
British Standard

Structural use of timber

Part 6. Code of practice for timber frame walls

Section 6.1 Dwellings not exceeding three storeys

Utilisation du bois en construction

Partie 2. Calcul des charges admissibles, matériaux et façonnage — Code de bonne pratique

Verwendung von Holz im Bauwesen

Teil 2. Leitfaden über zulässige Beanspruchbarkeit, Werkstoffe und Verarbeitung

Foreword

This Section of BS 5268 has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee.

Other Parts of BS 5268 are as follows.

- Part 1 Limit state design, materials and workmanship (for later publication)
- Part 2 Code of practice for permissible stress design, materials and workmanship
- Part 3 Code of practice for trussed rafter roofs
- Part 4 Fire resistance of timber structures
 - Section 4.1 Method of calculating fire resistance of timber members
 - Section 4.2 Method of calculating fire resistance of timber stud walls and joisted floor constructions*
- Part 5 Preservative treatments for constructional timber†
- Part 7 Recommendations for the calculation basis for span tables*

Timber frame walls have played a significant role in the construction of houses in the UK over the past 20 to 30 years. In the main, tens of thousands of houses have been satisfactorily designed without any evidence of structural problems. In the past, the design of these dwellings has been largely entrusted to designers with long practical experience of this form of construction. As the number of designers involved in timber frame construction has increased the need has arisen for codified rules that will allow uniformity of interpretation in applying racking strength data and carrying out other design calculations.

This code sets out to encompass as much of the known good practice as possible and it is expected that it will result in a more detailed presentation than has been the practice; and this will permit a more logical sequence of calculation that results in designs very similar to those currently in service.

This code covers the design of dwellings up to three storeys in height. Although the information given may be relevant to other building types, it is envisaged that BS 5268 : Section 6.2 will cover buildings other than dwellings.

This code clarifies where, and under what conditions, plasterboard internal linings may be permitted to contribute to racking resistance and also makes provision for the stiffening effect of masonry claddings. The information on masonry contribution is much simplified but ensures safe designs under all conditions. More research work is needed if the information in this code is to be more detailed in future revisions.

This code covers only the structural design of timber framed walls. However, the following constructional features may significantly affect the basis of the design, and they are drawn to the attention of the designer:

- (a) weathering;
- (b) condensation control;
- (c) thermal insulation;
- (d) fire resistance;
- (e) sound insulation;
- (f) durability.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

* In preparation.

† Revision in preparation.

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Structural use of timber
Part 6. Code of practice for timber frame walls
Section 6.1 Dwellings not exceeding three storeys

Revised text

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Clause 21.2 Conditions for use of table 2

In item (a), after the existing paragraph, insert the following:

'NOTE. Timber members of lesser rectangular section than 38 mm × 72 mm but not less than 38 mm × 63 mm may be taken into account for internal walls only, but in such cases all values for basic racking resistance given in table 2 should be reduced by 15 %.'

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July 1991

Front cover

Delete French and German title translations and substitute the following:

'Utilisation du bois en construction
Partie 6. Cloisons de charpente en bois — Code de bonne pratique
Section 6.1 Habitations ne dépassant pas trois étages

Verwendung von Holz im Bauwesen
Teil 6. Leitfaden für Holzfachwerkwände
Abschnitt 6.1 Häuser von nicht mehr als drei Stockwerken'

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Section one. General

1 Scope

This Section of BS 5268 gives recommendations for the design, testing, fabrication and erection of timber frame walls for dwellings, not exceeding three storeys and comprising timber frame walls not exceeding 3.5 m overall height between the lowest member and the soffit of the next floor or roof above, with studs not exceeding 610 mm centre to centre and one or both faces of studs being partly or wholly connected to sheathing, lining, gusset plates or other forms of bracing. All structural materials are assumed to be subject only to the dry exposure conditions as defined in BS 5268 : Part 2.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions and symbols

For the purposes of this Section of BS 5268 the definitions given in BS 6100 and the symbols given in clause 3 of BS 5268 : Part 2 : 1984 apply together with the following.

2.1 cripple stud. Vertical member in a framed partition or wall to support a lintel.

2.2 head binder. Horizontal member connected to the top of two or more wall panels to tie them together.

2.3 racking resistance. Ability of a partition or wall panel to resist horizontal wind forces.

2.4 spandrel panel. Wall panel for a gable.

2.5 stud. One of a number of vertical members in a framed partition or wall.

2.6 timber frame wall. Wall constructed of timber framing members, bracing and/or wall sheathing.

2.7 wall lining. Manufactured sheet or board used to line a wall or partition.

2.8 wall panel. Component that forms part of a timber framed wall.

2.9 wall sheathing. Manufactured sheet or board used as a bracing.

Section two. Materials

3 General

The materials used should comply with the appropriate British Standards, as listed in the relevant clauses.

Where wood preservation is specified reference should be made to BS 5268 : Part 5.

4 Species of timber

Any of the species of timber listed in BS 5268 : Part 2 may be used.

All structural timber should be stress graded in accordance with clause 9 of BS 5268 : Part 2 : 1984.

5 Plywood

The species and grades of plywood for sheathing should be one of those given in BS 5268 : Part 2, provided that the durability of a particular species is appropriate for the conditions of use. The minimum thickness of plywood recommended for structural sheathing is 5.5 mm.

6 Fibre building boards

Fibre building board for use as structural sheathing should be of the following types:

- (a) sarking and sheathing grade bitumen impregnated insulation board complying with BS 1142 : Part 3 and not less than 12.3 mm in thickness;
- (b) type HM medium board complying with BS 1142 : Part 2 and not less than 5.9 mm in thickness;
- (c) type TE tempered hardboard complying with BS 1142 : Part 2 and not less than 5.9 mm in thickness.

7 Wood chipboard

Wood chipboard sheathing should be type III in accordance with BS 5669 and not less than 11.6 mm in thickness.

8 Gypsum plasterboard

Where gypsum plasterboard is assumed to make a structural contribution in the design of a timber frame wall the plasterboard should be manufactured to comply with BS 1230 : Part 1 and be not less than 12.5 mm in thickness except in the case of separating wall construction where 9.5 mm plasterboard may be used in achieving the required total thickness.

9 Adhesives

Adhesives used in the construction of timber frame wall panels should be of a type and quality suitable for the conditions of use. Further advice on suitable adhesives and the quality of workmanship is given in BS 6446.

10 Masonry

Where masonry cladding is assumed to make a structural contribution, it should be at least 100 mm thick and have a minimum mass of 100 kg/m². It should also be designed and constructed in accordance with the recommendations of BS 5628 : Parts 1 and 3.

11 Fasteners

All fasteners used for designed connections within the scope of this code should be corrosion resistant and should be checked for compatibility with any timber preservative treatments used.

Section three. Loading

12 General

Timber frame walls should be designed to carry the appropriate dead, imposed and wind loads given in BS 6399 : Part 1 and CP 3 : Chapter V : Part 2, and transfer such loads to the foundations without undue distortion and movement.

13 Wind loading

13.1 Distribution of wind load

In this clause the windward and leeward walls are referred to as 'loaded walls'.

Wind acting on a building induces external and internal pressures acting on the roof and walls, as given in CP 3 : Chapter V : Part 2. Both horizontal and vertical loads so developed should be considered in the design of timber frame walls.

The horizontal wind load on a wall may be based on an S_2 factor, as derived from table 3 of CP 3 : Chapter V : Part 2 : 1972, corresponding to the maximum height of the building. Alternatively the building height may be divided into a number of convenient parts and the wind load calculated for each part using S_2 factors appropriate for the maximum height of each part; in this case the horizontal wind load calculated for each part may be assumed to apply over the whole of that part.

The wind load is resisted primarily by transfer directly to the ground at the base of the loaded wall and by the racking resistance of timber frame supporting walls, the load having been transferred via the floor and ceiling diaphragms. Other unquantifiable factors assisting in the resistance to wind loads are taken into account in the interaction factor given in 22.6.

13.2 Wind loading on masonry clad timber framed walls

Where timber frame walls are clad by masonry walls the external wind loading transferred to the timber structure can be determined by the method given in 13.3 subject to the following conditions.

- (a) The masonry walls are constructed of:
 - (1) clay bricks complying with BS 3921;
 - (2) concrete bricks complying with BS 6073;
 - (3) calcium silicate bricks complying with BS 187;
 - (4) clay or calcium silicate modular bricks complying with BS 6649;
 or, subject to a minimum compressive stress of 7 N/mm^2 :
 - (5) concrete blocks complying with BS 6073;

- (6) cast stone complying with BS 1217;
- (7) reconstructed stone complying with BS 6457;
- (8) stone masonry in accordance with BS 539.
- (b) The mortar is not lower than designation (iii) as defined in table 15 of BS 5628 : Part 3 : 1985.
- (c) The wall ties and their fixings are in accordance with DD 140 : Part 2 where applicable to timber frame construction.

13.3 Wind load transferred to timber frame wall

Where a loaded masonry wall of 9 m or less in length is supported at both ends by masonry buttresses or returns greater in length than 550 mm the racking load to be resisted by the timber frame walls should be derived by multiplying the external wind load by the appropriate modification factor K_{100} given in column (a) of table 1. For K_{100} given in column (a) of table 1 to be applied to walls longer than 9 m, additional buttresses or returns should be added to the masonry wall at a maximum spacing of 9 m.

Where a loaded masonry wall has no masonry returns or buttresses or has returns or buttresses the length of which are 550 mm or less, the racking load to be resisted by the timber frame walls should be derived by multiplying the external wind load by the appropriate modification factor K_{100} given in column (b) of table 1.

Table 1. Modification factor K_{100}

Percentage of loaded wall occupied by openings	K_{100}	
	(a) for masonry walls with buttresses or returns greater than 550 mm and not greater than 9 m centre to centre	(b) for masonry walls without buttresses or returns or with buttress or returns of 550 mm or less
0	0.5	0.75
10	0.55	0.775
20	0.60	0.80
30	0.65	0.825
40	0.70	0.85
50	0.75	0.875
60	0.80	0.90
70	0.85	0.925
Over 70	1.0	1.0

NOTE. Intermediate values may be obtained by linear interpolation.

Section four. Design of timber frame walls

14 Assessment of structural adequacy

The structural adequacy of a timber frame wall should be assessed by any one or combinations of the following methods:

- (a) satisfying the design requirements by calculations, using the laws of structural mechanics using the information given in BS 5268 : Part 2;
- (b) design in accordance with the method described in this section;
- (c) testing of full-size wall units in accordance with section five to derive racking strength data.

NOTE. Attention is drawn to the importance of checking the overall stability of the building.

15 Permissible stresses

The grade stresses for timber, plywood and tempered hardboard should be those given in BS 5268 : Part 2 modified for duration of loading, load sharing, depth and width factors, and slenderness ratio as appropriate.

A timber frame external wall should be designed using stresses for the dry exposure condition.

16 Composite action with other materials

A timber frame wall can be designed to act compositely with other materials such as cladding, sheathing or lining provided that the appropriate composite action can be established by test or by calculation or, in the case of racking resistance, based on information given in table 2.

Where composite action is not assumed but the other materials are partly self-supporting and are capable of carrying a share of the horizontal wind loading, the timber frame wall can be designed to carry a correspondingly reduced horizontal wind loading.

17 Overall stability

The factor of safety against overturning or sliding of a building with timber frame walls should be not less than 1.20 when subjected to dead loading, zero imposed loading and horizontal and vertical components of wind loading acting simultaneously.

Shear resisting connections should be provided to resist sliding unless the frictional resistance of the joining surfaces can be shown to be adequate.

NOTE. Attention is drawn to the need to consider the stability of the building during construction.

18 Horizontal diaphragms

The design method for timber frame walls given in this code assumes that, for the range of dwellings covered by this code, the normal construction of floors and roofs provide adequate diaphragm action, provided that, in the case of intermediate floors, a floor deck or sub-deck is fixed directly to the top faces of the joists or the floor is braced by some other means. In the case of pitched roofs it is assumed that the plasterboard ceiling under the roof, together with the roof bracing recommended in BS 5268 : Part 3 are sufficient to transfer applied wind forces to the resisting walls.

Due account should be taken of the eccentricity of the loading in relation to the wall panels providing resistance.

19 Design of wall studs

19.1 General

Wall studs should be designed as compression members, subject where appropriate to bending in a direction perpendicular to the plane of the wall, in accordance with BS 5268 : Part 2.

19.2 Lateral restraint

For the purpose of calculating the slenderness ratio of studs, sheathed with any of the board materials described in table 2 and fixed to the studs as recommended in table 2, the effective length may be assumed to be 0.85 times the actual length when considering buckling out of the plane of the wall.

Lateral restraint in the plane of the wall should be provided by noggings, sheathing or plasterboard lining. Solid rectangular studs in timber frame walls covered on one or both sides with any of the board materials described in table 2 and fixed as recommended in table 2, may be assumed to be fully restrained laterally in the plane of the wall.

Where noggings are used to provide lateral restraint, the total horizontal force in the noggings should be taken as 2.5 % of the average compressive force in any one stud; the horizontal force should be transmitted to the base of the wall by a system of bracing. In this case the effective length should be taken as the actual length of the stud between noggings or between nogging and the end of the stud.

19.3 Interaction with sheathing

Where advantage is taken of the interaction between the studs and sheathing in resisting compression and bending or in reducing deflection, account should be taken of the relative stiffnesses of the materials acting compositely and of the slip under load of mechanical fastenings.