645.1	Part 1: Essential safety
	3645.2	Part 2: Certification
	NZS	
	3501	Specification for copper tubes for water, gas, and sanitation
	4223	Code of practice for glazing in buildings
	4223.1	Part 1: Code of practice for glazing in buildings
	4223.4	Part 4: Dead, wind and snow loadings
	4602	Low pressure copper thermal storage electric water heaters
A3	‘Text deleted’	
	HB 18.28	Conformity assessment—Guidance on third-party certification system for products
	ISO	
	9060	Solar energy—Specification and classification of instruments for measuring hemispherical solar and direct solar radiation
	9553	Solar energy—Methods of testing preformed rubber seals and sealing compounds used in collectors
A3	9806	Solar energy—Solar thermal collectors—Test methods
	‘Text deleted’	
	ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories
	ASTM	
	D638	Standard Test Method for Tensile Properties of Plastics
	D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting
	E424	Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials
A3	G155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

NZBC New Zealand Building Code
 NZBC G12 Clause G12 Water Supplies

1.5 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.5.1 Absorber

A device within a collector for absorbing radiant energy and transferring this energy as heat into a fluid.

1.5.2 Air-source heat pump water heater

A system consisting of a heat pump with an evaporator, collecting energy from latent and sensible heat of the atmosphere, and a condenser delivering heat to water.

1.5.3 Casing

The assembly or jacket enclosing the absorber or the container and its thermal insulation, and, in the case of the absorber, holding the collector cover.

1.5.4 Close-coupled solar water heater

See solar water heater, close-coupled.

1.5.5 Collector

A device containing an absorber.

1.5.6 Collector aperture

The net area available for transmission of solar radiation through the outer air/cover interface; for unglazed collectors, the net plan area of the absorber.

1.5.7 Collector area, gross

Maximum projected area of a complete solar collector excluding any integral means of mounting and connecting fluid pipework.

For an array or assembly of flat plate collectors, evacuated tubes or concentrating collectors, the gross area includes the entire area of the array, and the borders and the frame.

1.5.8 Container

The vessel, including fittings, in which the heated water is stored; sometimes referred to as a storage container, cylinder or tank.

1.5.9 Custom-built system

A system assembled from an assortment of system components and designed to suit a particular installation.

NOTE: *See* also packaged system.

1.5.10 Design life

The life nominated by the manufacturer or supplier that a purchaser can reasonably expect of the system or component when installed, used and maintained in accordance with the manufacturer's or supplier's instructions.

1.5.11 Heat exchanger, single wall

A type of heat exchanger in which only one wall separates the drinking water and the heat-transfer fluid.

A3

1.5.12 Heat exchanger, double wall

A type of heat exchanger in which at least two distinct and separated walls separate the drinking water and the heat-transfer fluid.

1.5.13 Integral solar water heater

See solar water heater, integral.

1.5.14 Packaged system

A system with a fixed configuration, sold as a ready-to-install kit containing all system components.

1.5.15 Shell

The container excluding all detachable components.

1.5.16 Solar-boosted heat pump water heater

A system consisting of a heat pump with an evaporator, collecting energy from solar radiation and latent and sensible heat from the atmosphere, and a condenser delivering heat to water.

1.5.17 Solar water heater (heat-exchange type)

A solar water heater in which drinking water is heated by a heat-transfer system that maintains a physical separation between a primary heat-transfer fluid circulated in the collector and drinking water.

1.5.18 Solar water heater, close-coupled

A solar water heating system in which the storage vessel is mounted directly adjacent to the collector.

1.5.19 Solar water heater, integral

A solar water heating system in which the container and collector are constructed as a single unit.

1.5.20 Solar preheater

A solar water heater not containing a means of supplementary heating and installed to preheat the cold water supply prior to its entry into any other type of water heater.

1.5.21 Stagnation temperature

The steady state temperature in the collector fluid ways when no energy is being extracted from the collector.

NOTE: For test purposes, the maximum stagnation conditions for Australia are considered to be 1100 W/m² of radiation and 50°C ambient air temperature, and for New Zealand, 1100 W/m² and 40°C.

1.5.22 Supplementary heating unit

A heating unit for supplying supplementary energy, including where relevant its thermal insulation, supports and immediate enclosure.

1.5.23 Unvented water heater

A water heater in which the required venting is controlled by a pressure-relief valve.

1.5.24 Vented water heater

A water heater open to the atmosphere so that under no conditions of use can the pressure at the surface of the water be other than atmospheric.

1.5.25 Volumetric storage capacity of container

The total volume of water, in litres, that can be held in the container.

SECTION 2 GENERAL DESIGN REQUIREMENTS

2.1 SCOPE OF SECTION

This Section specifies minimum requirements for the design for durability and safe operation of solar and heat pump water heater systems and components.

2.2 MATERIALS IN CONTACT WITH DRINKING WATER

Systems and components shall be designed to avoid contamination of drinking water.

Components that comply with the requirements of AS/NZS 4020 shall be deemed to comply with this requirement.

2.3 FACILITIES FOR INSTALLATION

System components shall be designed so that they can be soundly supported when installed and do not form a hazard to people or the building.

Components shall be designed so that they can be fixed to structures in a secure and durable manner to withstand wind, earthquake and snow loadings applicable to the locality.

Fixing shall be designed so that the fixing components do not compromise the integrity of the roof cladding.

2.4 FACILITIES FOR MAINTENANCE

The design of the water heater system and components shall be such as to facilitate maintenance.

Where the water heater includes protective anodes, relief valves, thermostats or over-temperature protective devices, clearance from their housings shall be provided so that they may be withdrawn when the unit is installed in accordance with the manufacturer's instructions.

NOTE: Thermostats and over-temperature protective devices should be capable of removal without the need to drain off the water.

2.5 PIPES

Pipes shall be suitable for the chemical, thermal and mechanical conditions likely to be encountered in the operation of the system, including fault conditions such as failure of the circulating pump and those leading to operation of the temperature pressure-relief valve.

Water pipes shall be installed in accordance with the requirements of AS/NZS 3500.4, unless the pipes and all their mating parts are supplied as part of a packaged system.

Where piping is exposed to the weather, the insulation shall be of a weather-resistant type or surrounded by a weather-resistant enclosure.

NOTES:

- 1 Any pipe for hot fluid has to be used only within its specification. Generally, plastic piping is not suitable for use when the hot water system includes an uncontrolled heat source such as a slow combustion stove or room heater with water-heating coils, wetback boiler, or the like.
- 2 The pipe material is normally copper or an appropriate plastic. Some plastics piping systems may be acceptable for hot water if the temperature and pressure limitations of those materials are not exceeded by the system under normal operating conditions and under fault conditions.

2.6 PRESSURE AND TEMPERATURE PROTECTION

2.6.1 Requirement for protection

All systems shall be designed to prevent the pressure in the container from exceeding the rated pressure and the operating temperature of an unvented water heater from exceeding 99°C.

A water heater that complies with the control and protection requirements of AS 3498 is deemed to comply.

Any solar or heat pump water heater, intended for use as a preheater in series with another water heater, shall be fitted with independent protection as specified above or, in New Zealand, shall comply with the requirements specified in NZBC G12/AS1. Protection devices on the other water heater shall not be considered a means of providing protection for the solar or heat pump water heater component of the system.

2.6.2 Rating of relief valves

The thermal discharge rating of the protection valve(s) shall be not less than the total output power of the collectors or heat pump plus that of any integrated supplementary heater. The total output power of the collector or heat pump shall be determined at 99°C water temperature, 1100 W/m² radiation and 50°C ambient air temperature (see Note 1).

Unvented collectors that are provided with isolating valves on the connecting lines shall be fitted with expansion control valves or other appropriate means to cope with expansion (see Note 2).

NOTES:

- 1 Where the solar or heat pump system is used as a preheater for a water heater connected in series downstream of the solar or heat pump system, the thermal input of the downstream water heater need not be taken into account.
- 2 Where collectors filled with refrigerant or heat transfer fluid (other than water) are used, protection is still required, but discharge to the environment may be inappropriate.

2.7 OVER-TEMPERATURE PROTECTION DEVICE

Unvented systems that include a controlled supplementary heater shall be fitted with an over-temperature protection device. Over-temperature protection devices shall comply with the following, as appropriate:

- (a) *Electric supplementary heating* Over-temperature protection devices, as required by AS/NZS 60335.2.21.
- (b) *Gas supplementary heating* Over-temperature protection device, at least equivalent to that required by AS 4552.

NOTE: The design of the system should be such that the temperature of the water in the container does not activate any non-self-resetting thermal cut-outs under normal conditions of operation.

2.8 SUPPLEMENTARY HEATING UNIT

Where the system incorporates a supplementary heating unit, the unit shall comply with the following requirements:

- (a) Electric heating units shall comply with the requirements of AS/NZS 60335.2.21.
- (b) Gas heating units shall comply with the requirements of AS 4552 or, in New Zealand, NZS/AS 3645.1 and NZS/AS 3645.2.

NOTES:

- 1 Supplementary heating equipment should have sufficient capacity to supply the likely demand for heated water in the absence of solar or heat pump input.
- 2 Supplementary heating should be controlled so that supplementary heat is added only after the solar irradiation or the heat pump has been the priority energy source for heating water in the system.

2.9 INSTRUCTIONS

2.9.1 Installation instructions

Instructions for the installation and maintenance of the water heater shall be supplied in the English language complete with appropriate diagrams giving details of the methods of connection and installation, and any other pertinent information to achieve a safe and effective installation.

The information supplied with each water heater shall include, but not necessarily be limited to, the following, where applicable:

- (a) Any limitations on the water quality and supply pressure.
- (b) Details of the methods of connection and installation, which shall include the following:
 - (i) A statement to the effect that the water heater will have to be installed in accordance with the requirements of AS/NZS 3500.4 or, in New Zealand, NZBC G12, and including a statement of acceptable piping materials and the insulation requirements for pipes between the collector and the container.
 - (ii) An outline of the practices that must be followed to provide for the draining of the container, the expansion of water during heating, and the relief of partial vacuum.
 - (iii) A statement on the necessity for providing a properly drained safe-tray under heaters or feed tanks located where leakage may cause damage.
 - (iv) A statement (where applicable) that the water heater has a container of non-metallic material and that the method of fixing the fittings to the casing must not be interfered with, and that excessive strain should not be applied to these fittings when the external connections are made.
 - (v) A statement of any limitations on the suitability of the water heater for use with water of specified poor quality, and any need for water softening treatment.
- (c) A statement as to the level of frost protection the system is designed for.
- (d) Instructions indicating requirements for special guards to prevent damage to the collector.

NOTE: Guards may be necessary to prevent damage by hail, accident or vandalism. Where unglazed collectors are used as the evaporator in a solar-booster heat pump system, damage could result in the release of high-pressure refrigerant from the collector.
- (e) Information necessary for adequate structural design of the mounting system, including, for example, the mass of the system or its major component parts, when filled with water and, for roof-mounted units, appropriate mounting details for cyclonic areas if the unit is suitable for installation in such areas.
- (f) Instruction to the installer to ensure that the installation of the solar water heater does not compromise the structural integrity of the building.
- (g) Instructions for secure fixing on the roof for the range of roof claddings likely to be encountered.
- (h) Instructions for the setting of any boost controller.
- (i) Details of the setting of any adjustable thermostat.
- (j) The procedure to be followed to place the water heater system in service and to ensure that it is adequately filled with water.
- (k) Advice regarding the need for tempering valves.

2.9.2 Operating and maintenance instructions

The manufacturer shall supply with each water heater details of any operating and maintenance procedures to be followed by the householder.

The operating and maintenance instructions shall include the following, where applicable:

- (a) Instructions on the freeze protection mechanisms applying to the solar system and advice on any monitoring or other action that has to be taken in the event of freezing occurring.
- (b) Instructions for the operation of any supplementary heating, if supplied as part of the system.
- (c) Procedures for cleaning the collector glazing.
- (d) A warning regarding the hazards of replacing the glazing of collectors.
- (e) Instructions for draining and flushing the container and direct solar water heater collectors, and the appropriate interval at which this has to be carried out.
- (f) Instructions for operating the valve easing gear of the active expansion relief valve.
- (g) Details regarding replacement of the protective anode, if recommended by the manufacturer, at suitable intervals (dependent on the nature of the water supply) and a recommendation that the manufacturer be consulted regarding suitable replacement anodes.
- (h) If the water heater is fitted with an anode, a warning statement similar to the following:

WARNING:

IF THE HOT WATER SYSTEM IS NOT USED FOR TWO WEEKS OR MORE, A QUANTITY OF HIGHLY FLAMMABLE HYDROGEN GAS MAY ACCUMULATE IN THE WATER HEATER. TO DISSIPATE THIS GAS SAFELY, IT IS RECOMMENDED THAT A HOT TAP BE TURNED ON FOR SEVERAL MINUTES OR UNTIL DISCHARGE OF GAS CEASES. USE A SINK, BASIN, OR BATH OUTLET, BUT NOT A DISHWASHER, CLOTHES WASHER, OR OTHER APPLIANCE. DURING THIS PROCEDURE, THERE MUST BE NO SMOKING, OPEN FLAME, OR ANY ELECTRICAL APPLIANCE OPERATING NEARBY. IF HYDROGEN IS DISCHARGED THROUGH THE TAP, IT WILL PROBABLY MAKE AN UNUSUAL SOUND AS WITH AIR ESCAPING.

SECTION 3 CONTAINERS

3.1 SCOPE OF SECTION

This Section specifies minimum requirements for containers used in solar and heat pump water heater systems. It covers containers with a volumetric storage capacity up to and including 700 L.

3.2 CONSTRUCTION AND PERFORMANCE

Containers, their casings and any attached feed tanks shall comply with the relevant requirements of AS/NZS 4692.1 or AS 4552, as appropriate.

The relevant requirements for the purpose of this Standard are—

- (a) the performance of the container under hydrostatic pressure, pressure fluctuations and fatigue, and torque on fittings;
- (b) provision for anodic protection;
- (c) thermal insulation;
- (d) construction of the shell; and
- (e) performance of linings.

NOTE: Requirements prescribing bolt-on heating elements are not relevant.

Externally mounted containers shall be adequately weatherproofed and insulated, and enclosed in a casing that will resist weathering, ultraviolet radiation and corrosion, and protect the insulation for the design life of the installation.

Containers that comply with AS/NZS 4692.1 shall be deemed to satisfy this requirement.

3.3 MARKING

Containers shall be clearly and indelibly marked either on the nameplate or on the container casing itself, adjacent to the nameplate with sufficient information to identify—

- (a) the manufacturer and, if applicable, the importer;
- (b) the manufacturer's model number or name;
- (c) the month and year of manufacture (e.g., 01/2008 for January 2008) or a code or serial number, and such other information as necessary to provide traceability of the manufacturing batch;
- (d) the type of construction of the container;
- (e) the maximum operating pressure, in kilopascals or megapascals (kPa or MPa);
- (f) the manufacturer's nominated thermostat setting or maximum allowable thermostat setting, if applicable;
- (g) the volumetric storage capacity of the container, in litres; and
- (h) the number of the Standard to which the container conforms.

Where a system's future performance could be impaired by partial draining of the container, a warning notice shall be applied in a prominent position advising of the precautions that need to be observed.

SECTION 4 COLLECTORS

4.1 SCOPE OF SECTION

This Section specifies minimum requirements for absorbers and collectors for use in solar water heater systems and solar-boosted heat pump water heaters.

4.2 ABSORBERS

4.2.1 Materials

The absorber material shall be compatible with other materials in the collector.

For a painted absorber surface, the adhesion of the paint coating shall be such that, when tested in accordance with AS 1580.408.4, it shall achieve an adhesion classification of 0.

NOTE: The material used should have a surface having the property of high absorbance to solar radiation. A low thermal emittance may also be desirable and may be achieved by a selective surface treatment. Low thermal emittance is not important for unglazed solar boosted heat pump evaporators.

4.2.2 Fluid ways of absorbers

The fluid ways of the absorber shall be capable of meeting the hydraulic test requirements of AS/NZS 60335.2.21 appropriate to the intended operating pressures and not inferior with regard to corrosion resistance, and durability, under the conditions of use, to one of the following:

- (a) Copper tubing complying with the relevant requirements of AS 1432 for at least Type C tube, or of NZS 3501,
- (b) Stainless steel tubing complying with the relevant requirements of AS 1769 or AS 5200.053.

Where fabricated from copper alloy, the absorber fluid ways shall be resistant to the effects of dezincification and stress corrosion cracking.

4.3 COLLECTOR MATERIALS AND CONSTRUCTION

4.3.1 Thermal insulation of collector

Thermal insulation shall comply with the following requirements:

- (a) The insulating material shall be such that it will not—
 - (i) deteriorate in service;
 - (ii) become compacted and leave poorly insulated voids during transportation or installation; or
 - (iii) cause corrosion of any part of the collector with which it is in contact.
- (b) Insulating material shall not degrade or outgas when subject to the temperature reached by the absorber under stagnation conditions.
- (c) Where the design of the collector unit is such that insulating material will be exposed to sunlight under operating conditions, it shall not be adversely degraded by such exposure.

4.3.2 Collector casing

The collector casing and mountings shall be fabricated from materials that are robust and durable under the conditions of use. Suitable materials include:

- (a) metal or other material having durability properties under the conditions of use not inferior to those of hot-dip zinc-coated steel sheet; or
- (b) any material appropriate for the purpose, which is acceptable for use, under the New Zealand Building Code or the Australian Building Code, as external cladding or roof covering of buildings.

The collector casing shall be designed to accommodate any pressure changes resulting from temperature changes within the collector.

NOTE: This requirement is assessed during the stagnation test in Appendix B.

4.3.3 Sealing materials

Where the design of the collector is such that sealing materials, gaskets, grommets or hoses are exposed to heat and sunlight under operating conditions, these components shall be of such quality that they retain their ability to fulfil their function throughout the design life of the collector. Sealants and gaskets shall withstand the normal forces generated by thermal expansion of the collector components.

Seals and sealing materials that satisfy ISO 9553 type C class W are deemed to comply with this requirement;

4.3.4 Evacuated tube collectors

Evacuated tube collectors shall be constructed such that—

- (a) there is adequate support for the tubes;
- (b) there is suitable means of securing the tubes in the header; and
- (c) tubes are easily replaceable

Evacuated tubes shall be capable of holding a vacuum for the design life of the tubes, and each tube shall have an indicator to clearly show the loss of vacuum.

4.3.5 Loss of water due to glazing failure

Failure of any element of the glazing system shall not result in the continuous loss of water. The total volume of water lost as a result of glazing failure shall be no greater than two times the tank volume.

4.4 GLAZING OF COLLECTORS

4.4.1 Securing of glazing

Glazing systems for collectors shall be durable and capable of withstanding loadings likely to be imposed. The glazing shall also be able to withstand potential damage from animals and birds.

The glazing shall be securely fastened and sealed to make provision for thermal expansion and contraction of the glazing material and the collector.

4.4.2 Thickness of flat plate glazing

The thickness of any glazing of flat plate collectors shall comply with the relevant requirements of AS 1288 or NZS 4223.1 and NZS 4223.4, as appropriate, for any location at which it is intended that the collector be installed.

A3

- A3 | Based on AS 4055 and the mechanical load test of ISO 9806, a design wind pressure of 2.4 kPa shall be the minimum required design wind pressure for the AS 1288 glass thickness calculation.

For 3 mm toughened glazing, the AS 1288 maximum allowable span shall be calculated from that for 4 mm toughened glazing by multiplying the result by 0.762 (the approximate ratio of allowable spans between four-edge supported annealed 3 mm and 4 mm glazing with aspect ratio 2 subjected to the same design wind pressure).

4.4.3 Glass breakage

When an element of the glazing system breaks glass fragments with a dimension larger than 50 mm shall be safely retained. To assess the breakage safety of glass, an impact assessment test shall be conducted in accordance with Appendix C.

- A1 | Toughened safety glass complying with AS/NZS 2208 is deemed to comply with this requirement.

4.4.4 Glazing weather resistance

Collector glazing shall be of a material that can withstand the conditions to which it is exposed in normal service, such as temperature, wind, solar radiation and rain, without physical degradation or loss of transparency over the design life of the collector. Glass is deemed to comply with this requirement.

- A3 | When exposed to 2000 h of accelerated weathering in a weather simulation chamber (Xenon-arc weatherometer) operated in accordance with ASTM G155, using a black panel temperature of 70°C and a cycle of 102 min of light followed by 18 min of light and spray together, polymeric glazing material shall meet the following criteria:

- (a) There shall be no evidence of cracking or crazing when visually examined without magnification (other than using normal eyeglasses).
- (b) The optical transmittance of the glazing material, measured in accordance with ASTM E424, Part A or Appendix G of this Standard shall not decrease by more than 10% as a result of the exposure.
- (c) Neither the tensile strength nor the elongation of the glazing material shall decrease by more than 20% as a result of the exposure, when tested in accordance with either—
 - (i) AS 1145; or
 - (ii) ASTM D882 in the case of material less than 1.0 mm thick, or ASTM D638 in the case of material of thickness 1.00 mm or greater.

4.5 RESISTANCE TO STAGNATION CONDITIONS

4.5.1 General

Collectors shall be designed to resist damage due to stagnation, or alternatively the solar water heater system shall be designed to avoid the detrimental consequences of stagnation conditions.

Collectors designed to resist damage due to stagnation shall comply with the requirements of Clause 4.5.2. Systems designed to avoid stagnation conditions shall comply with the requirements of Clause 4.5.3.

4.5.2 Systems with collectors designed to resist stagnation conditions

When tested in accordance with Appendix B, collectors shall meet the following criteria:

- (a) There shall be no evidence of catastrophic or partial structural failure of the collector, or of the collector cover when visually examined without magnification (other than using normal eyeglasses).

- (b) There shall be no failure likely to impair the serviceability or durability of the collector.
- (c) There shall be no evidence of any burning or scorching of any part of the collector.
- (d) The thermal efficiency after the stagnation test shall be no less than 0.85 of the initial efficiency at the check test condition specified in Appendix B.

4.5.3 Systems designed to avoid stagnation conditions

Systems with collectors that are not subject to the requirements of Clause 4.5.2 shall meet the following criteria:

- (a) The system shall provide protection during normal operation and service, including the loss of water supply pressure or electricity supply for a period of 30 d, without damage as defined in Clause 4.5.2(a) to (c).
- (b) Collectors that rely on their system heat transfer fluid for permanent protection shall be permanently and prominently labelled on the side of the collector, on the storage tank, and on the opaque cover with a sign similar to the following:

WARNING:

THE SOLAR COLLECTOR MAY FAIL IF EXPOSED TO SUNLIGHT WHEN EMPTY.

USE ONLY A SUPPLIER-APPROVED INSTALLER FOR ALL INSTALLATION AND
SERVICING WORK.

CONTACT MANUFACTURER TO ASCERTAIN APPROVED INSTALLERS.

- (c) The manufacturer shall fit a removable weatherproof opaque cover to every collector to prevent radiation damage, and shall permanently and prominently include a warning label similar to the following:

WARNING:

THIS COVER SHALL BE REMOVED ONLY BY A SUPPLIER-APPROVED
INSTALLER.

NOTE: The cover and its securing should be capable of withstanding exposure to weather in the installed location for at least 12 months.

4.6 IMPACT RESISTANCE

Solar collectors shall be capable of withstanding large-stone hailstorms unless they are suitably marked.

Compliance with this requirement is achieved if—

- (a) when tested in accordance with method 1 or 2 of Appendix C, collectors sustain no significant damage, cracking, breaking or puncture of any glazing, or of the absorber in an unglazed collector; or
- (b) collectors supplied in Australia are fitted with suitable impact guards, and tested to comply with Item (a) with the guards fitted and have a permanent marking stating 'THIS ITEM IS NOT CERTIFIED FOR USE IN AUSTRALIA WITHOUT A SUITABLE IMPACT GUARD'; or
- (c) collectors have a permanent marking stating 'THIS COLLECTOR IS NOT CERTIFIED FOR USE IN AUSTRALIA'.

NOTE: Where hail guards are provided, it is recommended that they be located not less than 50 mm from the surface of the glazing of glazed collectors, or the absorber surface for unglazed collectors.