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THERMAL INSULATION OF DWELLINGS—DESIGN GUIDE

Part 1—THERMAL INSULATION OF ROOF/CEILING IN DWELLINGS WHICH REQUIRE HEATING

STANDARDS ASSOCIATION OF AUSTRALIA
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The following interests are represented on Committee BD/58:

Acceptable Standards of Construction Committee, N.S.W.
Aluminium Development Council
Association of Consulting Engineers Australia
Australian Cellulose Insulation Manufacturers Association
Australian Clay Brick Association
Australian Federation of Consumer Organizations Inc.
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Thermal Insulation Institute of Australia
University of Adelaide
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University of Sydney

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AUSTRALIAN STANDARD

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Part 1 THERMAL INSULATION OF ROOF/CEILING IN DWELLINGS WHICH REQUIRE HEATING

AS 2627, Part 1—1983

First edition.....1983

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PREFACE

This standard was prepared by the Association's Committee on Thermal Performance and Insulation of Dwellings. It is the first of a series which give guidance in improving the thermal performance of dwellings and will incorporate the role of thermal insulation and other considerations in achieving the design conditions of thermal comfort while being cost effective.

This standard, to be set in its right context, requires a brief outline of the underlying philosophy adopted in its preparation. Few would disagree that unnecessary use of energy in dwellings should be avoided. Inevitably there will be different views as to what constitutes 'unnecessary' and what measures should be taken to reduce energy use. Further, a standard setting out recommendations for thermal improvements to a dwelling does not guarantee that unnecessary use of energy is eliminated. Behaviour of each individual user is clearly an important and unknown factor. Simply expressed, standards of this nature can only provide potential for energy savings and thermal comfort. If such standards are to be effective they must be as simple as possible to apply, but at the same time encourage rather than inhibit good practice and innovation.

In this standard serious effort has been made to avoid a dogmatic approach. The committee has deemed it essential that the methods used be clearly set out. Also it was a fundamental premise that recommendations should be supported by the rationale upon which they were made.

In establishing recommendations, the committee gave consideration to improved practice in respect of energy use, thermal comfort and cost. The relative weight to be given to these items is a matter of judgement.

In developing this standard in conformity with the underlying philosophy referred to, the Committee decided that the recommendations should be accompanied by background information which would provide explanation for the choice of some of the requirements. This information is given in Appendices F and G.

This standard recommends the thermal resistance of insulation that can be justified financially in the roof/ceiling element of dwellings that are heated. It aims at achieving energy conservation and financial savings while maintaining preferred thermal comfort conditions in dwellings. It is intended to be a practical guide to the reduction of heat losses through the roof/ceiling element. It does not attempt to cover situations where minimum comfort is the major consideration.

Recommendations are given for specific localities in Australia. These are based upon measured weather characteristics from which a concept of 'heating numbers' has been derived.

This standard is presented in three sections, of which Section 1 is general, Section 2 deals with minimum requirements which could be taken up by regulatory and specifying authorities, and Section 3 deals with the basic concept. Section 3 also includes the method of calculation.

While specifically limited to the roof/ceiling element of dwellings which are heated, the scope of this standard should not discourage consideration of the thermal insulation requirements of the entire building envelope particularly in the design or construction stages, e.g. flat roofs.

A financial analysis of the cost effectiveness of insulation in dwellings is given in the standard. The method for deriving levels of insulation is based on an evaluation of the costs of insulation and the cost of energy saved compared with the return upon an alternative investment. Factors that are taken into account include the local cost of fuels, the typical efficiency of different types of heating plant, and appropriate costs for supplying and installing the thermal insulation required to reduce energy use while maintaining thermal comfort levels in the dwelling.

The basic method used is valid for an individual case, where the factors may be estimated with sufficient accuracy. In the preparation of the standard, a number of simplifying assumptions as set out in Appendix F were necessary. By outlining the method and necessary assumptions, this appendix provides the means for easy modification of the levels of resistance prescribed as changes in the factors occur.

Appendix F takes the form of explanatory notes and discursive material. It has been prepared so that the information provided can be related to the appropriate clauses in the preceding sections of the standard.

Originally it was envisaged that in Section 2 of this standard, Table 2.1 would list the major centres of population showing the R_1 value determined in accordance with methods described in the standard. In addition, it was intended to publish with this first edition a series of maps showing those parts of Australia where this design guide is intended to apply, the maps showing those places not listed in Table 2.1, which would enable users of this standard in such places to establish virtually at a glance the regions in which they were interested, displayed so that the R_1-value for that region could be determined easily. As the delineation of such regions and the subsequent production of a useful set of maps has occasioned some difficulty, it has been decided to publish the standard without the maps, with the intention that these may be issued on resolution of the difficulties.

The alphabetical listing by States of those localities having an R_1-value determined by application of this standard and based on known fuel cost data, also includes a secondary classification applying to locations for which an R_1-value has been estimated, using average fuel costs for surrounding regions. In order to revise these estimated R_1-values it will be necessary for further information on the actual pricing of fuel in diverse locations to be made available to the committee, and to this end it is hoped that at the next Commonwealth Census the documentation will include questions from which the data may be extracted.

Constructive comment on the application of this standard in the field is invited so that its efficacy may be gauged as quickly as possible, and to enable any amendments to be effected.

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FOREWORD

Many factors other than heat losses through roofs, walls and floors influence the cost of space heating in dwellings. Some of these factors are described in this Foreword.

Air Infiltration

Unnecessary air infiltration through the building envelope, e.g. around windows and doors, is a major source of heat loss in many dwellings and should be eliminated. Fixed room ventilation should be reduced to a minimum, but adjustable or mechanical ventilation may be needed to prevent condensation.

Consideration should be given to the use of weather-stripping around doors and windows together with proper sealing between the junction of their frames and the building structure, particularly in locations with heating numbers (see Clause 3.5) greater than 700. The use of airlocks and door closers will also help reduce heat losses through doorways.

Living Pattern

The amount of space heating energy used is dependent upon the size and number of rooms that are heated and the level of and duration of heating employed. The separation of zones that require different levels of heating and their relationship to the most favourable aspect of the micro-climate around the dwelling also influences energy consumption. In cold weather interior drapes and blinds may be opened to admit light and solar radiation during the day, but should be closed to reduce heat losses at night. Similar considerations apply to some external shading devices such as window shutters.

Deciduous trees can perform a dual role in controlling internal temperatures by allowing solar heat gain during winter, while providing shade in summer.

Heating Devices

Some heating devices by their nature encourage temperature stratification which results in excessive heat loss through the ceiling and upper parts of walls.

Heaters with large heat transfer surfaces operating at low temperatures or heaters which move large air quantities will minimize temperature stratification and reduce the heat loss through the ceiling. In general, the heat source should be as close to the floor as is practicable. The adverse effects of marked temperature stratification can be reduced by using ceiling mounted fans to create air movement.

Heaters equipped with thermostats can reduce heat losses by preventing overheating.

The installed capacity of heating plant will be smaller for a dwelling of which the roof/ceiling has been insulated, compared with one which is not (for the same comfort levels).