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Australian Standard®

Storage water heaters

Part 4: Calculations of energy consumption

STANDARDS AUSTRALIA

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The following interests are represented on Committee EL/20:

Australian Consumers Association

Australian Electrical and Electronic Manufacturers' Association

Australian Gas Association

Confederation of Australian Industry

Electricity Supply Association of Australia

Engineering and Water Supply Department, South Australia

Heat Exchange Water Heater Manufacturers Association

Metal Trades Industry Association of Australia

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PREFACE

This Standard was prepared by the Standards Australia Committee on Electric Water Heating Appliances to provide methods for calculating the energy consumption of storage water heaters in order to provide data which could form the basis for energy labelling of the heaters.

This Standard was prepared in response to proposals by the Department of Energy (now Department of Minerals and Energy), N.S.W. to introduce energy labelling of storage water heaters.

In order to contain costs, the calculations are based on already-known performance characteristics (heat losses of electrical heaters, maintenance gas consumption and thermal efficiency of gas heaters).

The adequacy of the calculations was checked by testing done under laboratory conditions by the State Electricity Commission of Victoria and independently verified (see Note to Clause 5.4.2).

For gas water heaters, this Standard specifies calculations in accordance with a Code AG 102, *Approval requirements for gas water heaters equipped with natural draught combustion systems*, published by the Australian Gas Association and the Australian Liquified Petroleum Gas Association, which is obtainable from AGA, 320 St. Kilda Rd., Melbourne, Vic. 3004.

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1 SCOPE This Standard specifies equations for the calculation of the annual energy consumption of electric and gas storage water heaters based on an assumed daily energy output of 37.7 MJ (equivalent to 200 L of water raised 45 °C) and on known performance characteristics of the water heaters under static (no delivery) conditions.

Where annual energy consumption calculations for electric water heaters are required for daily energy outputs other than 37.7 MJ and hot water temperatures other than 60 °C, Equation A5 (see Appendix A) shall be used with the appropriate value for factor F_E, and new values for factor F_C shall be determined from tests for the respective hot water output and temperature.

NOTE: The values of 37.7 MJ, 200 L, and 45 °C were chosen in order to align with AG 102. For electric heaters, the derivation of the equations is detailed in Appendix A. For gas heaters, calculations are not specified herein but in AG 102. See Clause 6 herein.

The equations are not applicable to heat-exchange, heat-pump, or solar water heaters.

2 APPLICATION This Standard is intended to be read in conjunction with AS 1056.1 and AG 102.

3 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS
1056 Storage water heaters
1056.1 Part 1: General requirements

AG
102 Approval requirements for gas water heaters equipped with natural draught combustion systems (see Preface)

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

4.1 Off-peak energization—energization of up to 10 h on a concessional (night rate) electricity tariff.

4.2 Continuous energization—energization without interruption, i.e. 24 h per day.

4.3 Thermal efficiency of a storage water heater—the ratio of the heat imparted to the water to the heat input to the water heater during the period when the water temperature is being raised from the inlet temperature to the cut-out temperature of the thermostat.

5 ELECTRIC WATER HEATERS

5.1 Principle The energy consumption of an electric storage water heater is taken as the sum of two components, as follows:

(a) The energy required to heat cold water to replace hot water drawn, the thermal efficiency being as calculated from the standing losses (corrected for the conditions applicable to the determination of energy consumption) and the element wattage.

(b) The losses due to conduction, convection, and radiation of heat from the stored water, as measured in accordance with AS 1056.1, Appendix B.

In some cases a factor is applied to account for the loss of hot water which is discharged as cold water expands on being heated.

The calculations are based on a daily energy output of 37.7 MJ, a hot water temperature of 60 °C, and a heating unit rating of 3.6 kW.

NOTE: As changes in the rated power of the main heating unit have little effect on the efficiency, a standard value of 3.6 kW has been used.

5.2 Notation Symbols used in this Section are as follows:

E_A = annual energy consumption, in kilowatt hours

F_C = test correlation factor (dimensionless) to allow for reduced losses on off-peak energization

F_E = expansion loss factor (dimensionless) to allow for losses due to the thermal expansion of water being heated, where applicable

H = heat loss as determined in accordance with AS 1056.1, Appendix B, in kilowatt hours per 24 h

T_S = nominal thermostat setting, in degrees Celsius

η_R = thermal efficiency, per unit