

AS 1684.1—1999 Residential timber-framed construction

Part 1

Design teria

(Incorporating Amendment No.1)



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Australian Standard[™]

Residential timber-framed construction

Part 1: Design criteria

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee TM/1, Timber Structures.

This Standard incorporates Amendment No. 1 (February 2002). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure, or part thereof affected.

This Standard is the result of a consensus of representatives on the Joint Committee that it be produced as an Australian Standard.

The objective of this Standard is to provide users with the design methods, assumptions and other design criteria, which have been used in the preparation of the Span Tables, uplift forces and racking pressures contained within AS 1684.2, AS 1684.3 and AS 1684.4.

Continued development of timber framing systems and the need to cater for a widening variety of materials and design conditions have led to a total revision of structural framing design. These developments include —

- (a) provision for limit state design methods;
- (b) revised/new structural grades for timber;
- (c) provisions catering for open plan living—larger spans, wider openings and bigger rooms, which need a more rational approach to bracing design;
- (d) special 'engineered' and fabricated timber products;
- (e) recognition of a wider range of high wind and cyclonic design; and
- (f) computer-aided design software for member sizes, bracing and tie-down.

This Standard is a companion publication to the following:

AS

- 1684 Residential timber-framed construction
- 1684.2 Part 2 Non-cyclonic areas
- 1684.3 Part 3 Cyclonic areas
- 1684.4 Part 4 Simplified—Non-cyclonic areas

The term 'normative' 'has been used in this Standard to define the application of the appendix to which it applies, A 'normative' appendix is an integral part of a Standard.

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STANDARDS AUSTRALIA

Australian Standard Residential timber-framed construction

Part 1: Design criteria

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION

1.1.1 Scope

This Standard sets out the design methods, assumptions and other criteria used in the preparation of the Span Tables, uplift forces and racking pressures contained within AS 1684.2, AS 1684.3 and AS 1684.4.

The design criteria apply for the preparation of design data for traditional timber-framed construction where the loading and performance requirements correspond to those for Class 1 and Class 10 buildings as defined by the Building Code of Australia.

This Standard should be read in conjunction with AS 1684.2, AS 1684.3 and AS 1684.4, the AS 1170 series, and AS 1720.1.

NOTE: Whilst this Standard may be used as a reference for the design of Class 10 buildings, less conservative levels of design for this building class may be permitted by building regulations and other Australian Standards.

1.1.2 Application

The design criteria contained herein may be used as a basis for the preparation of Span Tables and design data for structural wood products, having stress grades and sizes other than those included in AS 1684.2, AS 1684.3 and AS 1684.4 where the application and performance are claimed to be consistent with AS 1684.2, AS 1684.3 and AS 1684.4.

NOTE: The use of the design criteria contained in this Standard may provide evidence of satisfactory safety and serviceability performance.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

A	1	5
1	1	70

1170	Minimum design loads on structures (known as the SAA Loading Code)
1170.1	Part 1: Dead and live loads and load combinations
1170.2	Part 2: Wind loads
1170.3	Part 3: Snow loads
1170.4	Part 4: Earthquake loads
1684	Residential timber-framed construction
1684.2	Part 2: Non-cyclonic areas
1684.3	Part 3: Cyclonic areas

- 1684.4 Part 4: Simplified —Non-cyclonic areas
- 1720 Timber structures
- 1720.1 Part 1: Design methods

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AS	
4055	Wind loads for housing

CSIRO Low-rise domestic and similar framed structures Part 1: Design criteria (revised 1978)

1.3 OTHER METHODS

This Standard does not preclude the use of other methods of design, other assumptions or criteria for design or any other means of demonstrating satisfactory safety and serviceability performance.

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1.4 BASIS FOR DESIGN

1.4.1 General

The design criteria contained in this Standard are an interpretation of the AS 1170 series, and AS 1720.1. The criteria have been formulated for the preparation of generalized design data for houses constructed using the traditionally evolved timber framing system as described in AS 1684.2, AS 1684.3 and AS 1684.4. The design criteria are based upon the assumptions described in Clauses 1.4.2 to 1.4.11 below.

1.4.2 Geometric limitations

The following geometric limitations for houses have been assumed:

- (a) The overall width at any section, excluding eaves and lean-to verandahs but including verandahs under the main roof, does not exceed 16.0 m.
- (b) The roof pitch does not exceed 35° .
- (c) Roof shapes may be skillion or gable, hip or gable ended or any combination of these.
- (d) The number of trafficable floors supported by timber framing does not exceed two.
- (e) Wall height, measured from floor to ceiling, does not exceed 3.0 m.

NOTE: For further definitions of these limitations refer to AS 1684.2, AS 1684.3 and AS 1684.4.

1.4.3 Design methods

The design methods used are based upon analytical and engineering principles and comply with the requirements of AS 1720.1.

1.4.4 System-based assumptions

The design criteria include many system-based assumptions, which recognize the interactions between structural elements and other elements of the overall construction system. These assumptions are based upon the methods of assembly and materials given in AS 1684.2, AS 1684.3 and AS 1684.4.

NOTE: Changes in materials (both structural and non-structural) and the use of installation methods other than those given in AS 1684.2, AS 1684.3 and AS 1684.4, may invalidate the system-based assumptions contained in this Standard.

1.4.5 Durability

The structural design criteria have been developed on the assumption that materials used and their installation and maintenance ensure that components will fulfil their intended structural function for the intended life of the structure.

NOTE: In the selection of materials, specific consideration should be given to the risk of and resistance to biological attack and corrosion, long-term durability of adhesives and the long-term strength and rigidity of materials taking into account the short-term and long-term conditions of exposure.

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1.4.6 Structural timber

Member design for Span Tables in AS 1684.2, AS 1684.3 and AS 1684.4, is based upon the use of generic stress grades of scantling timber.

NOTE: For other materials, the design procedures and assumptions may require modification in accordance with the requirements of AS 1720.1.

1.4.7 Design properties

The design properties given in AS 1720.1 for stress grades and strength groups have been used for design, except for F-grades the characteristic beam shear strengths given in Appendix A have been used.

1.4.8 Effect of temperature on strength

The modification factor for the effect of temperature on strength (k_6) has been taken as unity regardless of location.

1.4.9 Design loads

1.4.9.1 Dead loads

Dead loads are based upon standardized allowances for the mass of roof, wall and floor constructions.

NOTE: Where mass allowances different from those referred in the Standard are used, then such variation should be noted in any published data.

1.4.9.2 *Live loads*

Generally, the live loads used for design correspond to those given in AS 1170.1. The following departures and interpretations have been used:

- (a) The partial-area live load for floor areas less than 10 m^2 is not considered.
- (b) The permanent component of floor live load is taken as 0.5 kPa.
- (c) To allow for balconies or decks 1 m or more above the ground, the cantilevered portion of floor joists and bearers and the main spans of floor joists and bearers for decks are designed for 3.0 kPa floor live load for the strength limit states and 1.5 kPa for the serviceability limit state.
- (d) The area used to calculate the distributed roof live load resultant from stacked materials or equipment used in repair or maintenance is taken as the area supported in the plane of the roof and not the plan projected area.
- (e) The occasional loading on roof and ceiling members is taken as 1.1 kN.

NOTE: Live loads specific to construction, for example, loads resulting from the use of fall protection devices or scaffolding attached to the structure, are not considered.

1.4.9.3 Wind loads

The free stream dynamic pressures for the strength limit state and the serviceability limit state are derived using AS 1170.2 for design wind speeds corresponding to wind classifications N1 to N4 and C1 to C3 as specified in Appendix B.

1.4.9.4 Snow loads

Snow loads, determined in accordance with AS 1170.3, up to 0.2 kPa have been considered and determined as not critical. For this reason, snow loading is not included in the load combinations given for member design in this Standard.

1.4.9.5 Earthquake loads

Earthquake loads for earthquake load categories H1 and H2, that is for domestic structures, have been determined in accordance with AS 1170.4 and found not critical for design. For this reason, earthquake loads are not included in the load combinations given for member design or for the methods of determination of racking loads in AS 1684.2 and AS 1684.3.

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1.4.9.6 Load combinations

Load combinations included for the determination of the strength limit states and the serviceability limit states for each member are those determined appropriate in accordance with AS 1170.1.

1.4.10 Strength limit states

For each member, all strength limit states have been considered; however, only those strength limit states deemed as potentially critical are included in the design criteria.

NOTE: For other timber-based products, design may require consideration of strength limit states other than those included in this Standard.

1.4.11 Serviceability limit states

The serviceability limit states used for the design have been determined on the basis of experience with the known serviceability performance of individual member types in typical applications. Serviceability limits used are intended to provide satisfactory rigidity for average situations.

NOTES:

- 1 For installations where greater than usual rigidity may be required, then it is anticipated that larger sizes and or materials with higher or more uniform modulus of elasticity will be used (see AS 1720.1).
- 2 The limits on deflection used as part of the definition of the serviceability limit states are limits intended for comparison with calculated deflections only. Actual or measured deflections may differ from calculated deflections due to any or all of the following factors:
 - (a) Differences between actual loads and design loads used for serviceability calculations.
 - (b) Differences between the actual modulus of elasticity of components and the average value used for design.
 - (c) Differences between the structural behaviour of the system and the structural models used for design.

1.5 DEFINITIONS

For the purpose of this Standard, the following definitions apply.

1.5.1 Balcony

An external trafficable floor area of a house including a deck that is 1 m or more above ground level.

1.5.2 Birdsmouth

A triangular notch cut into the underside of a sloping beam (e.g. rafter) to permit seating on the supporting member.

1.5.3 Bracing

An assembly intended to resist racking forces including diagonal members, shear panels, diaphragms, cantilevered columns or portal (rigid) frames.

1.5.4 Cladding

Material used for the external surface of walls or roofs.

1.5.5 Flooring or decking

Boards or sheets overlying floor joists intended to support floor loads. Flooring is usually tongue and groove jointed along the edges whereas decking is not.

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1.5.6 Generic stress grades

Stress grades for which properties are included in AS 1720.1.

1.5.7 Lining

The materials used for the internal faces of walls or ceilings.

1.5.8 Loadbearing walls

Walls required to support vertical loads from roofs and/or floors.

NOTE: This definition differs from that given in the Building Code of Australia.

1.5.9 Nogging

A horizontal member fitted between studs in a wall frame which restrains the studs against buckling in the plane of the wall. Noggings may also be used for attachment of cladding or lining or as part of a bracing system.

1.5.10 Non-loadbearing walls

Partition walls not supporting roofs or floors. Non-loadbearing walls may support ceilings.

NOTE: This definition differs from that given in the Building Code of Australia.

1.5.11 Sheet roofing

Includes sheet metal tile panels and other metal deck roofing of mass up to 10 kg/m^2 .

1.5.12 Span

The face to face distance between supports of a structural member measured along the axis of the member.

NOTES:

- 1 This definition differs from that given in AS 1720.1
- 2 Truss spans have traditionally been measured from outside to outside of pitching plates.

1.5.13 Standard roof truss

An engineered, triangulated framework installed at similar centres to rafters and designed to transfer roof and ceiling loads, usually, to external walls.

1.5.14 Tie-down

The connections or fixings designed to resist uplift forces due to wind.

1.5.15 Tiled roofing

Includes slate, terracotta and concrete tiles of mass up to 60 kg/m^2 .

1.5.16 Wall/brick tie

A bracket connecting brick cladding to a timber wall frame.

1.6 NOTATION

Generally, the notation used in AS 1720.1 and the AS 1170 series is used also in this Standard. Notation specific to each clause is defined in that clause. Some general notation symbols used in this Standard are as follows:

- b = breadth of member
- CLW = ceiling load width