

Australian Standard<sup>®</sup>

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**Solar water heaters—Domestic and  
heat pump—Calculation of energy  
consumption**

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This Australian Standard was prepared by Committee CS/28, Solar Water Heaters. It was approved on behalf of the Council of Standards Australia on 24 June 1994 and published on 22 August 1994.

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The following interests are represented on Committee CS/28:

Australian and New Zealand Solar Energy Society  
Australian Electrical and Electronic Manufacturers Association  
Department of Mines and Energy, N.T.  
Department of Primary Industries & Energy (Commonwealth)  
Electricity Supply Association of Australia  
Energy Research Centre  
Energy Victoria  
Engineering and Water Supply Department, S.A.  
Master Plumbers and Mechanical Services Association of Victoria  
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## PREFACE

This Standard was prepared by the Standards Australia Committee CS/28 on Solar Water Heaters. The performance evaluation procedure defined in this Standard has been designed to provide a means of evaluating the annual task performance of solar and heat pump water heaters and to provide a means for quickly evaluating the performance of a series of product configurations for a range of locations.

This Standard sets out a method of determining the annual performance of domestic solar and heat pump water heaters using a combination of test results for component performance and a mathematical model to determine an annual load cycle task performance. The Standard also defines a procedure for evaluating the task performance of conventional domestic water heaters so that the energy savings of solar and heat pump water heaters can be evaluated relative to conventional water heaters operated under the same annual task load.

Testing of solar water heating systems under outdoor or indoor solar irradiance conditions has been defined in AS 2984—1987, *Solar water heaters—Methods of test for thermal performance—Outdoor test method*, and AS 2813—1985, *Solar water heaters—Methods of test for thermal performance—Simulator method*. Outdoor testing requires a long test period (8-10 weeks) due to the need to obtain stable inputs for a range of operating conditions. Indoor testing (solar simulator) provides stable input conditions, however, the equipment required and operating costs are very expensive. The major drawback of the outdoor or indoor solar irradiance testing is that the test must be repeated for every variation of system configuration offered by the supplier.

The procedure defined in this Standard overcomes the time and cost limitations of previous water heater performance standards and provides a procedure for calculating the purchased energy consumption of solar and heat pump domestic water heaters.

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.

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## STANDARDS AUSTRALIA

## Australian Standard

**Solar water heaters—Domestic and  
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## SECTION 1 SCOPE AND GENERAL

**1.1 SCOPE** This Standard sets out a method of determining the annual performance of domestic solar and heat pump water heaters using a combination of test results for component performance and a mathematical model to determine an annual load cycle task performance. The procedure is applicable to solar water heaters with integral boosting or preheating into a conventional water heater and to heat pump water heaters. Solar and heat pump water heater types not covered in the application of this Standard can be tested under AS 2984 or AS 2813 to obtain an annual performance assessment.

**1.2 APPLICATION** The procedure in this Standard uses a mathematical model to assess annual task performance hence the application of the procedure is restricted by the availability of suitable mathematical models. The analysis required by this Standard shall be based on the TRNSYS simulation model (version 13.1 or later) with modifications to suit typical Australian solar and heat pump water heating products. The software required is included in this Standard together with weather data and typical system description files. The operating conditions to be used for evaluating the performance of a water heater are not defined in this Standard; however a set of typical weather and load conditions are specified in Appendix A.

This Standard defines computer simulation models for the following systems:

- (a) Single tank solar water heaters with electric or gas in-tank boosting.
- (b) Solar pre-heater in series with an instantaneous electric or gas booster.
- (c) Solar pre-heater in series with a conventional storage water heater
- (d) Heat pump water heaters with a flat plate evaporator exposed to ambient air or solar radiation, or both.

The following solar and heat pump water heater configurations are included:

- (i) Solar water heaters with flat plate, concentrating or evacuated tubular solar collectors.
- (ii) Thermosyphon or pumped fluid circulation through the solar collectors.
- (iii) Annular tank in tank heat exchanger in a thermosyphon loop.
- (iv) Horizontal or vertical water storage tanks.
- (v) Storage tanks with dual electric elements.
- (vi) Solar collectors acting as the evaporator in a heat pump circuit.
- (vii) Heat exchangers acting as the condenser in a heat pump circuit.

Other water heater configurations incorporating the above components may also be modelled.



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