

AS 2984—1987

Australian Standard<sup>®</sup>

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**SOLAR WATER HEATERS –  
METHOD OF TEST  
FOR THERMAL PERFORMANCE –  
OUTDOOR TEST METHOD**

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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 the Standards Association of Australia on 28 August 1987 and published on 5 October 1987.

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The following interests are represented on Committee CS/28:

Australian Gas Association  
CSIRO, Division of Energy Technology  
Department of Consumer Affairs, N.S.W.  
Department of Housing and Construction  
Department of Industrial Relations and Employment, N.S.W.  
Department of Mines and Energy, N.T.  
Department of Resources and Energy  
Electricity Supply Association of Australia  
Energy Authority of New South Wales  
Engineering and Water Supply Department, S.A.  
Gas and Fuel Corporation of Victoria  
International Solar Energy Society  
Master Plumbers and Mechanical Services Association of Victoria  
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*This Standard was issued in draft form for comment as DR 86145.*

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## PREFACE

This Standard was prepared by the Association's Committee on Solar Water Heaters. It is one of a series of Standards relating to solar hot water systems prepared in response to requests from the solar industry and the CSIRO. The proposal for a Standard dealing with outdoor testing of systems was made by the Energy Authority of N.S.W.

Outdoor testing of solar water heaters has been carried out over many years in Australia, by Government and industrial organizations and educational establishments, as a tool in research, and product development. Much recent work has been done by the School of Mechanical and Industrial Engineering at the University of N.S.W. for the purpose of comparison of different systems, and it is this work which forms the basis of this Standard. The assistance received from the University of N.S.W. is gratefully acknowledged.

The thermal performance of a household solar water heating system depends on external factors such as –

- (a) climate;
- (b) total daily load and monthly variation of daily load;
- (c) time of loads during the day; and
- (d) temperature of the cold inlet and hot outlet water.

Testing of solar water heating systems using a solar simulator has been defined in AS 2813. The range of systems that can be tested in a simulator is governed by the degree to which the simulator can produce the irradiation incidence angle patterns specified in AS 2813. To test collectors that are influenced strongly by irradiation incidence angle (e.g. evacuated tube and stationary concentrator collectors) AS 2813 specifies that the simulator has to be capable of operating through angles from 10 degrees to the horizontal to the maximum solar elevation.

As few test sites in Australia will have access to a simulator that satisfies the requirements of AS 2813, this Standard outdoor test method is proposed as an alternative.

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## STANDARDS ASSOCIATION OF AUSTRALIA

**Australian Standard**  
**SOLAR WATER HEATERS —**  
**METHOD OF TEST FOR THERMAL PERFORMANCE — OUTDOOR TEST METHOD**

## SECTION 1. SCOPE AND GENERAL

**1.1 SCOPE.** This Standard sets out a method of determining the performance of a solar water heating system under natural outdoor conditions and prescribes a method of transforming the test results from the particular climate conditions of the test to long-term average conditions for the test location or for other locations with similar solar irradiation conditions.

**1.2 APPLICATION.** The tests are carried out in typical operational conditions, the only restriction on the nature of systems that can be tested is that there can be no long-term energy storage. The total energy storage capacity in the solar pre-heat section of the system shall be less than twice the nominal system capacity (see Clause 3.4.2).

The Standard applies only to systems with an auxiliary heating system that can satisfy the load under no-solar input conditions.

Types of solar water heating systems that can be tested include—

- (a) solar collector with remote hot water container system—both components supplied as a complementary and rated system with the primary circuit piping arranged to suit site conditions when installed;
- (b) close coupled, or integral unit system—which may be tested as a complete unit.

The primary energy transfer circuit between the collector and container may be either thermosiphon or forced circulation for the type described in (a) above. Supplementary water heating incorporated in the solar water heating system may be either integral with the solar water heater or remote from it.

**1.3 REFERENCED DOCUMENTS.** The following documents are referred to in this Standard:

- AS 2535 Solar Collectors with Liquid as the Heat-transfer Fluid—Method for Testing Thermal Performance.
- AS 2813 Solar Water Heaters—Method of Test for Thermal Performance—Simulator Method.
- AG 102 Approval Requirements for Class A Gas Water Heaters Equipped with Natural Draft Combustion Systems\*.

\* Published by the Australian Gas Association.

**1.4 DEFINITIONS.** For the purpose of this Standard, the definitions below apply:

**1.4.1 Absorber**—device within a collector for absorbing radiant energy and transferring this energy as heat into a fluid.

**1.4.2 Angle of incidence** — angle between the direct radiation and the plane of the absorber.

**1.4.3 Angle of inclination** — angle between the absorbing surface of the collector and the horizontal.

**1.4.4 Class A operation** — mode of operation in which the delivery temperature at the hot outlet connection never falls below 57°C under a specified load.

**1.4.5 Class B operation** — mode of operation in which the delivery temperature at the hot outlet connection never falls below 45°C under a specified load.

NOTE: The terms Class A and Class B are used here to describe modes of operation. They should not be confused with the use of the terms by the Australian Gas Association to describe different types of gas water heaters.

**1.4.6 Close-coupled solar water heater** — unit where the collector abuts the container on a common chassis or cradle.

**1.4.7 Collector** — device containing an absorber.

**1.4.8 Collector aperture (A)** — net area measured parallel to the plane of the collector available to admit, reflect or refract solar radiation to the absorber. The aperture width for different collector types is illustrated in AS 2535.

**1.4.9 Container** — vessel (including fittings) in which the heated water is stored; sometimes referred to as a storage container, cylinder or tank.

**1.4.10 Electricity tariffs.**

**1.4.10.1 Continuous tariff**— tariff for continuously available electricity supply.

**1.4.10.2 Off-peak tariffs.**

(a) Off-peak one (OP1) — restricted or night hours electricity supply. For test purposes the hours of supply shall be 10 p.m. to 7 a.m. (a period of 9 hours).

(b) Off-peak two (OP2) — extended hours supply. For test purposes the hours of supply shall be 10 p.m. to 5 p.m. (a period of 19 hours).

**1.4.10.3 Combined tariff (off-peak and continuous)** —tariff used by systems having an upper level, continuous tariff element and a lower level, off-peak tariff element.

**1.4.11 Irradiance**—flux of radiation per unit area (at a point on a surface): quotient of the flux of radiation incident on an infinitesimal element of the surface containing the point under consideration, by the area of the element. Irradiance is normally expressed in watts per square metre (W/m<sup>2</sup>).

**1.4.12 Irradiation**—integrated total irradiance normal to the plane of the collector aperture whose