

Supplement

Heated water systems — Calculation of energy consumption — Parameters and outcomes for software simulations (Supplement to AS/NZS 4234:2021)



AS/NZS 4234:2021 Sup 1:2021

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Preface

This Supplement was prepared by the Joint Standards Australia/Standards New Zealand Committee CS-028, Solar Heating and Cooling.

This document is intended to be used with AS/NZS 4234:2021 to establish if a proposed simulation program meets the modelling requirements specified in AS/NZS 4234.

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Supplement

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1 Scope

This Supplement to AS/NZS 4234:2021 provides the input parameters and outcome values to be used when establishing the suitability of simulation software.

2 References

AS 3498, *Safety and public health requirements for plumbing products—Water heaters and hot-water storage tanks*

AS/NZS 2535.1, *Test methods for solar collectors, Part 1: Thermal performance of glazed liquid heating collectors including pressure drop (ISO 9806-1:1994, MOD)*

AS/NZS 4692.1, *Electric water heaters, Part 1: Energy consumption, performance and general requirements*

AS/NZS 5125, *Heat pump water heaters—Performance assessment, Part 1: Air source heat pump water heaters*

3 Input parameter tables

The information in the tables is arranged for each technology type, as follows:

- (a) [Table 1](#) — Thermosiphon SWH with inline instantaneous gas boost.
- (b) [Table 2](#) — Thermosiphon SWH with in-tank electric boost.
- (c) [Table 3](#) — Pumped SWH with inline instantaneous gas boost.
- (d) [Table 4](#) — Pumped SWH with inline instantaneous electric boost.
- (e) [Table 5](#) — Pumped SWH with in-tank electric boost.
- (f) [Table 6](#) — Heat pump water heater — Integral with in-tank electric boost.
- (g) [Table 7](#) — Heat pump water heater — Standalone with in-tank electric boost.
- (h) [Table 8](#) — PV powered heat pump — Standalone with in-tank grid electric boost.
- (i) [Table 9](#) — PV powered SWH with grid electric boost.
- (j) [Table 10](#) — Pumped SWH with heat pump — Standalone boost.
- (k) [Table 11](#) — Electric reference water heater, very small and small loads for Australia.
- (l) [Table 12](#) — Electric reference water heater, medium and large loads for Australia.
- (m) [Table 13](#) — Gas reference water heater, all loads for Australia and New Zealand.
- (n) [Table 14](#) — Electric reference water heater, all loads for New Zealand.

Table 1 — Thermosiphon SWH with inline instantaneous gas boost

System type	Thermosiphon SWH with inline instantaneous gas boost	
Tank		
Parameter	Units	
Tank inner diameter	m	0.5
Tank volume (physical not delivery)	L	270
Tank configuration	Vertical or horizontal	Horizontal
Tank wall thickness	m	0.003
Thermal conductivity of tank wall material. Use default values if specific conductivity data is not available. Carbon steel = 50 W/m K, Stainless steel = 15 W/m K	W/(m K)	50
Height of flow input from collector above bottom of inside tank wall	m	0.24
Height of flow outlet to collector above bottom of inside tank wall	m	0
Height of outlet to load supply above bottom of inside tank wall	m	0.5
Height of cold water inlet above bottom of inside tank wall	m	0
Ratio of insulation thickness at top to bottom of horizontal tank		1
Tank heat loss (electric boosted tanks and solar preheat tanks)		
Tank standing heat loss (AS/NZS 4692.1) conditions with element in the bottom of the tank	kWh/day for $\Delta T = 55\text{ K}$	2.2
Supplementary boosting		
Instantaneous gas boosting		
Determined gas capacity (maximum gas input)	MJ/h	
Efficiency AS 4552	%	0.8
Electric power consumption during standby	W	10
Electric power consumption during burner operation	W	50
Start-up heat capacity (AS 4552)	MJ	0.5
Thermostat set temperature	°C	70
Supplementary boost energy control (detail all elements or burners)		
Boosting control strategy (all supplementary boost options)		Instantaneous gas boosting is operated during load flow periods when gas booster water inlet temperature is less than trigger temperature.
Gas booster trigger temperature		70°C
Legionella control method — Provide details of control strategy		Instantaneous gas boosting set to a temperature of 70 °C, which satisfies the minimum legionella sanitation required by AS 3498

Table 1 (continued)

Pipe between solar preheat tank and gas booster		
Inner diameter (ID)	m	0.01
Pipe length (minimum 5 m)	m	10
Thermal conductivity of pipe insulation material	W/(m K)	0.06
Pipe insulation thickness	m	0.01
Solar collector		
Type of collector	Flat plate, evacuated tube, CPC or other	Flat plate
Collector efficiency parameters (AS/NZS 2535) specify a or b coefficients		
$a_1 =$		0.7
$a_2 =$	W/(m ² K)	5
$a_3 =$	W/(m ² K ²)	0.02
Collector area used by test laboratory to define efficiency	m ²	1.8
Number of collectors used in water heater		2
Incidence angle modifier		
Flat plate $b =$		0.06
Number of risers or evacuated tubes in each collector		7
Riser inner diameter	m	0.012
Riser length	m	1.8
Header inner diameter	m	0.024
Header length (one header only)	m	1.072
Solar collector loop plumbing		
Direct connection to tank or via heat exchanger	Direct or heat exchanger	Direct
Vertical separation between the centre-line of the collector upper header and the centre-line of the collector lower header	m	0.616
Vertical separation between the tank cold outlet to the collector and the centre-line of the collector inlet header	m	0.716
Collector supply (inlet) pipe inner diameter	m	0.016
Collector supply (inlet) pipe number of 90° bends		3
Inlet pipe length	m	3.1
Inlet pipe insulation thickness	m	0.01
Thermal conductivity of inlet pipe insulation material. Use default values if specific insulation data is not available. Closed cell foam = 0.06 W/m K Rubberized, polytube or fibre = 1.0 W/m K	W/(m K)	0.06
Collector outlet pipe inner diameter	m	0.016
Collector outlet pipe number of 90° bends		3
Outlet pipe length	m	1.1
Outlet pipe insulation thickness	m	0.01
Thermal conductivity of outlet pipe insulation material. Use default values if specific insulation data is not available.	W/(m K)	0.06

Table 1 (continued)

Closed cell foam = 0.06 W/m K, Rubberized, polytube or fibre = 1.0 W/m K		
Outlet pipe insulation thickness	m	0.01
Thermosiphon flow limiting valve set-point temperature	°C	65

Table 2 — Thermosiphon SWH with in-tank electric boost

System type	Thermosiphon SWH with in-tank electric boost	
Tank		
Parameter	Units	
Tank inner diameter	m	0.5
Tank volume (physical not delivery)	L	270
Tank configuration	Vertical or horizontal	Horizontal
Tank wall thickness	m	0.003
Thermal conductivity of tank wall material. Use default values if specific conductivity data is not available. Carbon steel = 50 W/m K, Stainless steel = 15 W/m K	W/(m K)	50
Height of flow input from collector above bottom of inside tank wall	m	0.24
Height of flow outlet to collector above bottom of inside tank wall	m	0
Height of outlet to load supply above bottom of inside tank wall	m	0.5
Height of cold water inlet above bottom of inside tank wall	m	0
Ratio of insulation thickness at top to bottom of horizontal tank	—	1.5
Tank heat loss (electric boosted tanks and solar preheat tanks)		
Tank standing heat loss (AS/NZS 4692.1) conditions with element in the bottom of the tank	kWh/day for $\Delta T = 55$ K	2.2
Supplementary boosting		
Electric boosting in tank		
Height of electric element No. 1 above bottom of inside tank wall. For sickle elements, the volume above the level with 50 % of the active length of the element above and below.	m	0.25
Height of thermostat No. 1 above bottom of inside tank wall	m	0.26
Thermostat 1 set temperature	°C	60
Thermostat 1 deadband	K	5
Element heating capacity No. 1	kW	3.6
Electric boost power connection for element No. 1	Night rate off-peak (OP1), extended off-peak (OP2), continuous (C) or local controller timing (L).	Continuous

Table 2 (continued)

Supplementary control energy control (detail all elements or burners)		
Boosting control strategy (all supplementary boost options)	Detail supplementary heating times (e.g. continuous, off-peak), other time control or other strategy (provide separate description of control logic if strategy is not simple time control).	Continuous
Legionella control method — Provide details of control strategy		In-tank boosting has an effective volume of 52.5 % and is set to 60 °C, which meets legionella requirements specified in AS 3498.
Solar collector		
Type of collector	Flat plate, evacuated tube, CPC or other	Flat plate
Collector efficiency parameters (AS/NZS 2535) specify a or b coefficients		
$a_1 =$		0.7
$a_2 =$	W/(m ² K)	5
$a_3 =$	W/(m ² K ²)	0.02
Collector area used by test laboratory to define efficiency	m ²	1.8
Number of collectors used in water heater		2
Incidence angle modifier		
Flat plate $b =$		0.06
Number of risers or evacuated tubes in each collector		7
Riser inner diameter	m	0.012
Riser length	m	1.8
Header inner diameter	m	0.024
Header length (one header only)	m	1.072
Solar collector loop plumbing		
Direct connection to tank or via heat exchanger	Direct or heat exchanger	Direct
Vertical separation between the centre-line of the collector upper header and the centre-line of the collector lower header	m	0.616
Vertical separation between the tank cold outlet to the collector and the centre-line of the collector inlet header	m	0.716
Collector supply (inlet) pipe inner diameter	m	0.016
Collector supply (inlet) pipe number of 90° bends		3
Inlet pipe length	m	3.1
Inlet pipe insulation thickness	m	0.01
Thermal conductivity of inlet pipe insulation material. Use default values if specific insulation data is not available. Closed cell foam = 0.06 W/m K Rubberized, polytube or fibre = 1.0 W/m K	W/(m K)	0.06

Table 2 (continued)

Collector outlet pipe inner diameter	m	0.016
Collector outlet pipe number of 90° bends		3
Outlet pipe length	m	1.1
Outlet pipe insulation thickness	m	0.01
Thermal conductivity of outlet pipe insulation material. Use default values if specific insulation data is not available. Closed cell foam = 0.06 W/m K, Rubberized, polytube or fibre = 1.0 W/m K	W/(m K)	0.06
Outlet pipe insulation thickness	m	0.01
Thermosyphon flow limiting valve set-point temperature	°C	65

Table 3 — Pumped SWH with inline instantaneous gas boost

System type	Pumped SWH with inline instantaneous gas boost	
Tank — Provide dimensioned drawing of the inner tank shell showing all tank connections and heat exchangers		
Tank inner diameter	m	0.59
Tank volume (physical not delivery)	L	315
Tank configuration	Vertical or horizontal	Vertical
Tank wall thickness	m	0.003
Thermal conductivity of tank wall material. Use default values if specific conductivity data is not available. Carbon steel = 50 W/m K Stainless steel = 15 W/m K	W/(m K)	50
Volume above flow input from collector	L	155
Volume above flow outlet to collector	L	315
Volume above outlet to load supply	L	0
Volume above cold water inlet	L	315
Ratio of insulation thickness at the top of the tank to the side of the tank for a vertical tank		1
Tank heat loss (electric boosted tanks and solar preheat tanks)		
Tank standing heat loss (AS/NZS 4692.1) conditions with element in the bottom of the tank	kWh/day for $\Delta T = 55\text{ K}$	2.93
Supplementary boosting		
Instantaneous gas boosting		
Determined gas capacity	MJ/h	
Efficiency	%	80
Electric power consumption during standby	W	10
Electric power consumption during burner operation	W	50
Start-up heat capacity	MJ	0.5
Thermostat set temperature	°C	70