

BS 8103-3:2009



BSI British Standards

Structural design of low-rise buildings –

Part 3: Code of practice for timber floors and roofs for housing

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to viii, pages 1 to 200, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 8103 is published by BSI and came into effect on 30 November 2009. It was prepared by Technical Committee B/204, *Structural design of low-rise buildings*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 8103 supersedes BS 8103-3:1996, which is withdrawn.

Relationship with other publications

BS 8103 is published in four parts as follows:

- *Part 1: Code of practice for stability, site investigation, foundations and ground floor slabs for housing;*
- *Part 2: Code of practice for masonry walls for housing;*
- *Part 3 (this part): Code of practice for timber floors and roofs for housing;*
- *Part 4: Code of practice for suspended concrete floors for housing.*

Information about this document

A large proportion of the national building programme is concerned with new housing and alterations in both the public and private sectors, where the majority of houses are constructed with masonry walls and timber floors and roofs. This Part of BS 8103 covers timber used in that form of construction. It does not cover joinery or wood trim.

This code is written for those with expertise in building construction, but not necessarily in structural engineering design. Therefore, the recommendations are intended to provide safe design without the need for strength calculations, except for trussed rafter design which is normally entrusted to a specialist. Much of the guidance previously provided for trussed rafter roof construction has been removed from this revision in favour of reference to BS 5268-3¹⁾. Houses constructed within the limitations stated in the relevant clauses will not require additional specialist advice. For any conditions outside the scope of this part of BS 8103 (e.g. trimmers assembled from three or more members or supporting heavy partitions, or the use of connections other than nails, screws, bolts or toothed-plate connectors), appropriate specialist advice should be obtained.

Although BS 5268-2 permits load-sharing to be considered for spacings, etc. up to 610 mm centres, the span tables in this code are limited to 600 mm centres for convenience.

NOTE *This is compatible with the guidance to be included in the non-contradictory complimentary information (NCCI) to BS EN 1995-1-1.*

In respect of timber members (floor joists, rafter, purlins, binders, etc.) the span tables in this code are based upon the use of strength graded solid timber and BS 5268-2 design philosophy. Proprietary items such as composite timber and wood-based panel or timber and metal section web joist members are not covered by the scope of the span tables in BS 8103-1. These items need purpose design by a specialist.

¹⁾ BS 5268-3 will be replaced by BS EN 1995-1-1 and PD 6693-1.

The design guidance for wood-based panels for use in floor and flat roof structural decking have been updated and new sections including Oriented Strand Boards (OSB) have been added.

When using this code, it is important to ensure that the overall stability of the building is achieved and that the work of any specialist engaged is properly co-ordinated. BS 8103-1 covers the stability aspects of low-rise housing.

The recommendations in this code are intended to provide safe designs without the need for calculations of loading and strength/stiffness criteria. The provisions and limitations of this standard do not preclude other designs, provided that a specialist provides evidence of their adequacy.

Illustrations do not show all constructional details and are not intended to illustrate compliance with any other requirements or recommendations. They are not to scale and are not suitable for use as working drawings.

This revision takes into account the introduction of the new harmonized product specifications relating to timber and wood-based panels and other relevant construction products. This code also includes a new simplified snow loading zonal map for the United Kingdom which is based upon BS EN 1991-1-3 together with its UK National Annex.

The code is intended to support the various UK building regulations [1], [2], [3] and standards.

Use of this document

As a code of practice, this part of BS 8103 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 8103 is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

The object of this Part of BS 8103 is to provide sufficient information to enable supervisory/technical staff of building companies to determine the size, grade and any limitations such as notching of certain timber components for floors and roofs of dwellings of limited size. It has to be emphasized, however, that a structural designer should be employed where the building falls outside the scope of this Part of BS 8103.

Much of the information provided is linked to the provisions given in supporting technical documents to the appropriate statutory building regulations of the UK [1], [2], [3]. Significant content details are as follows:

- a) tables for determining timber sizes for roof members to buildings situated at sites at which the imposed roof loading is not greater than 1.25 kN/m^2 ;
- b) a wide range of solid timber sizes;
- c) loading on joists, beams or trimmers, trimming joists, purlins and ceiling binders (see Table 6);

NOTE The bearing lengths quoted, are minimum design values and might need to be increased to accommodate fixings, tolerances in building, or to give stability to masonry walls.

- d) the inclusion of alternative decking materials for floors and flat roofs;
- e) timber bracing for single-storey non-residential buildings and annexes (see Annex N);
- f) tables for trimmers and beams (see Table 6);
- g) guidance on the determination of the imposed snow loading for a particular site location (see Annex M).

The tables for plywood floor decking or roof decking have been agreed with the major associations representing imported structural plywood, based on historical data and information.

The committee was advised by checking authorities that joist span tables were erroneously being used as though they applied also for trimmers and beams supporting joists. The tables for trimmers and beams have been added in an attempt to prevent this unacceptable practice and to make this Part of BS 8103 as useful as possible. It was difficult to evolve an easy method of deriving sizes, but it is hoped that, with a little familiarity, the new tables will prove useful even though they are for a limited range of spans, are only for single or twin members, and cover dead loading not heavier than 0.5 kN/m^2 .

The span tables do not include sizes that are based on the *North American NLGA/NGRDL rules* [4] [5] for green Imperial sawn sizes and tolerances. Therefore, none of the span tables are relevant for such sizes and tolerances. The tables may be used, however, if North American timber, stress-graded to the NLGA/NGRDL rules or to BS 4978, is sawn, re-sawn or processed to the BS EN 336 basic dry metric sizes and tolerances.

One aim of this Part of BS 8103 is to minimize the extent to which other British Standards and Codes need to be examined. For those cases where grading needs to be completed before the timber, or wood-based panels arrive on site e.g. for floor boards of solid timber, or tiling battens, grading rules are included in an annex. For those

cases where grading needs to be completed before the timber, plywood or orientated strand board arrives on site, grading rules are not repeated, but marks are given in Annex C, Annex F, Annex G and Annex H, which will assist site staff to identify that the correct grade has been delivered.

Throughout this Part of BS 8103, the figures are only illustrative, and do not show all the details of construction.

1 Scope

This Part of BS 8103 gives recommendations for the sizes of timber elements, fixings, and their connections with masonry walls, etc. It applies to detached, semi-detached, terraced houses and flats (with not more than four self-contained dwelling units per floor, accessible from one staircase) of not more than three storeys above ground, intended for domestic occupation. The recommendations also apply to single-storey non-residential buildings, e.g. domestic garages and annexes, not exceeding 36 m² in floor area.

The design of proprietary housing systems, i.e. cross wall constructions, timber framed houses, steel or concrete framed constructions, concrete panel constructions, is not covered by this standard.

The recommendations of this Part of BS 8103 are applicable only to housing where:

- a) the construction comprises masonry walls, timber roofs, suspended timber or precast concrete intermediate floors, suspended timber or concrete ground floors (either suspended or ground bearing);
- b) the roof profile is symmetrical duopitch, monopitch or flat;
NOTE 1 Pitched roofs of trussed rafter or traditional constructions are covered, but not constructions using principal trusses. Hip ends and "L" shaped plans are not specifically covered although values are given for jack rafters.
- c) the maximum clear span of a pitched roof does not exceed 12.0 m and imposes a total load on the supporting perimeter walls not greater than 12 kN/m run;
- d) gable and separating walls are of masonry construction extending up to the roof line in the case of pitched roofs;
- e) the roof area is not larger than 200 m² on plan; or, in the case of pitched roofs where no parapets exist, one of the roof dimensions does not exceed 10 m;
- f) there are no other buildings within 1.5 m of the perimeter of the building;
- g) the roof has no abrupt changes of height greater than 1 m on which snow drifting could occur;

NOTE 2 This limitation does not apply to the change of height between the main roof and the roof of a lower annexe, if the roof area of the annexe does not exceed 36 m². Chimneys and dormers whose vertical elevation areas, against which a drift could form, are less than 1 m², need not be considered as being an abrupt change of height.

- h) the maximum clear span of any floor joist or flat roof joist does not exceed 6.0 m;
- i) the design wind criteria is within the scope of BS 8103;

NOTE 3 Guidance is given in BS 8103-1 and BS 8103-2 on how to determine whether the design wind criteria for a building on a particular site is within the scope and application of BS 8103. Guidance is given in Annex M regarding the determination of snow load for a particular site.

- j) no part of any wall or roof is higher than 15m above the lowest adjacent ground level;
- k) floor joists, ceiling joists, flat roof joists, common or jack rafters or trussed rafters are spaced at centres which do not exceed 600 mm;
- l) the stability requirements and dimensional limitations accord with BS 8103-1:1995+A1:1995, Clause 5.

The sizes of timber shown in the span tables are limited to those normally readily available but do not preclude the use of larger or different sizes if justified by specialist calculation.

The design requirements and those for durability and timber preservation given in this Part of BS 8103 are related only to structural considerations.

For trussed rafter roofs, this standard contains only as much information as is necessary and mainly comprises references to BS 5268-3²⁾.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 1202-1, *Specification for nails – Part 1: Steel nails*

BS 1210, *Specification for wood screws*

BS 1297, *Specification for tongued and grooved softwood flooring*

BS 4190, *ISO metric black hexagon bolts, screws and nuts – Specification*

BS 4320, *Specification for metal washers for general engineering purposes – Metric series*

BS 4978, *Visual strength grading of softwood – Specification*

BS 5268-3, *Structural use of timber – Part 3: Code of practice for trussed rafter roofs*

BS 5534, *Code of practice for slating and tiling (including shingles)*

BS 5628-3, *Code of practice for the use of masonry – Part 3: Materials and components, design and workmanship*

BS 6100-3, *Building and civil engineering – Vocabulary – Part 3: Civil engineering – General*

²⁾ BS 5268-3 will be replaced by BS EN 1995-1-1 and PD 6693-1.

BS 8103-1, *Structural design of low-rise buildings – Part 1: Code of practice for stability, site investigation, foundations and ground floor slabs for housing*

BS 8103-2, *Structural design of low rise buildings – Part 2: Code of practice for masonry walls for housing*

BS 8417:2003, *Preservation of timber – Recommendations*

BS EN 300, *Oriented strand boards (OSB) – Definitions, classification and specifications*

BS EN 312, *Particleboards – Specifications*

BS EN 335-1, *Durability of wood and wood-based products – Definitions of use classes – Part 1: General*

BS EN 336, *Structural timber – Sizes, permitted deviations*

BS EN 338, *Structural timber – Strength classes*

BS EN 350-2, *Durability of wood and wood-based products – Natural durability of solid wood – Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe*

BS EN 636, *Plywood – Specifications*

BS EN 845-1, *Specification for ancillary components for masonry – Part 1: Ties, tension straps, hangers and brackets*

BS EN 912, *Timber fasteners – Specifications for connections for timber*

BS EN 1912, *Structural timber – Strength classes – Assignment of visual grades and species*

BS EN 1991-1-1, *UK National Annex to Eurocode 1: Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings*

BS EN 1991-1-3, *Eurocode 1– Actions on structures – Part 1-3: General actions –Snow loads*

BS EN 13556, *Round and sawn timber – Nomenclature of timbers used in Europe*

BS EN 13986, *Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking*

BS EN 14081-1:2005, *Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements*

BS EN ISO 3166-1, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*

EN 15228³⁾, *Structural timber – Structural timber preservative treated against biological attack*

Canadian NLGA rules [1],

CLS/ALS sizes [6] [7],

USA NGRDL rules [5],

³⁾ In preparation.

3 Terms and definitions

For the purposes of this part of BS 8103, the terms and definitions given in BS 6100-3 and the following apply.

3.1 clear span

clear distance between supports of joists, trimmed joists, etc. and rafters, measured along the member

3.2 common rafter

timber rafter, not forming part of a truss, extending from eaves to ridge board, normally supported by purlins

3.3 flat roof

roof having a slope of not more than 10° from the horizontal

3.4 jack rafter

shortened rafter abutting a hip rafter or valley rafter

3.5 spacing of joists or rafters

distance between the centres of joists or rafters

3.6 trimmed joist

joist supported at one or both ends by a trimmer joist

3.7 trimmer joist

joist supported at one or both ends by a trimming joist and supporting the ends of trimmed joists

NOTE See Figure 12 and Figure 13.

3.8 trimming joist

joist which, for part or all of its length, forms the edge of an opening (such as a stair well) and supports the end of a trimmer joist

NOTE See Figure 12 and Figure 13.

4 Materials

4.1 Timber

4.1.1 Maximum moisture content

The maximum moisture content at the time of erection or fixing should conform to Annex A.

4.1.2 Flooring

Softwood flooring should conform to and be graded in accordance with BS 1297. The timber should be one of the species listed in B.1. The thickness should conform to 5.2.1.1. As an alternative to softwood flooring, a hardwood of at least the same thickness as that given in 5.2.1.1 and having a density of at least 500 kg/m³ at 12% moisture content should be used. In such a case, the grading should conform to Annex B.

4.1.3 Flat roof decking

Softwood flat roof decking should be tongued and grooved and should conform to BS 1297. The timber should be one of the species listed in B.1. The thickness should conform to Table 76

4.1.4 Joists, beams or trimmers, trimming joists, common or jack rafters, purlins, ceiling joists and binders, trussed rafter material and secondary solid timber structural members

Joists, beams or trimmers, trimming joists, common or jack rafters, purlins, ceiling joists and binders, trussed rafter material and secondary timber structural members of solid softwood, but not strutting or solid bridging between joists, should be strength-graded and marked in accordance with BS 4978 or the Canadian NLGA rules [4] or the USA NGRDL rules [5] and BS EN 14081-1. The sizes should be sawn, or processed in accordance with BS EN 336, or CLS/ALS sizes [6] [7] as defined in the NLGA or NGRDL rules outlined in National Annex to BS EN 336, all with the tolerances given in BS EN 336, or, for trussed rafter material, sizes as processed in accordance with BS 5268-3⁴⁾.

NOTE 1 Sizes to BS EN 336 are referred to by a target size and a tolerance class. The target size is the size desired by the specifier.

NOTE 2 Tolerance class 1, designated (T1), is appropriate to sawn timber and tolerance class 2, designated (T2), and is appropriate to planed or processed timber. The term "regularized" is not used in BS EN 336, but the same end result can be achieved by specifying the thickness dimension to be tolerance class 1 and the width dimension to be tolerance class 2, for example 50(T1) × 194(T2) (see National Annex to BS EN 336). The span tables given in this part of BS 8103 (Table 7 to Table 74) are for sawn or processed sizes or surfaced CLS/ALS sizes.

NOTE 3 Table 7 to Table 74 cover strength-grade/species combinations which, conform to strength classes C16 and C24 as defined in BS EN 338.

NOTE 4 Softwood strength-grade/species combinations which conform to strength classes C16 and C24 are listed in Table 1.

Identification marks for strength-graded timber should be in accordance with Annex C.

4.1.5 Solid timber roof bracing, gable ladders, noggings, strutting, bridging or blocking between joints

Timber for roof bracing, gable ladders, noggings, strutting, bridging or blocking between joists should be one of the species given in Table 1 and should be free from any major strength-reducing defects, and from distortions which could affect the serviceability.

4.1.6 Wallplates

Wallplates should be of one of the species given in Table 1 and should be free from any major distortion. The top surface should be free of wane. Sizes should be as recommended in 6.2.4.

4.1.7 Battens for roof slating and tiling

Battens to support roof slates or tiles should be of one of the species listed in Annex D. Battens should span over at least three supports (i.e. at least two bays).

⁴⁾ BS 5268-3 will be replaced by BS EN 1995-1-1 and PD 6693-1.  Documents
Document Sharing Hub

Table 1 Strength-grade/species combinations which meet classes C16 and C24

Species	Grade to meet strength class C16	Grade to meet strength class C24
All species listed in this table, machine graded to BS EN 14081-1 and marked accordingly	Machine graded to C16	C24
Imported redwood or whitewood graded to BS 4978	GS	SS
British-grown graded to BS 4978		
Douglas fir	SS	—
Larch	GS	SS
Pine	SS	—
Spruce	SS	—
Canadian graded to BS 4978		
Douglas fir-larch	GS	SS
Hem-fir	GS	SS
Spruce-pine-fir	GS	SS
Sitka spruce	SS	—
Canadian graded to NLGA [6] rules	Joist and plank/structural light framing	Joist and plank/structural light framing
Douglas fir-larch	No. 1 and No. 2	Select structural (SelStr)
Hem-fir	No. 1 and No. 2	Select structural (SelStr)
Spruce-pine-fir	No. 1 and No. 2	Select structural (SelStr)
Sitka spruce	Select structural (SelStr)	—
Canadian graded to MSR standard		
Douglas fir-larch	Machine stress-rated, 1 450f-1.3E	Machine stress-rated, 1 800f-1.6E
Hem-fir	Machine stress-rated, 1 450f-1.3E	Machine stress-rated, 1 800f-1.6E
Spruce-pine-fir	Machine stress-rated, 1 450f-1.3E	Machine stress-rated, 1 800f-1.6E
USA graded to BS 4978		
Douglas fir-larch	GS	SS
Hem-fir	GS	SS
Southern pine	GS	SS
Spruce-pine-fir	GS	SS
Western white woods	SS	—
USA graded to NGRDL	Joist and plank/structural light framing	Joist and plank/structural light framing
Douglas fir-larch	No. 1 and No. 2	Select structural (SelStr)
Hem-fir	No. 1 and No. 2	Select structural (SelStr)
Spruce-pine-fir	No. 1 and No. 2	Select structural (SelStr)
Western white woods	Select structural (SelStr)	—
Southern pine	No. 1, No. 2 and No.3	Select structural (SelStr)

Table 1 **Strength-grade/species combinations which meet classes C16 and C24** (*continued*)

Species	Grade to meet strength class C16	Grade to meet strength class C24
USA graded to MSR Standard	Light framing – construction (const)	
	Stud	
Douglas fir-larch	Machine stress-rated, 1 450f-1.3E	Machine stress-rated, 1 800f-1.6E
Hem-fir	Machine stress-rated, 1 450f-1.3E	Machine stress-rated, 1 800f-1.6E
Southern pine	Machine stress-rated, 1 450f-1.3E	Machine stress-rated, 1 800f-1.6E
Spruce-pine-fir	Machine stress-rated, 1 450f-1.3E	Machine stress-rated, 1 800f-1.6E

NOTE 1 Where one strength-grade is tabulated, any stronger strength-grade of the same species also meets the strength class.

NOTE 2 Additional grades and species can be found in BS EN 1912.

NOTE 3 Strength class allocations of North American machine graded strength timber can vary according to production source, but for the purposes of this part of BS 8103 the relevant information in the grade mark is the strength class C16 or C24.

4.2 Plywood

4.2.1 General

Plywood for use in structural applications should comply with the requirements of BS EN 13986. Requirements for plywood for use in dry, humid and exterior conditions are outlined in BS EN 636.

4.2.2 Flooring

Plywood used for structural flooring where design and construction are in accordance with the relevant timber span tables given in this part of BS 8103, should be one of the types and grades given in Annex E and should also meet the requirements of BS EN 636. The thickness should conform to 5.2.2.1 and Table 3.

4.2.3 Flat roof decking

Plywood to be used for flat roof decking, where design and construction are in accordance with the relevant timber span tables given in this part of BS 8103, should be one of the types and grades given in Annex E and should also meet the requirements for BS EN 636. The thickness should conform to 8.2.2.2 and Table 77.

4.2.4 Identification marks

Identification marks for structural plywood should be in accordance with Annex F.

4.3 Particleboard

4.3.1 Flooring

Particleboard used for flooring should be of type P4, P5, P6 or P7 in accordance with BS EN 312.

NOTE 1 Types P4 and P6 are intended for use in non-humid environments. The National House-Building Council (NHBC) standards do not recommend type P4 or P6 for use in domestic floors.

NOTE 2 Manufacturers who have carried out performance testing will be able to provide information on the panel thickness required for various joist spacings.

The thickness should conform to **5.2.3.1** and Table 4.

4.3.2 Flat roof decking

Particleboard used for decking on flat roofs of uninsulated roof design or warm deck design, should be of type P5 or P7 in accordance with BS EN 312.

NOTE 1 Manufacturers who have carried out performance testing will be able to provide information on the panel thickness required for various joist spacings.

The thickness should conform to **8.2.3.1** and Table 79.

NOTE 2 BS 8217 does not recommend the use of particleboard under reinforced bitumen membranes.

4.3.3 Identification marks

Identification marks for particleboard covered by **4.3.1** and **4.3.2** should be as given in Annex G.

4.4 Oriented Strand Board (OSB)

4.4.1 Flooring

OSB used for flooring should be of type OSB/2, OSB/3 or OSB/4 to BS EN 300.

NOTE 1 Manufacturers who have carried out performance testing will be able to provide information on the panel thickness required for various joist spacings.

NOTE 2 NHBC Standards do not recommend type OSB/2 for use in domestic floors.

The thickness should conform to **5.2.4.1** and Table 5.

4.4.2 Flat roof decking

OSB used for decking on flat roofs of uninsulated roof design or warm deck design where insulation is placed above the deck should be of type OSB/3 or OSB/4 to BS EN 300.

NOTE Manufacturers who have carried out performance testing will be able to provide information on the panel thickness required for various joist spacings.

The thickness should conform to **8.2.4.1** and Table 81.

4.5 Mechanical fasteners

4.5.1 Nails

Nails should conform to BS 1202-1.

4.5.2 Steel screws

Steel screws should conform to BS 1210.

4.5.3 Bolts and washers

Bolts should conform to BS 4190. Bolts for timber fixings should be fitted with extra-large washers (form G, i.e. outside diameter approximately three times bolt diameter) which conform to BS 4320, or are made from equivalent steel plate of a size at least three times the bolt diameter.

4.5.4 Toothed-plate connector units

Toothed-plate connector units should conform to BS EN 912.

4.5.5 Joist hangers

For timber to masonry connections, joist hangers should conform to BS EN 845-1.

NOTE See also Figure 13.1 and Figure 13.2.

4.5.6 Metal restraint straps

Straps providing lateral restraint or restraint against uplift of roofs should normally be of low-carbon steel protected by galvanizing, austenitic stainless steel or of other suitably strong and durable materials as recommended in BS 5628-3⁵⁾ and specified in accordance with BS EN 845-1.

5 Flooring

5.1 General

5.1.1 Loading

NOTE 1 Flooring constructed in accordance with this standard is capable of supporting the loadings specified for residential occupancy subcategory A1 in BS EN 1991-1-1. This part of BS 8103 does not make provisions for other heavy concentrated loads.

The timber sizes given in the span tables can be used when a bath is to be placed on the floor area being supported, but the joists supporting the bath should be doubled-up.

NOTE 2 This applies whether the joists are parallel or perpendicular to the length of a rectangular bath. Other shapes of bath might need special consideration.

5.1.2 Non load-bearing lightweight partitions

Non load-bearing lightweight partitions should be supported directly by a joist; beam; solid blocking or noggings between joists (see Figure 9, Figure 10 or Figure 11). Partitions should not be supported directly by flooring.

⁵⁾ BS 5628-3 will be replaced by BS EN 1996-2 and PD 6697.

NOTE 1 For the purposes of this standard, a non load-bearing lightweight partition is one which weighs not more than 0.8 kN/m run. No member referred to in this part of BS 8103 is designed to support a load-bearing partition.

NOTE 2 Examples of non load-bearing partitions which weigh 0.8 kN/m run (82 kg/m) or less, are those with facings of 12.5 mm thick plasterboard on timber studding or a lightweight core.

5.1.3 Support members

Members supporting domestic flooring should be at least 35 mm thick, or 38 mm thick if supporting a plasterboard ceiling.

5.2 Materials and fixing recommendations

5.2.1 Timber flooring

5.2.1.1 Species and size

Tongued and grooved softwood flooring of the species and grading detailed in B.1 should be of at least the finished thickness shown in Table 2.

Table 2 Thickness of tongued and grooved softwood flooring for domestic loading

Maximum support centres of support members	Finished thickness
mm	mm
505	16
600	19

5.2.1.2 Fixing

Timber flooring should be fixed in accordance with I.1.

5.2.2 Plywood flooring

5.2.2.1 Species and size

Plywood flooring should be of one of the grades listed in Annex E. The nominal thicknesses for the range of plywoods described in 4.2.2 and Annex E, in relation to the joist centres, should conform to Table 3.

Table 3 Thickness of plywood flooring for domestic loading

Plywood type	Recommended nominal thickness	
	mm	
	Support members at 450 mm centres max.	Support members at 600 mm centres max.
American construction and industrial plywood: C-D grade exterior. Un-sanded	15.0	18.0
American construction and industrial plywood: C-C grade exterior. Un-sanded	15.0	18.0
Canadian Douglas fir plywood: select tight face, select and sheathing grades. Un-sanded	15.5	15.5
Canadian softwood plywood: select tight face, select and sheathing grades. Un-sanded	15.5	18.5
Finnish birch faced plywood: 1/1, 1/11, etc. Sanded	15.0	18.0
Finnish conifer plywood: 1/1, 1/11, etc. Sanded	15.0	18.0
Swedish softwood plywood: P30 grade. Un-sanded	15.0	16.0

NOTE The thicknesses shown apply to boards spanning three or more joists and where the face grain of the boards is perpendicular to the support members.

5.2.2.2 Fixing

Plywood flooring should be fixed in accordance with I.2.

5.2.3 Particleboard flooring

5.2.3.1 Specification and size

Particleboard flooring should be of one of the grades specified in 4.3.1 (i.e. type P5 or P7) and should have a minimum thickness conforming to Table 4 unless otherwise determined according to performance test or calculated design.

Table 4 Thickness of particleboard flooring for domestic loading

Maximum centres of support members	Minimum thickness
mm	mm
450	18
600	22

5.2.3.2 Fixing

Particleboard flooring should be fixed in accordance with I.3.

5.2.4 OSB flooring

5.2.4.1 Specification and size

OSB flooring should be one of the grades specified in 4.4.1 (i.e. type OSB/2, OSB/3 or OSB/4). The minimum thickness should conform to Table 5 unless otherwise determined according to performance test or calculated design.

Table 5 Thickness of OSB flooring for domestic loading

Maximum centres of support members	Minimum thickness
mm	mm
450	15
600	18

5.2.4.2 Fixings

OSB flooring should be fixed in accordance with I.4.

6 Spans, sizes and spacings for solid timber members, notching, drilling and end-trimming

6.1 General**6.1.1 Span tables**

Table 7 to Table 74 inclusive, recommend timber sizes for spans and spacings for certain timber floor, flat roof, pitched roof and ceiling members. Explanatory notes and diagrams are also provided.

In these tables all spans are measured as the clear distance between supports. All spacings are the distance between longitudinal centres of members. Table 6 is a key to the contents of the span Table 7 to Table 74.

6.1.2 Loading

The recommendations given in this subclause assume that the dead and imposed loads to be sustained by the floor, ceiling or roof of which the member forms part do not exceed the values given in the notes to the appropriate diagrams and tables.

NOTE See also 5.1.1 and 5.1.2.

Examples of dead loading for typical floor, pitched roof and flat roof constructions are given in Annex L. These relate to the dead loading categories stated in individual span tables.

6.1.3 Strength classes

Combinations of species and strength grades of timber which achieve the strength classes to which the span tables relate are listed in Table 1.

6.1.4 Sizes of solid timber members

The dimensions of solid timber members given in Table 7 to Table 74 are based upon the size and tolerance requirements of BS EN 336. For certain joist members (e.g. those supporting a ceiling) the tables have been prepared on the basis that members are processed in accordance with tolerance class 2 of BS EN 336 across the timber width (joist depth) or are CLS/ALS processed sizes to provide level surfaces for ease of ceiling lining and the fixing of structural decking. For other timber

members (e.g. rafters, purlins and binders), the tables have been prepared on the basis of sawn dimensions or CLS/ALS processed sizes. The notes to individual tables state whether basic sawn or processed dimensioned timber is appropriate for the particular use. For timber of North American origin, the sizes shown are CLS/ALS sections, or sawn, resawn or processed to the BS EN 336 sizes and tolerances.

6.2 Floor joists and flat roof joists

6.2.1 Span tables

Span Table 7 to Table 10 inclusive give recommendations on the sizing of floor joists.

NOTE 1 These members have been calculated in accordance with BS 5268-7.1 to be capable of supporting the loadings given for each table. This is compatible with the guidance to be included in the non-contradictory complimentary information (NCCI) to BS EN 1995-1-1.

Table 7 and Table 8 should be applied where there are no partitions on the floor area being supported.

Table 9 and Table 10 should be applied where non load-bearing lightweight partitions as described in 5.1.2, at centres as close as is likely to occur, are supported on the floor.

Table 9 and Table 10 should be used in conjunction with Figure 9, Figure 10 and Figure 11. See also 5.1.1 regarding support for baths and other heavy concentrated loads.

Span Table 61 to Table 68 inclusive give recommendations on the sizing of flat roof joists.

NOTE 2 These members have been calculated in accordance with BS 5268-7.2 to be capable of supporting the loadings given for each table. This is compatible with the guidance to be included in the non-contradictory complimentary information (NCCI) to BS EN 1995-1-1.

Table 61, Table 62, Table 63, Table 65, Table 66 and Table 67 should be applied to situations where the only access is for the purposes of maintenance and repair.

Table 64 and Table 68 should be applied to situations where access is not limited to the purposes of maintenance and repair.

NOTE 3 See Annex M for guidance on the snow loading which is relevant for a particular site.

6.2.2 Notching, drilling and end-trimming

Notches, holes and end-trimming in floor joists and flat roof joists should be within the limits shown in Figure 1.

6.2.3 Strutting or bridging

Where the span of a floor joist or flat roof joist is more than 2.5 m, strutting is necessary.

This should be provided either by timber bridging or strutting in accordance with Figure 3, or by a proprietary system.

Timber strutting can be in the form of solid bridging of at least 38 mm basic thickness and with a depth equal to at least three-quarters of the depth of the joists; or it can consist of herringbone strutting with members of at least 38 mm by 38 mm basic size.

Herringbone strutting should not be used where the distance between the joists is more than approximately three times the depth of the joists.

6.2.4 Wallplates

Timber wallplates used to support floor joists and flat roof joists should be at least 70 mm wide.

NOTE In England and Wales it is normal for wallplates to have a basic thickness of 38 mm, whilst in Scotland thicknesses of 25 mm or 47 mm are common. These thicknesses are acceptable for this Part of BS 8103.

Joints along a wallplate should be made either with a halving joint at least 100 mm long with at least two nail fixings (see Figure 4), or by means of a proprietary fixing at a butt joint. A joint between wallplates at a corner should either be a halving joint with at least two nail fixings, or a proprietary fixing at a butt joint.

6.2.5 Bearing length

The ends of floor joists and flat roof joists are normally supported on masonry, a wallplate or a hanger. The bearing lengths given with each span table are minimum design values. Where it is necessary to provide a longer bearing to accommodate the end fixings or, in the case of floor joists supported on masonry, a 90 mm min. bearing should be provided to give restraint to the masonry wall.

6.2.6 Tying of floors and flat roofs to walls

Tying of floors and flat roofs to walls should be in accordance with BS 8103-1.

NOTE The strap details are shown in Figure 2 and Figure 7.

6.3 Trimmers, trimming joists and beams supporting floor joists

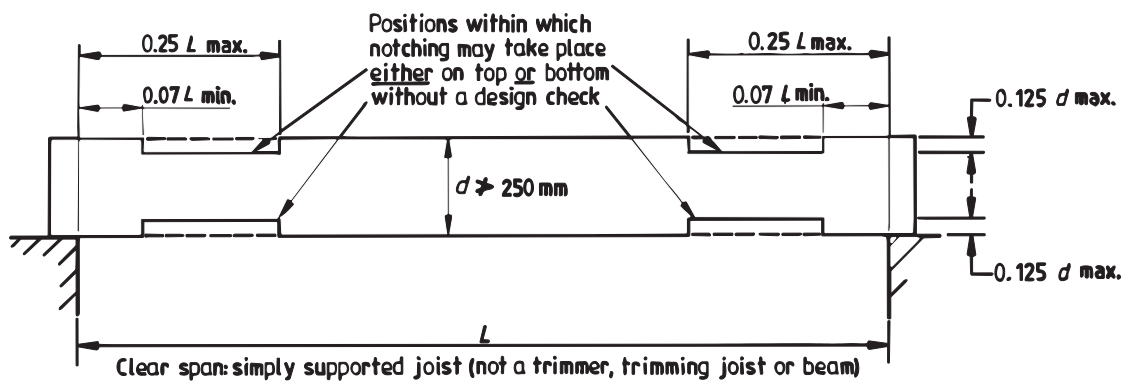
6.3.1 Span tables

Span Table 11 to Table 20 inclusive give recommendations on the sizing of trimmers, trimming joists and beams supporting a range of floor joist arrangements. These members are defined diagrammatically in the plans in Figure 12 to Figure 14, related to the relevant span tables.

NOTE These members have been calculated in accordance with BS 5268-2 to be capable of supporting the loadings applied by the various floor joist arrangements. This is compatible with the guidance to be included in the non-contradictory complimentary information (NCCI) to BS EN 1995-1-1.

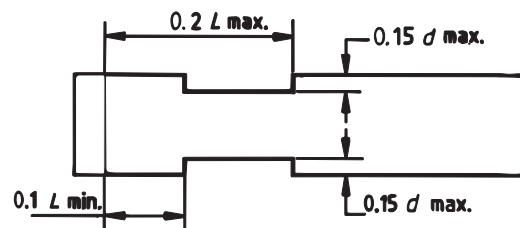
Table 11, Table 12, Table 13, Table 14, Table 17 and Table 18 should be applied to situations where partitions do not occur on the floor area being supported. Table 15, Table 16, Table 19 and Table 20 should be applied to situations where non load-bearing lightweight partitions (see 5.1.2) are supported on the floor.

Figure 1 Limits for notching and drilling of floor joists and end-trimming to fit steel hangers



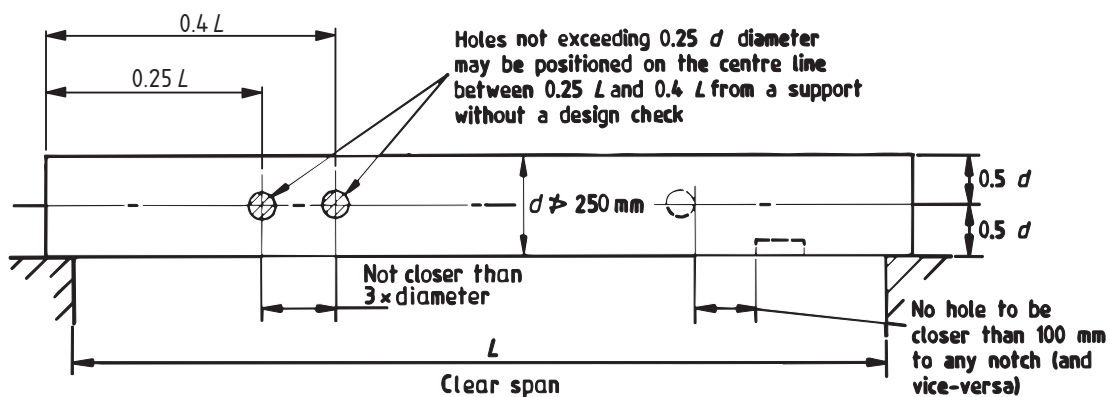
a) Limits for notching

NOTE 1 This alternative notching can occur at both ends, either on top or bottom, without a design check.



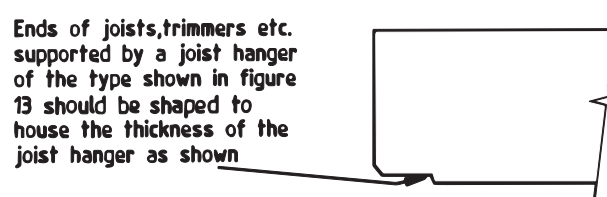
b) Alternative limits for notching

NOTE 2 This alternative notching can occur at both ends, either on top or bottom, without a design check.



c) Limits for drilling

NOTE 3 The holes permitted on the centre line can occur as well as a notch on the top or bottom.



d) End trimming

NOTE 4 The type shown in Figure 13.4 does not require the additional angled trim cut.

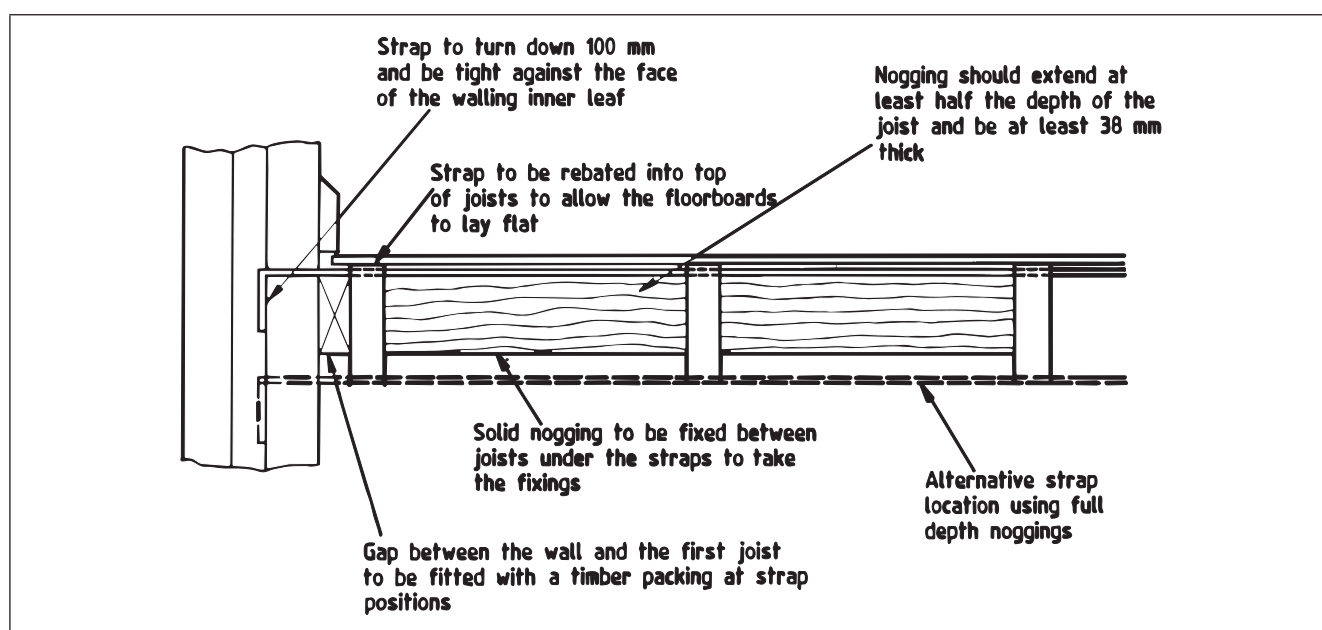
6.3.2 Notching, drilling and end-trimming

Trimmers, trimming joists and beams supporting floor joists should not be notched, drilled or end-trimmed unless justified by specialist calculation.

6.3.3 Bearing

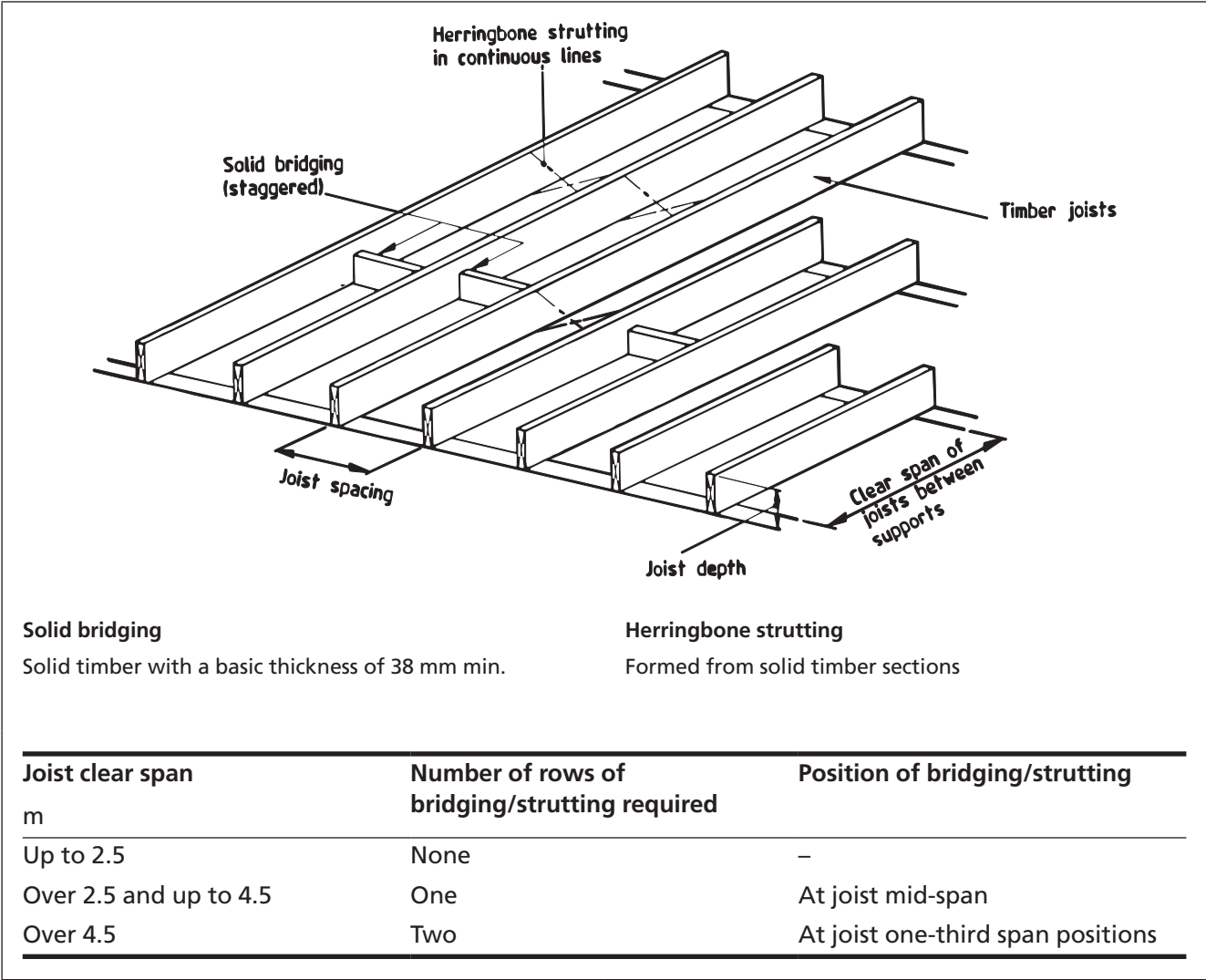
The ends of trimmers, trimming joists and beams supporting floor joists are normally supported on masonry, a wallplate or a hanger. The recommended minimum bearing length needed to support the design load should be selected from the span table for the worst design case within each table. It might be necessary to provide longer bearing to accommodate fixings or to give restraint to masonry.

Figure 2 Timber floor spanning parallel with a wall



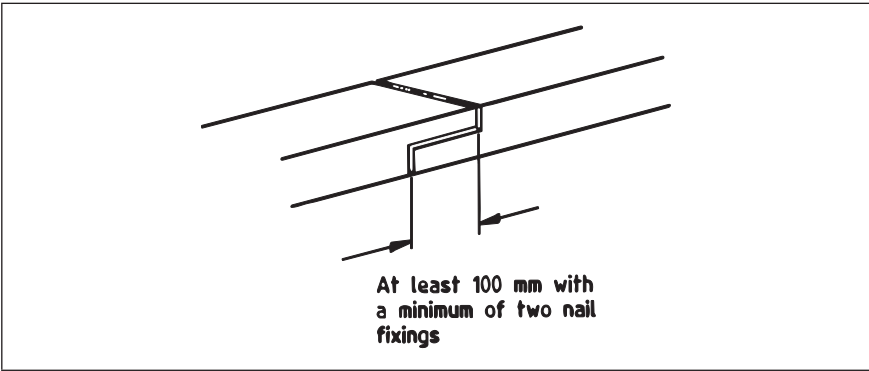
The strap illustrated in Figure 2 should be carried over at least three joists and be secured with four fixings, of which at least one should be in the third joist or in a noggings beyond the third joist.

Figure 3 Timber joist bridging/strutting requirements



Herringbone strutting (see Figure 3) should not be used where the spacing of the joists is greater than approximately three times the depth of the joist. In these instances only solid bridging should be used.

Figure 4 Wallplate halving joint



6.4 Traditional cut, framed pitched roof construction

6.4.1 General

A typical arrangement of a traditional cut, framed pitched roof construction is shown in Figure 5.

Span Table 21 to Table 60 inclusive recommend member sizes for traditional cut, framed pitched roofs which include ceiling joists, binders to support ceiling joists, rafters, and purlins to support rafters.

NOTE 1 A number of rafter pitches and rafter loading conditions are covered which is in accordance with BS EN 1991-1-3.

The span Table 21 to Table 60 can be used for member selection without further calculation, provided that the conditions referred to in the scope apply, together with the following:

- a) the dead and imposed loadings to be sustained by the ceiling, or the roof of which the members form a part do not exceed the values given in the notes to the appropriate diagrams or tables; and
- b) the timber is not holed or notched, other than birdsmouthing of rafters to a depth not exceeding one third of the depth of a rafter.

NOTE 2 See Annex M for guidance on the snow loading which is relevant for a particular site.

6.4.2 Bracing

A traditional cut, framed and pitched roof generally has sufficient built-in resistance to instability and wind forces by virtue of the nature of the roof and supporting construction (e.g. use of purlins and binders, tiling battens propping to members, hip ends, rigid sarking, or the like). However, the need for diagonal rafter bracing 5268-3 for trussed rafter roofs should be considered especially for single-hipped end and for non-hipped ended roofs of greater than 40° roof pitch to detached houses.

6.4.3 Battens for roof slating and tiling

Battens for roof slating and tiling of the species listed in Annex D should be in accordance with the sizes and tolerances given in 7.5.

NOTE This information has been presented in 7.5, which deals with trussed rafters, rather than in 6.4.3, as trussed rafters are the most common current form of construction for pitched roofs on small buildings.

6.4.4 Wallplates

Cut, framed, pitched roofs are normally supported on timber wallplates or similar flat bearing surfaces which should be carefully levelled and positioned to ensure that the roof is correctly aligned, with the bearings located at the positions assumed in the design and shown on the drawings. In all cases, the bearing areas should be sufficient to ensure that the permissible stresses for compression perpendicular to the grain are not exceeded in either the bearing or the roof timber. As a guide, the length of the bearing should be not less than 0.008 times the span of the roof, with a minimum value of 70 mm.

Joints along a wallplate should be made either with a halving joint at least 100 mm long with at least two nail fixings (see Figure 4), or by use of a proprietary fixing at a butt joint. A joint, between wallplates at a corner should either be a halving joint with at least two nail fixings, or consist of a proprietary fixing at a butt joint.

NOTE In England and Wales it is normal for wallplates to have a basic thickness of 38 mm, whilst in Scotland thicknesses of 25 mm or 47 mm are typical. These thicknesses are acceptable for this Part of BS 8103.

6.4.5 Connections including metal restraint straps

NOTE 1 For recommendations regarding tying the roof to the walls, see BS 8103-1. The tying details are shown in Figure 6 and Figure 7

Wallplates can be held down by one of the proprietary types of fixings [see Figure 7 b)] or, in the case of certain pitched roofs (see BS 8103-1), but not flat roofs, by nails into blockwork (but not into brickwork) by 75 mm long masonry nails at centres not exceeding 1 m, taking care to avoid vertical mortar joints.

At the eaves, each rafter or ceiling joist should be fixed to a wallplate by one of the proprietary types of fixings [see Figure 7 b)] or by nails. If nails are used, the minimum fixing at each bearing position should consist of two 4.5 mm diameter by 100 mm long round wire nails skew-nailed from each side of the ceiling joist or rafter into the wallplate.

If it is necessary to join lengths of rafters, the joint should be at a support position if bending is to be avoided in the connection.

NOTE 2 A typical detail which is not designed to take bending is shown in Figure 5 b).

If it is necessary to join lengths of ceiling joists, the joint should occur at a support position if bending is to be avoided in the connection.

NOTE 3 A typical detail which is not designed to take bending is shown in Figure 5 d).

Rafters should be joined to ceiling joists at the eaves.

NOTE 4 Typical details are shown in Figure 5 e).

Figure 5 Traditional cut framed pitched roof

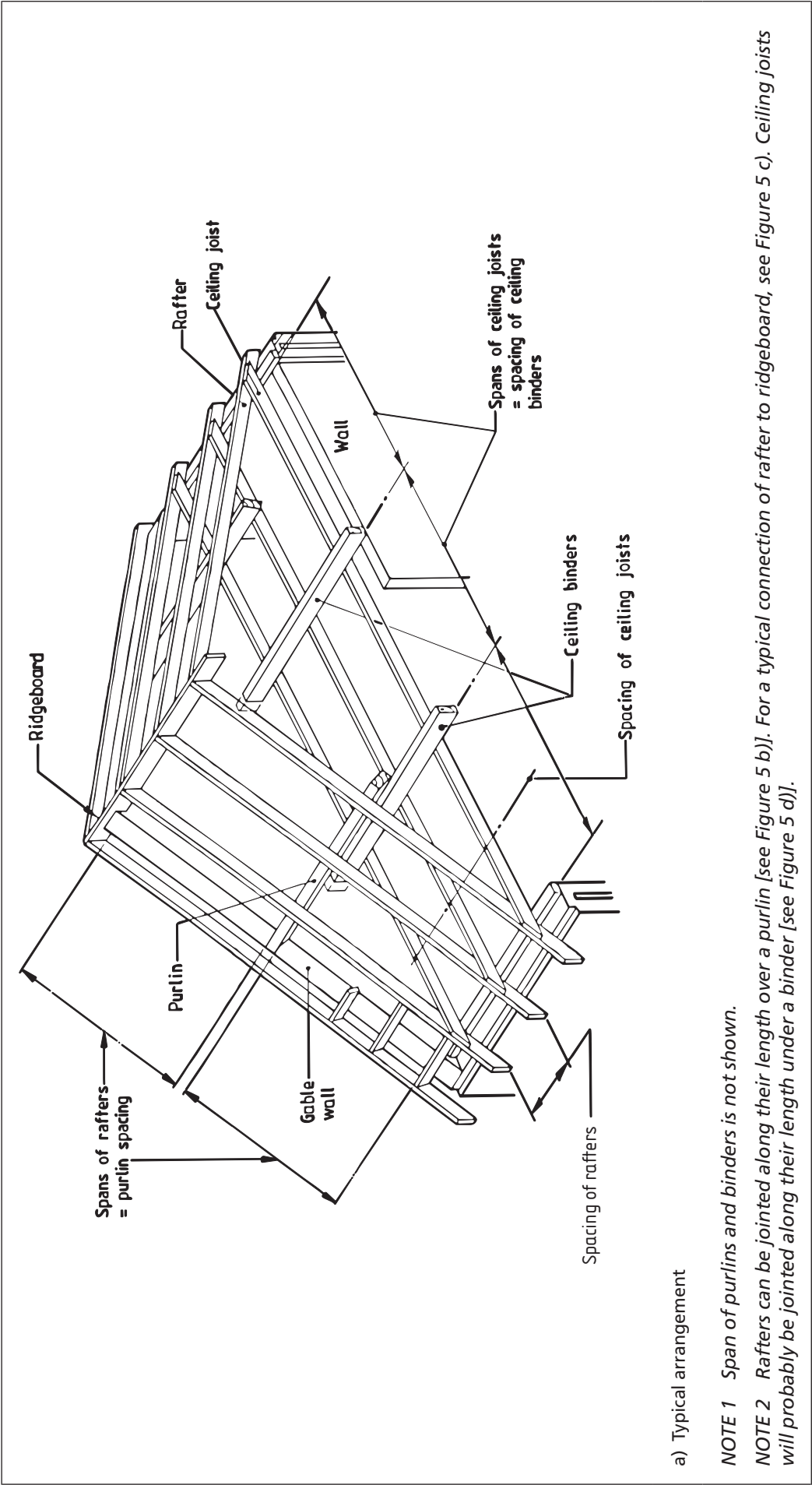
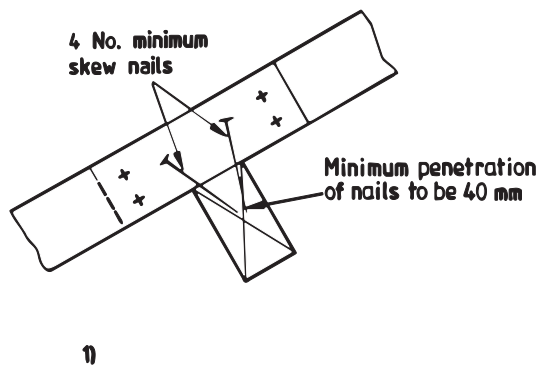
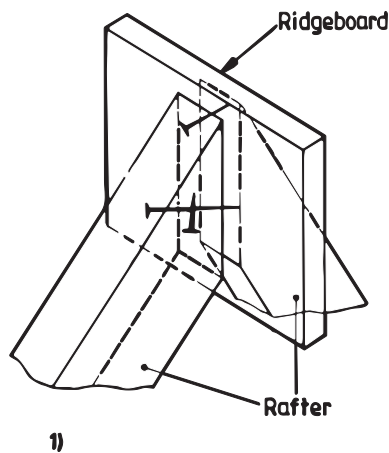
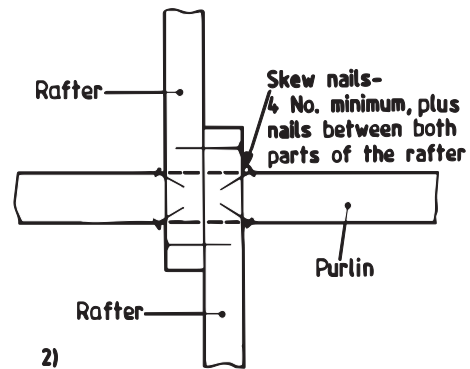


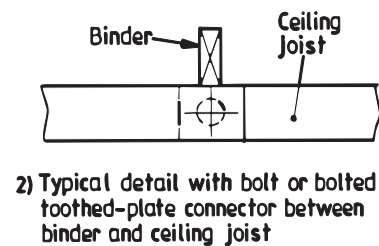
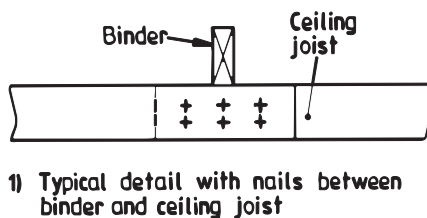
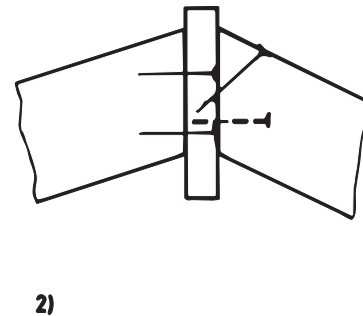
Figure 5 Traditional cut framed pitched roof (*continued*)

b) Typical detail of joint in a rafter over a purlin

NOTE 1 This joint is not designed to take axial compression.

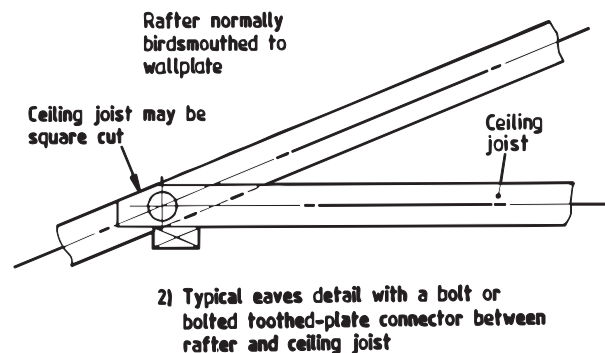
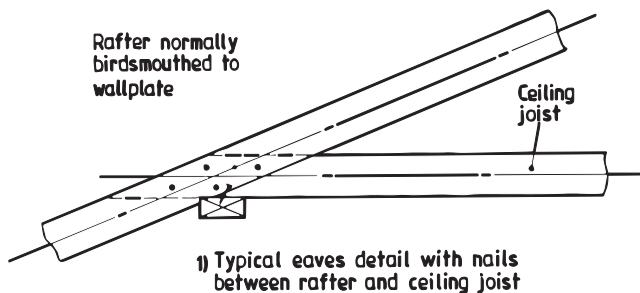


c) Typical detail of joint of rafter to ridgeboard



d) Typical details of joint (required to take axial tension) along length of ceiling joists at a binder position

NOTE 2 Binders and ceiling joists are fixed together by nails, a hanger or proprietary clip.



e) Typical details of joint (required to take axial load) between rafter and ceiling joist

Figure 6 Tying of pitched roofs to gable walls

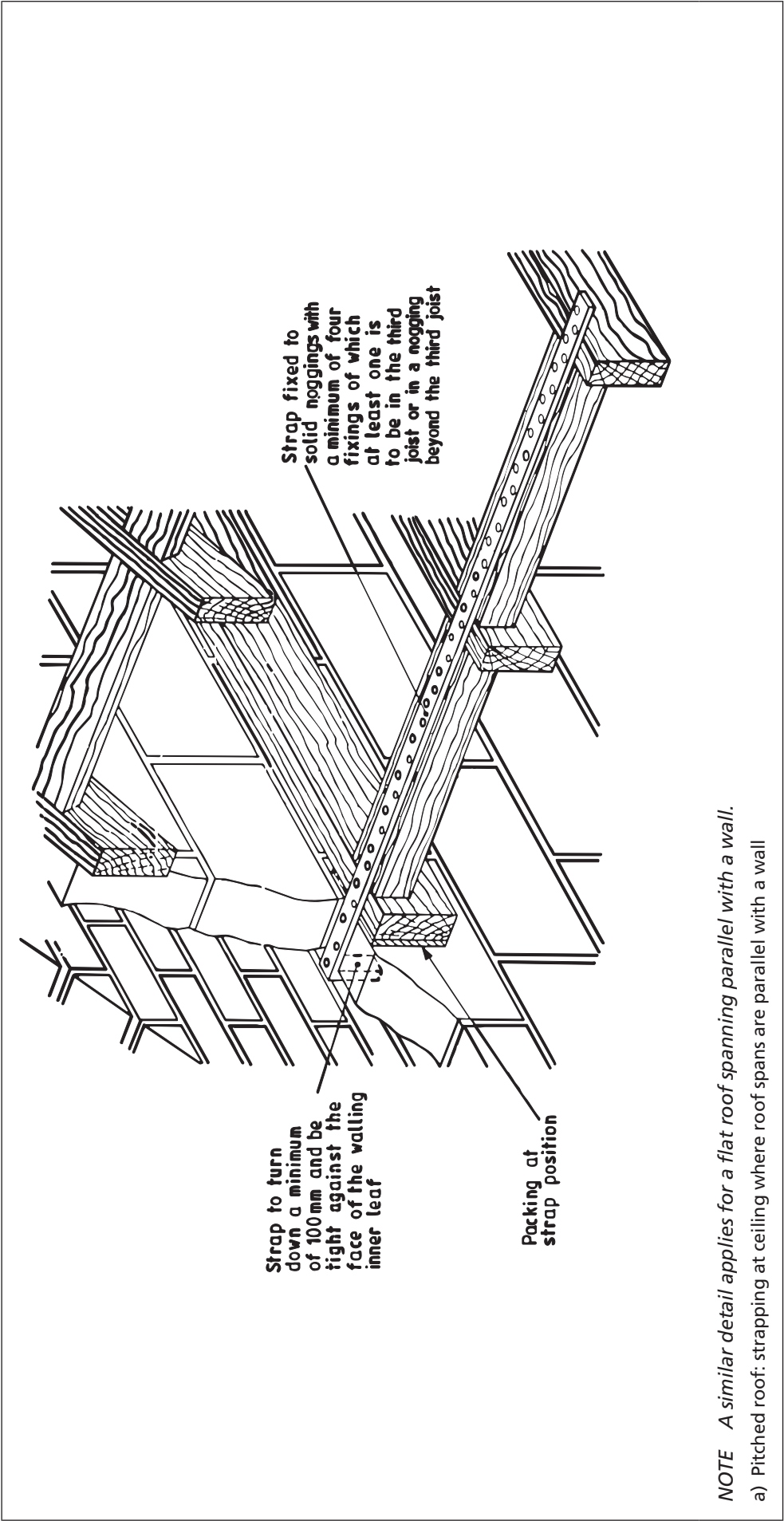
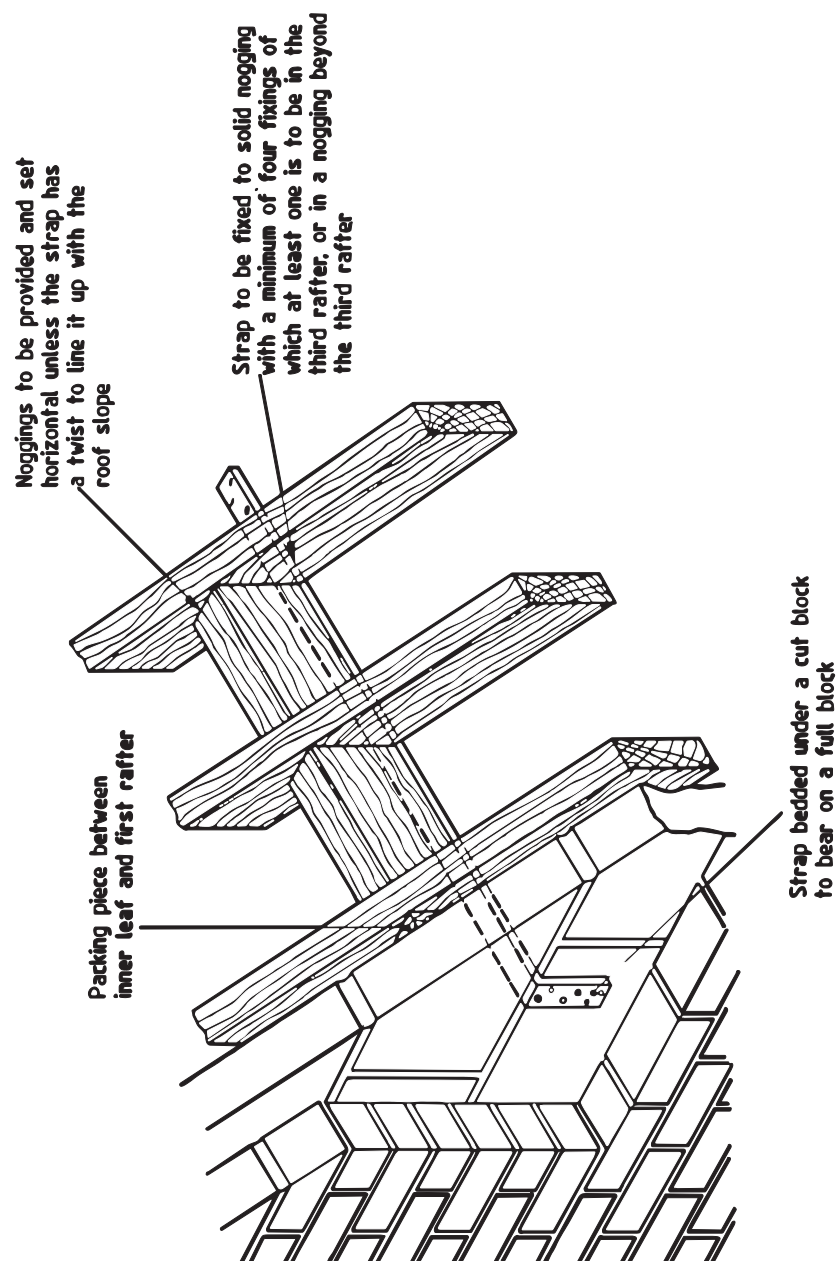


Figure 6 Tying of pitched roofs to gable walls (*continued*)

b) Pitched roof: connections at gable verge line

Figure 7 Pitched or flat roof bearing on to a wallplate

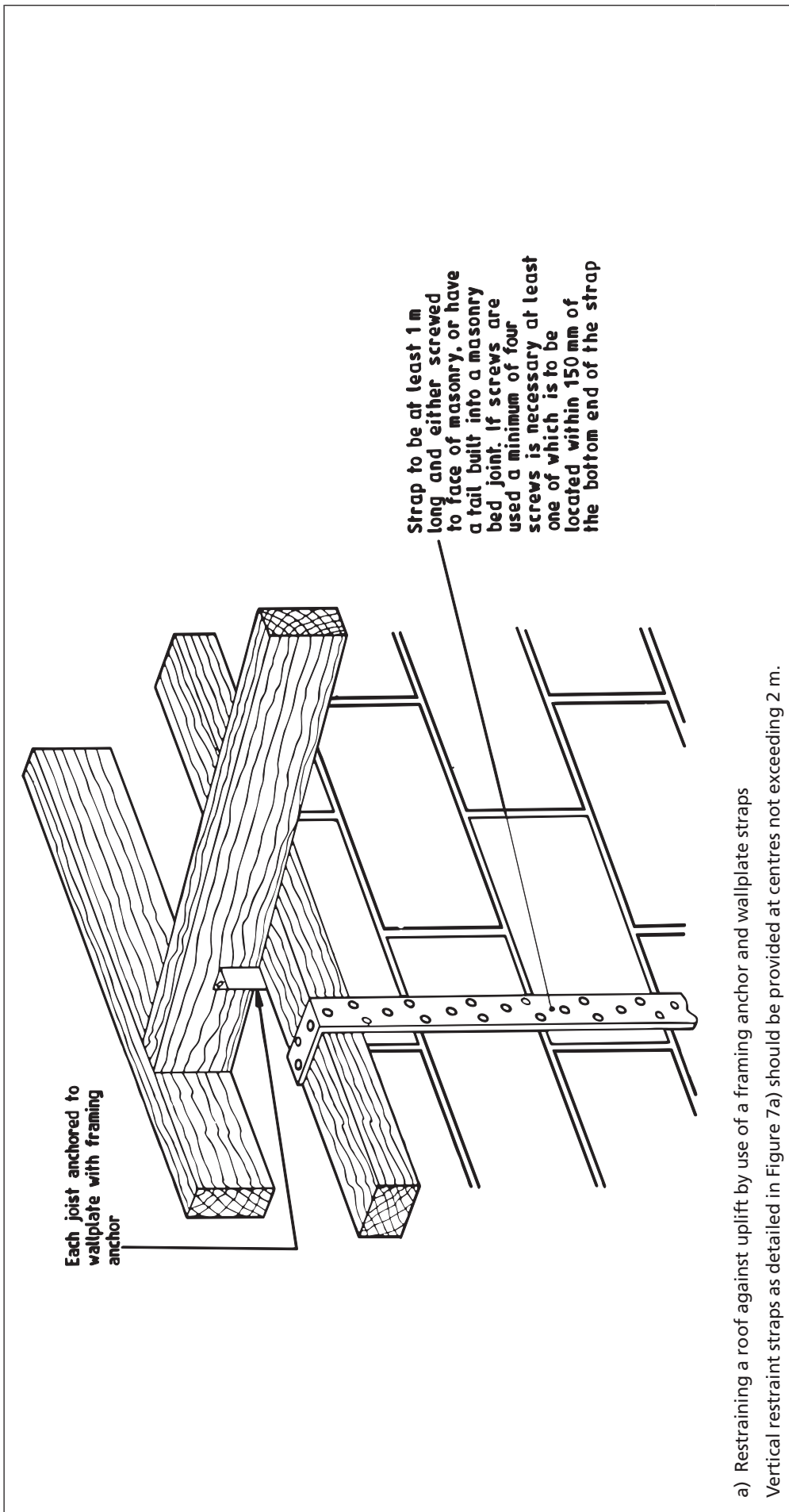


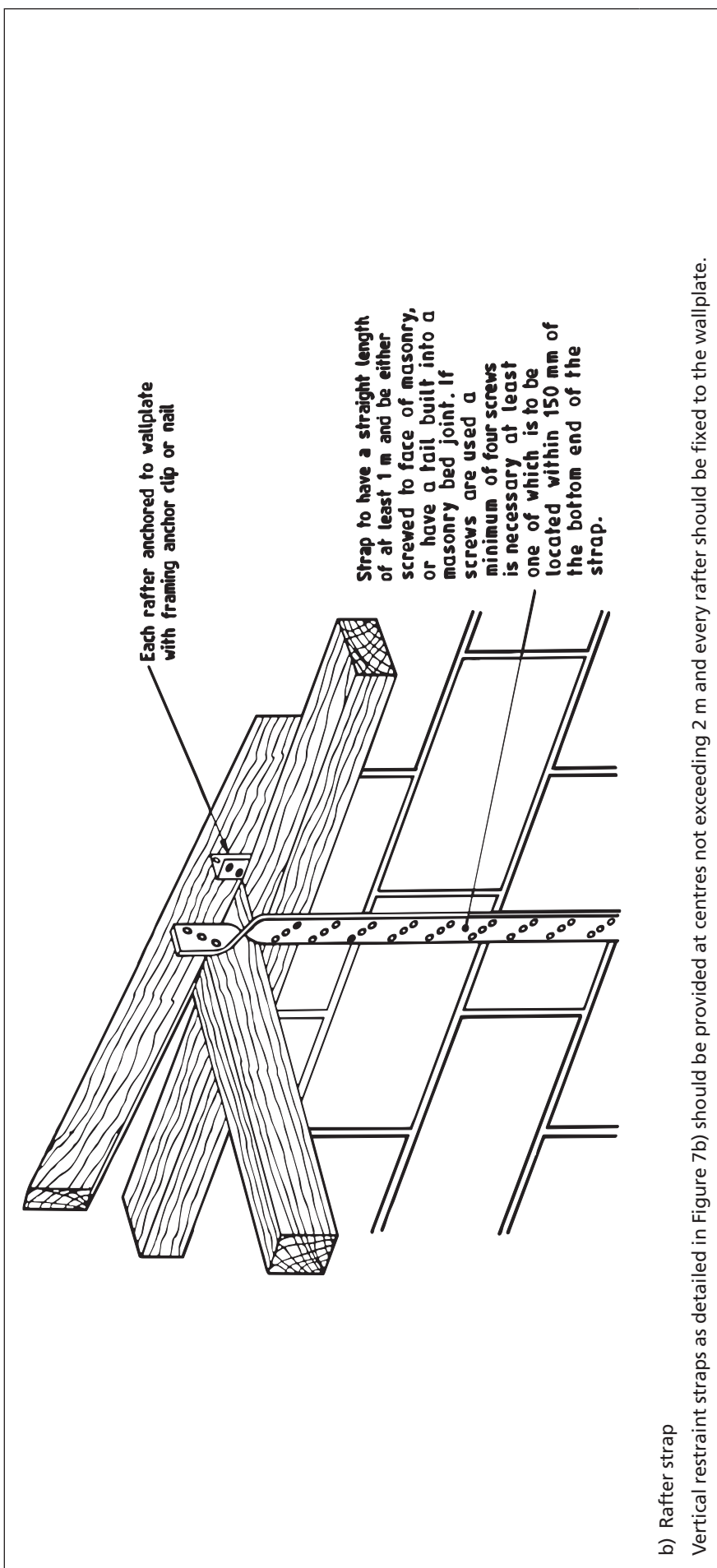
Figure 7 Pitched or flat roof bearing on to a wallplate (*continued*)

Table 6 Key to Table 7 to Table 74

Construction element	Timber member	Table reference	
		Timber strength class (see Table 1)	
		C16	C24
Floors:			
Not supporting partitions	Joists	7	8
	Beams or trimmers	11 and 12	13 and 14
	Trimming joists	17	18
Supporting non load-bearing lightweight partitions	Joists	9	10
	Beams or trimmers	15	16
	Trimming joists	19	20
Ceilings:			
	Joists	21	23
	Binders	22	24
Pitched roofs:			
Pitch greater than 15° but not more than 22½°			
— Imposed snow load 0.75 kN/m ²	Rafters	25	31
	Purlins	26	32
— Imposed snow load 1.00 kN/m ²	Rafters	37	43
	Purlins	38	44
— Imposed snow load 1.25 kN/m ²	Rafters	49	55
	Purlins	50	56
Pitch greater than 22½° but not greater than 30°			
— Imposed snow load 0.75 kN/m ²	Rafters	27	33
	Purlins	28	34
— Imposed snow load 1.00 kN/m ²	Rafters	39	45
	Purlins	40	46
— Imposed snow load 1.25 kN/m ²	Rafters	51	57
	Purlins	52	58
Pitch greater than 30° but not greater than 45°			
— Imposed snow load 0.75 kN/m ²	Rafters	29	35
	Purlins	30	36
— Imposed snow load 1.00 kN/m ²	Rafters	41	47
	Purlins	42	48
— Imposed snow load 1.25 kN/m ²	Rafters	53	59
	Purlins	54	60
Flat roofs:			
With access for the purposes of maintenance and repair only (Access limited)			
— Imposed snow load 0.75 kN/m ²	Joists	61	65
— Imposed snow load 1.00 kN/m ²	Joists	62	66
— Imposed snow load 1.25 kN/m ²	Joists	63	67
With access not limited to the purposes of maintenance and repair (Access not limited)			
— Imposed load 1.50 kN/m ²	Joists	64	68

Table 6 Key to Table 7 to Table 74 (continued)

Construction element	Timber member	Table reference	
		Timber strength class (see Table 1)	
		C16	C24
Sheeted or decked roofs:			
Pitch greater than 10° but not greater than 35°			
— Imposed snow load 0.75 kN/m ²	Purlins	69	72
— Imposed snow load 1.00 kN/m ²	Purlins	70	73
— Imposed snow load 1.25 kN/m ²	Purlins	71	74

NOTE 1 The strength classes given in Table 7 to Table 74 assume that the qualifying species/strength grade combinations to be used are those given in Table 1.

NOTE 2 The illustrations which accompany the span tables are diagrammatic and do not show all details of construction.

NOTE 3 The imposed snow loading categories assume that actual imposed loads on roof constructions will be calculated using BS EN 1991-1-3. See Annex M for guidance on snow loadings relevant for a particular site.

NOTE 4 Span tables are not given for trussed rafter roof constructions.

Adequate connections between members should be provided as appropriate.

Trussed rafters should be designed in accordance with BS 5268-3⁶⁾.

6.5 Floor joists: Notes and recommendations to Table 7, Table 8, Table 9 and Table 10

6.5.1 When a lightweight partition is parallel to the joist span, one additional joist should be provided directly under the partition, as shown in Figure 9 and Figure 10, or noggings should be provided as shown in Figure 11. Non load-bearing lightweight partitions perpendicular to floor joists spaced at centres not exceeding 600 mm do not require support from noggings.

NOTE 1 The sizes, spacings and spans given will support the dead loads stated in the tables together with an imposed load not exceeding 1.50 kN/m². Examples of some typical floor constructions and their respective dead loadings are given in Annex L. In addition, Table 9 and Table 10 make allowance for non load-bearing lightweight partitions weighing not more than 0.8 kN/m run at spacings as close as is likely to occur in practice. See also Figure 8.

NOTE 2 The timber sizes given in the span tables can be used when a bath is to be placed on the floor area being supported providing that the joists supporting the bath are doubled-up. This applies both if the joists are parallel or perpendicular to the length of a rectangular bath. Other shapes of bath need special consideration. Special consideration might also be required for other heavy concentrated loads.

⁶⁾ BS 5268-3 will be replaced by BS EN 1995-1-1 and PD 6693-1.

NOTE 3 The section sizes given in the tables are either sawn across the timber thickness in accordance with tolerance class 1 of BS EN 336 and processed in accordance with tolerance class 2 across the timber width (joist depth), or are CLS/ALS processed sizes in accordance with tolerance class 2, to provide level surfaces for ease of ceiling lining and the fixing of structural decking. BS EN 336 tolerances are as follows:

- a) on a sawn thickness of not greater than 100 mm (tolerance class 1):
 - 1 mm;
 - + 3 mm;
- b) on a processed thickness or depth of not greater than 100 mm (tolerance class 2):
 - 1 mm;
 - + 1 mm;
- c) on a processed depth greater than 100 mm (tolerance class 2):
 - 1.5 mm;
 - + 1.5 mm.

6.5.2 Unless justified by specialist calculation, the minimum bearing length at supports for floor joists should be as stated at the base of each table.

NOTE It might be necessary to provide longer bearing to accommodate fixings or simply for practical reasons such as construction tolerances.

If the end of a joist is supported on a steel hanger, the end should if necessary be shaped to fit the hanger neatly as indicated in diagrammatic form in Figure 1d), and the gap between the end of the joist and the inside face of the hanger should not exceed 6 mm. If the end of a joist is supported on masonry, the end bearing should be at least 90 mm to provide restraint to the masonry wall.

6.5.3 Notching and drilling of floor joists should not exceed the limits given in 6.2.2 and Figure 1.

NOTE Permissible clear spans have been calculated in accordance with BS 5268-7.1. This is compatible with the guidance to be included in the non-contradictory complimentary information (NCCI) to BS EN 1995-1-1.

Figure 8 Floor joist arrangement

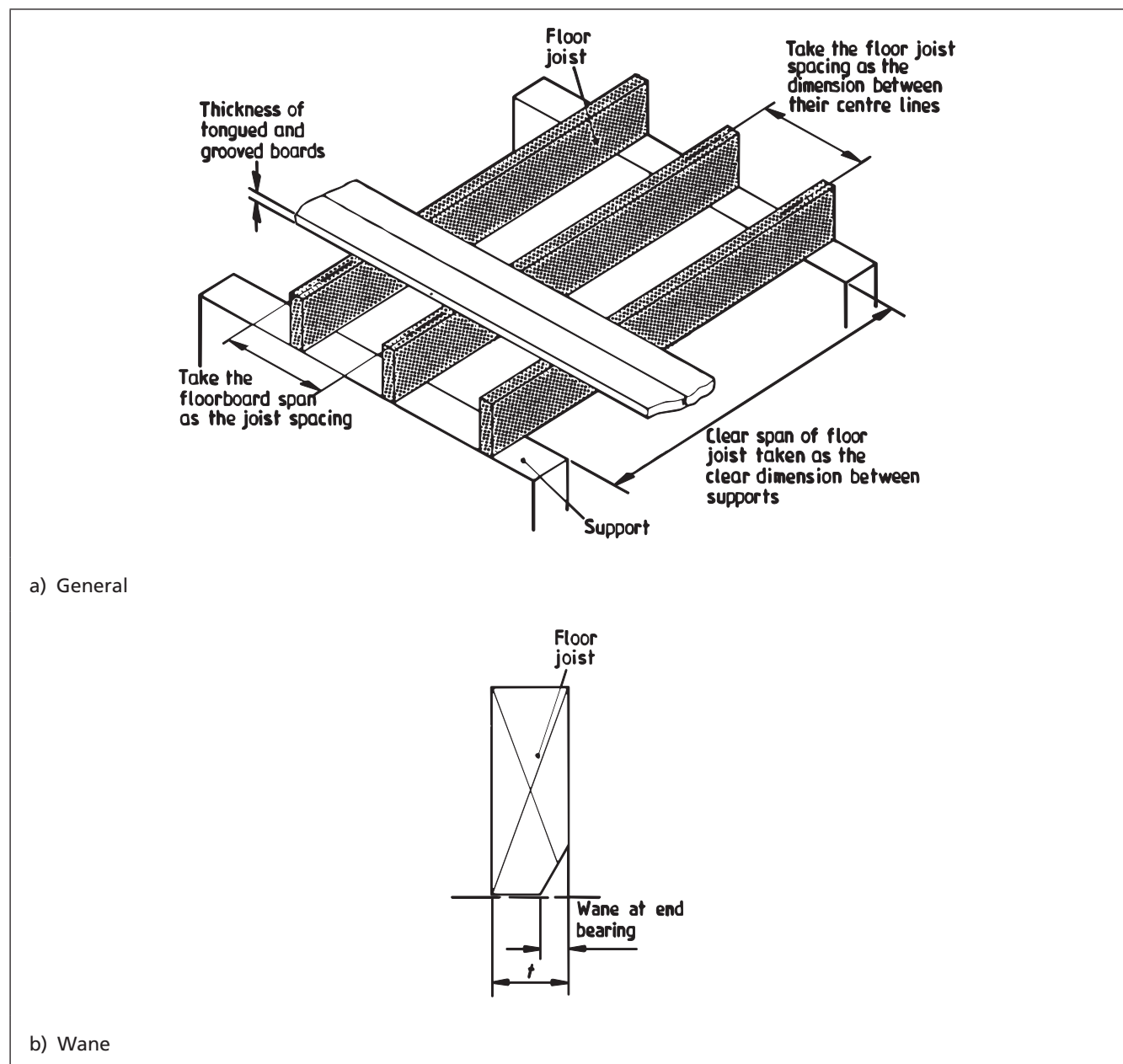


Figure 9 Double joist construction

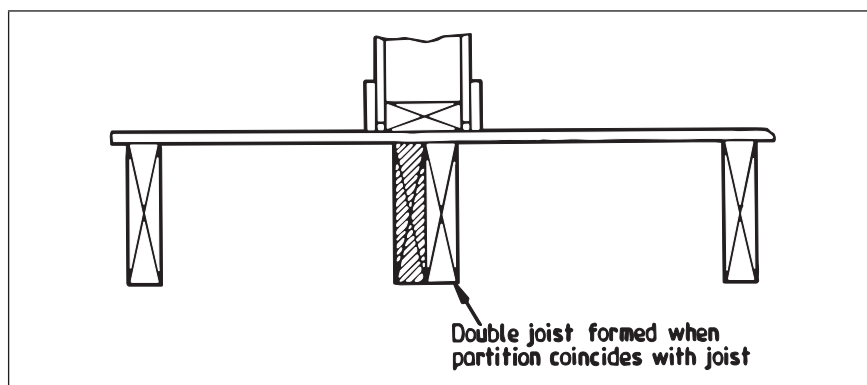


Figure 10 Provision of extra joist

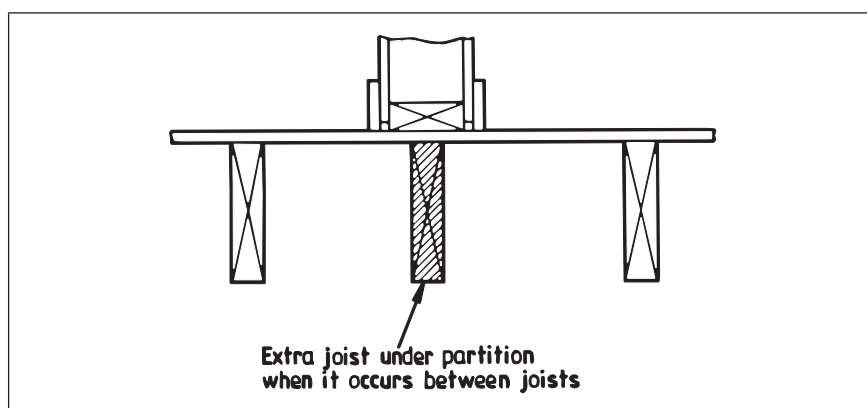


Figure 11 Noggings supporting partitions

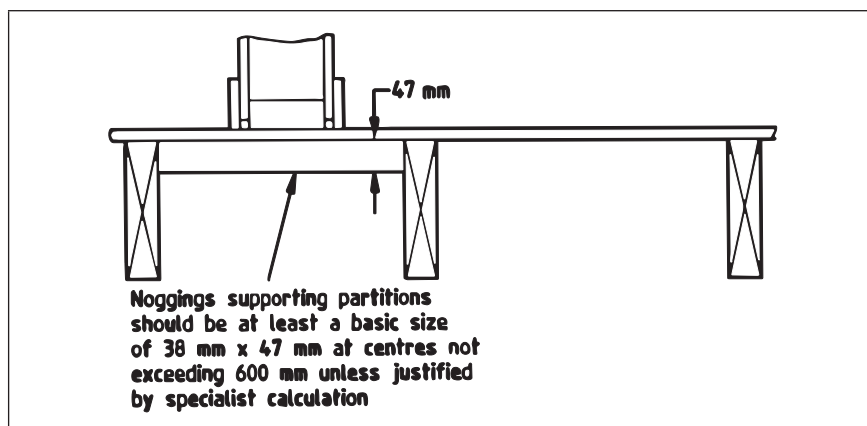


Table 7 Permissible clear spans of joists supporting floors with no partitions. Timber of strength class C16

C16		No partitions								
Size of joist ^{A)} mm × mm		Dead load kN/m ²								
		Not more than 0.25			More than 0.25 but not more than 0.50			More than 0.50 but not more than 1.25		
		Spacing of joists mm								
		400	450	600	400	450	600	400	450	600
		Maximum clear span of joist m								
BS EN 336 sizes with sawn thickness to tolerance class 1 and processed depth to tolerance class 2	38 × 72	1.130	1.011	0.767	1.061	0.954	0.731	0.920	0.834	0.652
	38 × 97	1.828	1.692	1.303	1.717	1.556	1.214	1.423	1.301	1.037
	38 × 120	2.482	2.385	1.925	2.368	2.215	1.755	1.947	1.791	1.448
	38 × 145	2.983	2.868	2.510	2.853	2.707	2.331	2.453	2.290	1.872
	38 × 170	3.442	3.306	2.873	3.281	3.098	2.690	2.808	2.649	2.267
	38 × 195	3.939	3.752	3.263	3.724	3.518	3.056	3.189	3.010	2.609
	38 × 220	4.434	4.193	3.648	4.161	3.932	3.418	3.567	3.367	2.920
	47 × 72	1.324	1.233	0.942	1.272	1.154	0.891	1.091	0.993	0.783
	47 × 97	2.024	1.914	1.583	1.920	1.818	1.460	1.665	1.527	1.228
	47 × 120	2.663	2.561	2.302	2.548	2.450	2.087	2.255	2.081	1.696
	47 × 145	3.200	3.078	2.786	3.062	2.945	2.609	2.723	2.570	2.174
	47 × 170	3.691	3.551	3.188	3.533	3.398	2.987	3.116	2.942	2.552
	47 × 195	4.221	4.063	3.619	4.042	3.889	3.391	3.538	3.341	2.900
	47 × 220	4.723	4.572	4.044	4.549	4.354	3.791	3.954	3.735	3.244
	63 × 97	2.319	2.197	1.919	2.191	2.079	1.822	1.934	1.839	1.533
	63 × 120	2.931	2.821	2.566	2.807	2.700	2.454	2.527	2.429	2.088
	63 × 145	3.518	3.388	3.084	3.370	3.244	2.950	3.037	2.920	2.577
	63 × 170	4.055	3.905	3.558	3.886	3.741	3.404	3.504	3.370	2.950
	63 × 195	4.633	4.465	4.070	4.442	4.278	3.896	4.009	3.850	3.350
	63 × 220	5.061	4.923	4.580	4.905	4.770	4.365	4.512	4.301	3.745
	75 × 120	3.100	2.985	2.718	2.970	2.859	2.601	2.677	2.575	2.327
	75 × 145	3.719	3.582	3.265	3.564	3.432	3.125	3.216	3.094	2.807
	75 × 170	4.283	4.128	3.765	4.107	3.957	3.605	3.709	3.569	3.212
	75 × 195	4.830	4.700	4.306	4.683	4.523	4.125	4.242	4.084	3.646
	75 × 220	5.268	5.128	4.793	5.109	4.971	4.641	4.740	4.595	4.074
CLS/ALS sizes	38 × 89	1.617	1.463	1.121	1.499	1.356	1.052	1.259	1.149	0.910
	38 × 140	2.843	2.733	2.398	2.719	2.587	2.167	2.330	2.149	1.752
	38 × 184	3.721	3.557	3.092	3.530	3.334	2.895	3.022	2.852	2.471
	38 × 235	4.710	4.460	3.890	4.430	4.180	3.640	3.800	3.590	3.110

Minimum design bearing length

If wane at end-bearing [see Figure 8 b)] is permitted to the strength class limit, i.e. one-third of thickness for strength class C16, the minimum design bearing length is 38 mm.

If wane is not permitted, the minimum design bearing length is 20 mm.

See also 6.5.2.

^{A)} Check the availability of section sizes.

Table 8 Permissible clear spans of joists supporting floors with no partitions. Timber of strength class C24

C24		No partitions								
Size of joist ^{A)} mm × mm		Dead load kN/m ²								
		Not more than 0.25			More than 0.25 but not more than 0.50			More than 0.50 but not more than 1.25		
		Spacing of joists mm								
		400	450	600	400	450	600	400	450	600
		Maximum clear span of joist m								
BS EN 336 sizes with sawn thickness to tolerance class 1 and processed depth to tolerance class 2	38 × 72	1.262	1.189	1.023	1.215	1.146	0.989	1.108	1.048	0.874
	38 × 97	1.936	1.829	1.586	1.838	1.739	1.514	1.635	1.551	1.358
	38 × 120	2.582	2.482	2.200	2.469	2.369	2.076	2.180	2.073	1.826
	38 × 145	3.103	2.984	2.709	2.969	2.854	2.588	2.667	2.561	2.305
	38 × 170	3.580	3.444	3.128	3.426	3.294	2.989	3.079	2.958	2.678
	38 × 195	4.096	3.941	3.581	3.921	3.771	3.423	3.526	3.388	3.068
	38 × 220	4.609	4.436	4.034	4.413	4.246	3.856	3.971	3.816	3.458
	47 × 72	1.404	1.324	1.144	1.347	1.273	1.103	1.223	1.159	1.010
	47 × 97	2.141	2.025	1.763	2.026	1.920	1.678	1.795	1.705	1.499
	47 × 120	2.770	2.664	2.421	2.651	2.549	2.290	2.382	2.268	2.006
	47 × 145	3.327	3.201	2.910	3.185	3.064	2.783	2.865	2.754	2.496
	47 × 170	3.836	3.693	3.359	3.674	3.535	3.212	3.307	3.179	2.883
	47 × 195	4.387	4.224	3.845	4.202	4.045	3.678	3.786	3.640	3.302
	47 × 220	4.860	4.725	4.328	4.707	4.552	4.141	4.262	4.099	3.720
	63 × 97	2.432	2.321	2.030	2.308	2.192	1.925	2.032	1.934	1.709
	63 × 120	3.046	2.933	2.669	2.918	2.808	2.553	2.628	2.527	2.273
	63 × 145	3.665	3.521	3.207	3.503	3.372	3.069	3.158	3.038	2.759
	63 × 170	4.211	4.058	3.699	4.037	3.888	3.541	3.643	3.505	3.185
	63 × 195	4.770	4.637	4.231	4.614	4.445	4.052	4.168	4.011	3.646
	63 × 220	5.204	5.064	4.731	5.046	4.908	4.560	4.678	4.514	4.106
	75 × 120	3.220	3.102	2.827	3.086	2.972	2.705	2.784	2.678	2.678
	75 × 145	3.862	3.721	3.394	3.703	3.567	3.250	3.344	3.218	3.218
	75 × 170	4.446	4.286	3.913	4.265	4.110	3.748	3.855	3.711	3.711
	75 × 195	4.966	4.833	4.474	4.816	4.686	4.287	4.408	4.245	4.245
	75 × 220	5.415	5.272	4.932	5.253	5.113	4.778	4.878	4.743	4.743
CLS/ALS sizes	38 × 89	1.713	1.617	1.399	1.633	1.544	1.341	1.464	1.388	1.201
	38 × 140	2.957	2.844	2.581	2.829	2.719	2.466	2.541	2.440	2.170
	38 × 184	3.869	3.723	3.382	3.703	3.561	3.232	3.329	3.199	2.897
	38 × 235	4.850	4.710	4.310	4.700	4.540	4.120	4.240	4.080	3.700

Minimum design bearing length

If wane at end-bearing [see Figure 8 b)] is permitted to the strength class limit, i.e. one-third of thickness for strength class C24, the minimum design bearing length is 45 mm.

If wane is not permitted, the minimum design bearing length is 24 mm.

See also 6.5.2.

^{A)} Check the availability of section sizes.

Table 9 Permissible clear spans of joists for floors supporting non load-bearing lightweight partitions ^{A)}.
Timber of strength class C16

C16		Lightweight partitions								
Size of joist ^{B)} mm × mm		Dead load kN/m ²								
		Not more than 0.25			More than 0.25 but not more than 0.50			More than 0.50 but not more than 1.25		
		Spacing of joists mm								
		400	450	600	400	450	600	400	450	600
		Maximum clear span of joist m								
BS EN 336 sizes with sawn thickness to tolerance class 1 and processed depth to tolerance class 2	38 × 72	1.017	0.910	0.690	0.955	0.859	0.658	0.828	0.751	0.586
	38 × 97	1.646	1.523	1.173	1.545	1.401	1.093	1.281	1.171	0.933
	38 × 120	2.234	2.147	1.732	2.131	1.993	1.579	1.753	1.612	1.303
	38 × 145	2.685	2.581	2.259	2.568	2.437	2.098	2.207	2.061	1.684
	38 × 170	3.098	2.976	2.586	2.953	2.788	2.421	2.527	2.384	2.040
	38 × 195	3.545	3.377	2.937	3.352	3.166	2.750	2.871	2.709	2.348
	38 × 220	3.990	3.773	3.284	3.745	3.539	3.076	3.210	3.030	2.628
	47 × 72	1.191	1.110	0.848	1.145	1.038	0.802	0.982	0.894	0.705
	47 × 97	1.822	1.723	1.424	1.728	1.636	1.314	1.498	1.375	1.105
	47 × 120	2.397	2.305	2.071	2.293	2.205	1.878	2.030	1.872	1.526
	47 × 145	2.880	2.770	2.507	2.756	2.650	2.348	2.451	2.313	1.957
	47 × 170	3.322	3.196	2.869	3.180	3.059	2.688	2.805	2.648	2.297
	47 × 195	3.799	3.657	3.257	3.638	3.500	3.052	3.184	3.007	2.610
	47 × 220	4.250	4.115	3.640	4.094	3.918	3.412	3.559	3.362	2.920
	63 × 97	2.087	1.978	1.727	1.972	1.871	1.640	1.740	1.655	1.380
	63 × 120	2.638	2.539	2.309	2.526	2.430	2.209	2.274	2.186	1.879
	63 × 145	3.166	3.049	2.775	3.033	2.919	2.655	2.733	2.628	2.319
	63 × 170	3.649	3.515	3.202	3.497	3.367	3.064	3.153	3.033	2.655
	63 × 195	4.170	4.018	3.663	3.998	3.850	3.506	3.608	3.465	3.015
	63 × 220	4.555	4.431	4.122	4.415	4.293	3.928	4.061	3.871	3.370
	75 × 120	2.790	2.687	2.446	2.673	2.573	2.341	2.409	2.317	2.094
	75 × 145	3.347	3.224	2.939	3.208	3.089	2.813	2.894	2.785	2.526
	75 × 170	3.855	3.715	3.389	3.697	3.561	3.245	3.338	3.212	2.891
	75 × 195	4.347	4.230	3.875	4.214	4.070	3.712	3.818	3.675	3.281
	75 × 220	4.741	4.615	4.314	4.598	4.474	4.177	4.266	4.136	3.667
CLS/ALS sizes	38 × 89	1.455	1.317	1.009	1.349	1.220	0.947	1.133	1.034	0.819
	38 × 140	2.559	2.460	2.158	2.447	2.329	1.951	2.097	1.934	1.577
	38 × 184	3.349	3.201	2.783	3.177	3.000	2.606	2.720	2.567	2.224
	38 × 235	4.236	4.009	3.490	3.979	3.760	3.270	3.412	3.221	2.794

Minimum design bearing length

If wane at end-bearing [see Figure 8 b)] is permitted to the strength class limit, i.e. one-third of thickness for strength class C16, the minimum design bearing length is 34 mm.

If wane is not permitted, the minimum design bearing length is 18 mm.

See also 6.5.2.

^{A)} See 6.5.1 when a partition is parallel to the joists.

^{B)} Check the availability of section sizes.

Table 10 Permissible clear spans of joists for floors supporting non load-bearing lightweight partitions^{A)}.
Timber of strength class C24

C24		Lightweight partitions								
Size of joist ^{B)} mm × mm		Dead load kN/m ²								
		Not more than 0.25			More than 0.25 but not more than 0.50			More than 0.50 but not more than 1.25		
		Spacing of joists mm								
		400	450	600	400	450	600	400	450	600
		Maximum clear span of joist m								
BS EN 336 sizes with sawn thickness to tolerance class 1 and processed depth to tolerance class 2	38 × 72	1.136	1.070	0.921	1.093	1.031	0.890	0.997	0.943	0.786
	38 × 97	1.742	1.646	1.427	1.654	1.565	1.362	1.472	1.396	1.222
	38 × 120	2.324	2.234	1.980	2.222	2.132	1.868	1.962	1.865	1.644
	38 × 145	2.793	2.686	2.438	2.672	2.568	2.330	2.400	2.305	2.074
	38 × 170	3.222	3.099	2.815	3.083	2.965	2.690	2.771	2.662	2.410
	38 × 195	3.686	3.547	3.223	3.529	3.394	3.081	3.173	3.049	2.761
	38 × 220	4.148	3.993	3.630	3.972	3.821	3.471	3.574	3.435	3.112
	47 × 72	1.263	1.191	1.029	1.213	1.145	0.993	1.101	1.043	0.909
	47 × 97	1.926	1.823	1.587	1.824	1.728	1.510	1.615	1.535	1.349
	47 × 120	2.493	2.398	2.179	2.386	2.294	2.061	2.144	2.042	1.806
	47 × 145	2.994	2.881	2.619	2.866	2.757	2.504	2.579	2.478	2.246
	47 × 170	3.453	3.323	3.023	3.306	3.181	2.891	2.977	2.861	2.594
	47 × 195	3.948	3.801	3.460	3.782	3.640	3.310	3.407	3.276	2.972
	47 × 220	4.374	4.253	3.895	4.237	4.097	3.727	3.836	3.689	3.348
	63 × 97	2.189	2.089	1.827	2.077	1.972	1.732	1.829	1.741	1.538
	63 × 120	2.742	2.639	2.402	2.626	2.527	2.298	2.366	2.275	2.046
	63 × 145	3.290	3.168	2.886	3.152	3.035	2.762	2.842	2.734	2.483
	63 × 170	3.790	3.652	3.329	3.634	3.499	3.187	3.279	3.155	2.866
	63 × 195	4.293	4.174	3.808	4.153	4.001	3.646	3.751	3.610	3.282
	63 × 220	4.684	4.558	4.258	4.541	4.417	4.104	4.211	4.063	3.696
	75 × 120	2.898	2.792	2.544	2.778	2.675	2.435	2.505	2.410	2.190
	75 × 145	3.475	3.349	3.055	3.333	3.210	2.925	3.009	2.896	2.633
	75 × 170	4.001	3.858	3.522	3.839	3.699	3.374	3.470	3.340	3.039
	75 × 195	4.469	4.350	4.027	4.334	4.217	3.858	3.968	3.820	3.478
	75 × 220	4.874	4.745	4.438	4.728	4.601	4.300	4.390	4.268	3.915
CLS/ALS sizes	38 × 89	1.542	1.456	1.259	1.470	1.390	1.207	1.318	1.249	1.081
	38 × 140	2.662	2.560	2.323	2.546	2.448	2.220	2.287	2.196	1.953
	38 × 184	3.482	3.350	3.044	3.333	3.205	2.909	2.996	2.879	2.607
	38 × 235	4.361	4.238	3.874	4.222	4.077	3.704	3.814	3.666	3.322

Minimum design bearing length

If wane at end-bearing [see Figure 8 b)] is permitted to the strength class limit, i.e. one-third of thickness for strength class C24, the minimum design bearing length is 41 mm.

If wane is not permitted, the minimum design bearing length is 21 mm.

See 6.5.2.

A) See 6.5.1 when a partition is parallel to the joists.

B) Check the availability of section sizes.

6.6 Beams and trimmers: Notes to Table 11 to Table 16

NOTE 1 The overall sizes of the double (or single) beams or trimmers shown in Figure 12 will support load from the area shown hatched in plans A and B, including the following loads:

- a) load from the trimmed floor joists;
- b) a dead load not exceeding 0.5 kN/m^2 ;
- c) an imposed load not exceeding 1.5 kN/m^2 ;
- d) and, in the case of Table 15 and Table 16, loads from non load-bearing lightweight partitions weighing not more than 0.8 kN/m run at spacings as close as those likely to occur in practice.

Examples of some typical floor constructions and their respective dead loadings are given in Annex L.

NOTE 2 The section sizes given in the tables are either sawn across the timber thickness in accordance with tolerance class 1 of BS EN 336 and processed in accordance with tolerance class 2 across the timber width (joist depth), or are CLS/ALS processed sizes in accordance with tolerance class 2, to provide level surfaces for ease of ceiling lining and the fixing of structural decking. BS EN 336 tolerances are as follows:

- a) on a sawn thickness of not greater than 100 mm (tolerance class 1):
 - 1 mm;
 - + 3 mm;
- b) on a processed thickness or depth of not greater than 100 mm (tolerance class 2):
 - 1 mm;
 - + 1 mm;
- c) on a processed depth greater than 100 mm (tolerance class 2):
 - 1.5 mm;
 - + 1.5 mm.

6.6.1 Where the beams or trimmers in Table 15 and Table 16 consist of double-members; they should be fixed together with their tops flush. Unless justified by specialist calculation, the fixings should be by nailing as follows.

Overall width of double-member	Nail length and diameter	Nominal centres of nails
mm	mm	mm
76	75 × 3.8	150
94	90 × 4.2	150
126	125 × 5.5	200
150	150 × 6.0	200

NOTE 1 These values are relevant only where the span of floor joists, which are supported by a beam or trimmer, does not exceed 6 m.

NOTE 2 The centres quoted apply where two rows of nails in line are used. If staggered nailing is used, the values refer to the centres in one row.

6.6.2 Unless justified by specialist calculation, the minimum design bearing length at supports should be as stated at the base of each table.

NOTE It might be necessary to provide longer bearing to accommodate fixings or simply for practical reasons such as construction tolerances.

If a beam or trimmer is supported by a hanger, it is strongly recommended that a structural designer be consulted or that a proprietary design of hanger be used. If the end of a beam or trimmer is supported on masonry, the end bearing should be at least 90 mm to provide restraint to the masonry wall. Also, where the bearing is on masonry, the bearing area provided should conform to BS 8103-2.

6.6.3 Notching or drilling of a beam or trimmer should not be carried out unless justified by specialist calculation.

NOTE The design of the beams and trimmers has been based on BS 5268-2. This is compatible with the guidance to be included in the non-contradictory complimentary information (NCCI) to BS EN 1995-1-1. Spans of less than 1.8 m are not tabulated.

6.6.4 Particularly where floor joists occur only on one side of a beam or trimmer and are supported on steel hangers, it is recommended that consideration be given to preventing rotation of the beam or trimmer, e.g. by a fixing into the beam or trimmer near the bottom of the hangers.

NOTE 1 For guidance on fixing joists to beams or trimmers by a hanger see Figure 13.

Connections of joists to trimmers, or trimming joists or beams (see Figure 12) should be by:

- a) a proprietary joist hanger of adequate capacity; or
- b) a connection justified by specialist calculation; or
- c) a beam positioned beneath the floor joist.

NOTE 2 Typical joist hangers are shown in Figure 13.

If the floor joists are perpendicular to the trimming joist, the latter should be designed as a beam. (See Table 11 to Table 14.)

Figure 12 Plans relating to Table 11 to Table 16

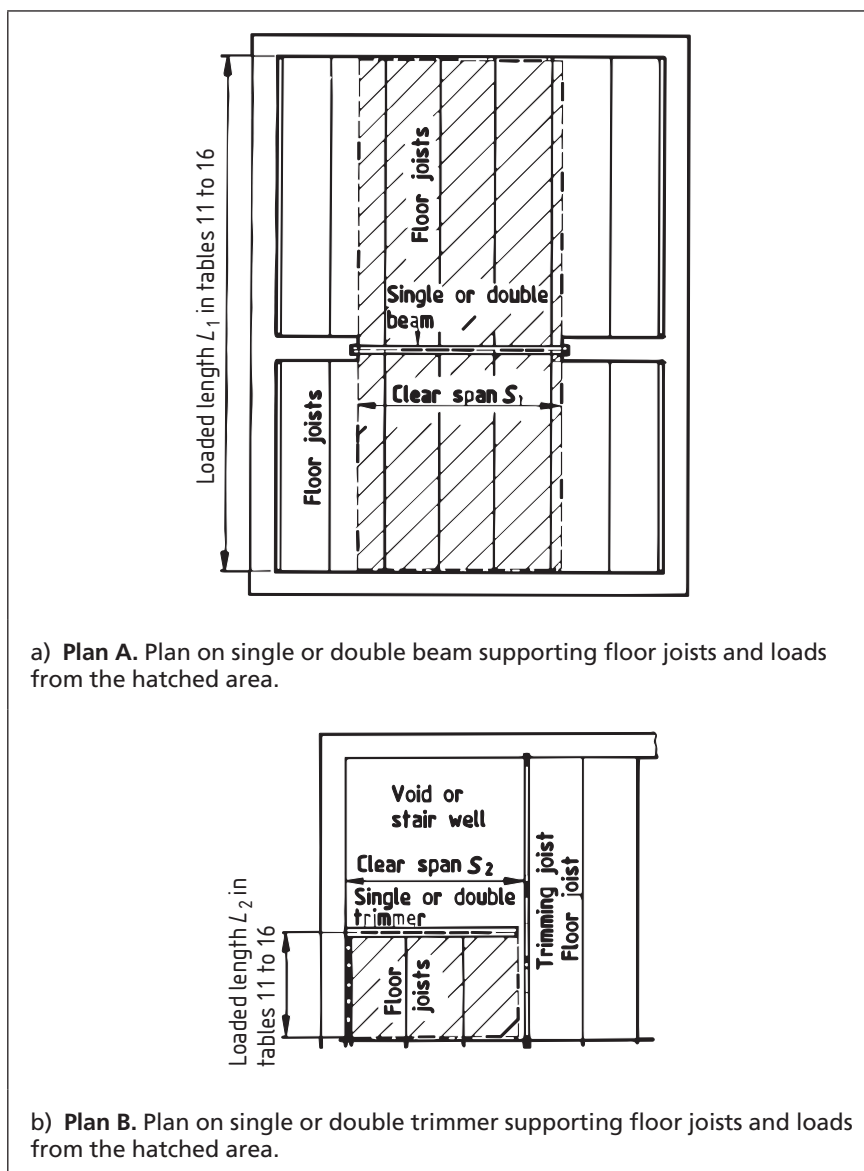


Figure 13 Typical steel hanger details

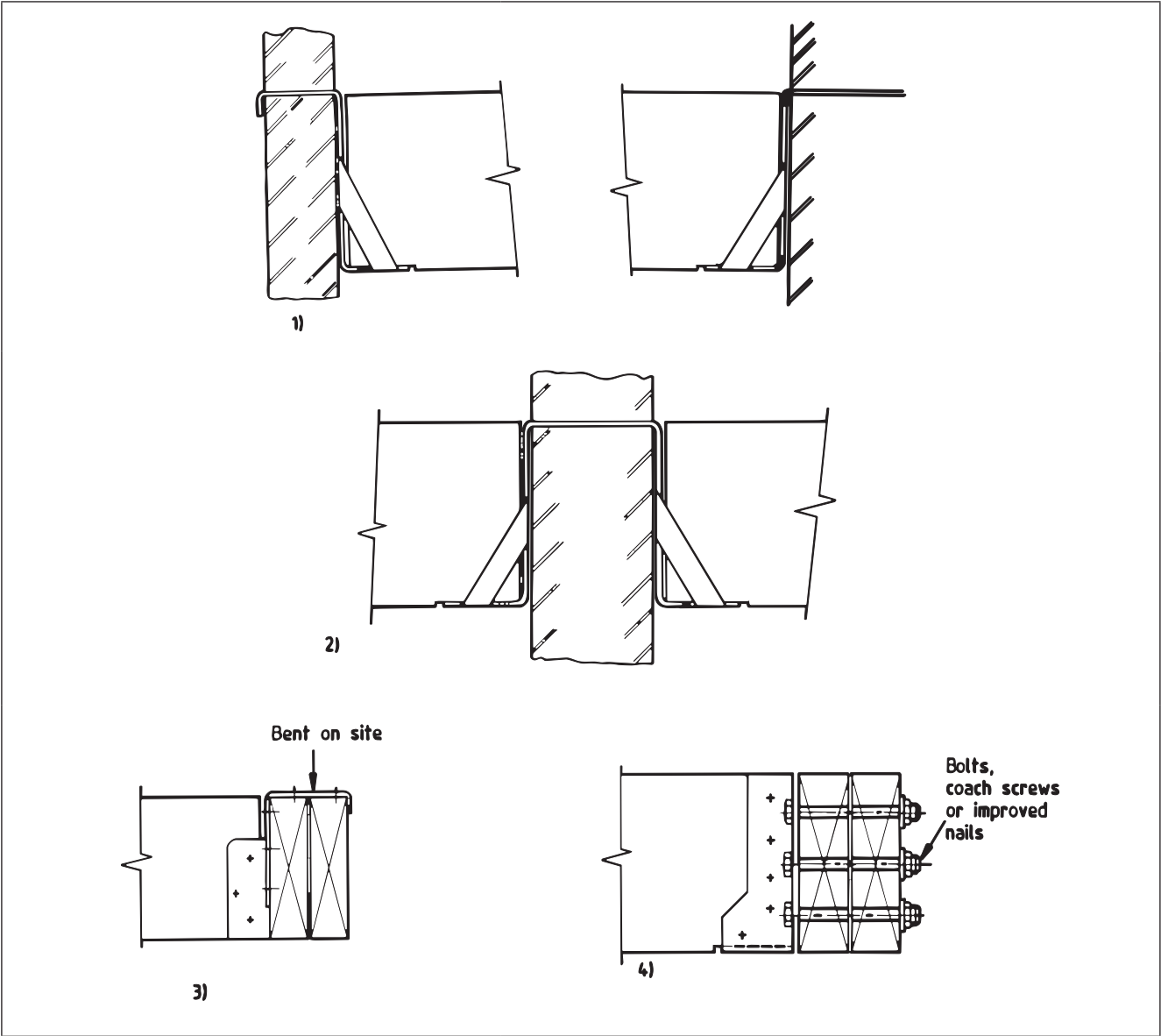


Table 11 Permissible clear spans of single-member beams or trimmers which support floor joists, and floors with no partitions. Timber of strength class C16

C16 Single-members		No partitions											
Size of beam or trimmer ^{A)} Single-member mm × mm		Loaded length, L_1 in plan A or L_2 in plan B in Figure 12 m											
		1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0
		Clear spans, S_1 in plan A or S_2 in plan B in Figure 12 m											
BS EN 336 sizes with sawn thickness to tolerance class 1 and processed depth to tolerance class 2	38 × 72	—	—	—	—	—	—	—	—	—	—	—	—
	38 × 97	—	—	—	—	—	—	—	—	—	—	—	—
	38 × 120	1.903	—	—	—	—	—	—	—	—	—	—	—
	38 × 145	2.289	—	—	—	—	—	—	—	—	—	—	—
	38 × 170	2.643	1.983	—	—	—	—	—	—	—	—	—	—
	38 × 195	3.027	2.255	1.833	—	—	—	—	—	—	—	—	—
	38 × 220	3.409	2.524	2.052	—	—	—	—	—	—	—	—	—
	47 × 72	—	—	—	—	—	—	—	—	—	—	—	—
	47 × 97	—	—	—	—	—	—	—	—	—	—	—	—
	47 × 120	2.048	—	—	—	—	—	—	—	—	—	—	—
	47 × 145	2.462	1.927	—	—	—	—	—	—	—	—	—	—
	47 × 170	2.842	2.208	—	—	—	—	—	—	—	—	—	—
	47 × 195	3.253	2.510	2.044	—	—	—	—	—	—	—	—	—
	47 × 220	3.662	2.809	2.289	1.974	—	—	—	—	—	—	—	—
	63 × 145	2.716	2.145	1.821	—	—	—	—	—	—	—	—	—
	63 × 170	3.133	2.477	2.087	1.803	—	—	—	—	—	—	—	—
	63 × 195	3.584	2.837	2.372	2.050	1.828	—	—	—	—	—	—	—
	63 × 220	4.033	3.197	2.655	2.295	2.047	1.862	—	—	—	—	—	—
	75 × 195	3.793	3.013	2.589	2.240	1.999	1.820	—	—	—	—	—	—
	75 × 220	4.265	3.394	2.897	2.507	2.239	2.038	1.881	—	—	—	—	—
CLS/ALS sizes	38 × 89	—	—	—	—	—	—	—	—	—	—	—	—
	38 × 140	2.181	—	—	—	—	—	—	—	—	—	—	—
	38 × 184	2.858	2.136	—	—	—	—	—	—	—	—	—	—
	38 × 235	3.638	2.685	2.183	1.879	—	—	—	—	—	—	—	—

Minimum design bearing length

If wane at end-bearing [see Figure 8 b)] is permitted to the strength class limit, i.e. one-third of thickness for strength class C16, the minimum design bearing length is 63 mm.

If wane is not permitted, the minimum design bearing length is 33 mm.

See also 6.6.2.

A) Check the availability of section sizes.