BRITISH STANDARD

BS 6446 : 1997

Specification for

Manufacture of glued structural components of timber and wood based panels

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ICS 79.060.01; 91.080.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee B/518, Structural timber, to Subcommittee B/518/3 Glued laminated timber, upon which the following bodies were represented:

British Adhesives and Sealants Association
British Woodworking Federation
Department of the Environment (Building Research Establishment)
Glued Laminated Timber Association
Institution of Civil Engineers
Nordic Timber Council (UK)
Timber Research and Development Association
Timber Trade Federation
Wood Panel Industries Federation

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Committee reference B/518/3
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Contents

Foreword

This British Standard has been prepared by Subcommittee B/518/3, Glued laminated timber. It supersedes BS 6446 : 1984, which is withdrawn.

This edition of BS 6446 has been revised to take account of the deletion of BS 1204 : Part 1, and its replacement by BS EN 301. This affects the scope, **6.3** and **7.1**. The climate conditions given in the previous edition have been replaced by the corresponding 'service classes' referred to in DD ENV 1995-1-1 and BS 5268 : Part 2 (see list of standards on the inside back cover). Other minor revisions have been made to accommodate the revision or deletion of the standards referred to in this 1997 edition of this standard. The contents of the standard have in parts been re-arranged to reflect more closely component manufacturing processes, and annex A has been re-written so that it is compatible with related European standards.

When the original edition of this standard was prepared, the only woodbased panels for which design stresses were available (from BS 5268 : Part 2) were plywood and tempered hardboard. Both BS 5268 : Part 2 and DD ENV 1995-1-1 now recognize design stresses for other types of woodbased panel, and this term has been substituted for 'plywood' and/or 'tempered hardboard'.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

Specification

Introduction

There is a long history of structural components being successfully assembled from pieces of timber and plywood glued together, particularly in the aircraft industry. The use in buildings of glued structural components (e.g. box beams, single web beams, stressed skin panels, gusseted trusses, etc.) made from timber, and wood based panels poses various problems with regard to the preparation of materials and the selection of adhesives because of the wide range of environmental conditions that can be encountered in service.

The gluing process is a sensitive operation. Changes in either environment of the production area or in the conditions of materials can have adverse effects upon the performance of the component in service. The work should be supervised by skilled and experienced personnel and throughout the manufacturing operations strict control of quality should be maintained. Routine testing of glue line strength together with records of production are essential aspects of the quality assurance required by this standard.

The handling, storage and protection of components after manufacture, including transportation to site, erection and any protection that may be required until the building is completed, are of equal importance to the manufacturing requirements given in this standard. Due regard should be given in this respect to the recommendations of BS 5268 : Part 2.

The requirements of this standard are the minimum to achieve sound glued joints and consequently an adequate performance in service.

1 Scope

This British Standard specifies the requirements for the manufacture of structural components which have been designed using either:

a) design or load testing data from BS 5268 : Part 2;

b) properties established from European Technical Approvals;

c) information derived from prototype testing according to BS 5268 : Part 2.

In such components (e.g. box beams, single web beams, stressed skin panels, gusseted trusses) made from separate pieces of timber, plywood or other wood based panels that are glued together, the continued integrity of the glue line is essential for satisfactory performance in service.

Requirements are specified for production facilities, materials, types of joint, production, production control, the use of preservative and flame retardant treated materials and storage.

Glued laminated timber structural members and finger joints in structural softwood are specified in accordance with BS EN 386 and BS EN 385 respectively.

NOTE. Components manufactured in accordance with this British Standard may not be suitable for use in service class 3 of DD ENV 1995-1-1 and BS 5268 : Part 2 where they are exposed directly to the weather, e.g. marine structures.

2 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

3 Definitions

For the purposes of this British Standard the definitions given in BS 6100 : Part 4 and BS 6138 apply together with the following:

3.1 adhesive spread

Amount of adhesive applied to the surfaces to be bonded. In a single spreading this amount is applied to one surface, in double spreading it is divided between the two surfaces to be joined.

3.2 closed assembly

A number of pieces spread with adhesive and assembled in a component prior to the application of pressure.

3.3 open assembly

A number of pieces spread with adhesive prior to closed assembly.

3.4 clenching

Method of securing the point side of a protruding nail by driving it sideways thereby forming a right angled bend.

3.5 cold-setting adhesive

Adhesive that can be applied and will set at a temperature of 23 °C or lower.

3.6 curing time

Curing time is that time interval between mixing the adhesive and the attainment of full bond strength.

NOTE. Full water resistance may not be attained for considerably longer. The glue lines of components should therefore be protected from wetting (e.g. due to weather or by water-based finishes and preservative treatment) for at least 7 days after assembly.

3.7 cramping pressure

Force applied to the contact faces of glued pieces divided by the area of the glued surface over which the force is deemed to act.

3.8 glue line (bond-line)

The adhesive layer in a bonded joint.

NOTE. The term 'glue line' is deprecated in BS 6138; the preferred term is 'bond-line'. 'glue line' has been used throughout this document, however, as it is the term most widely used and understood in the woodworking industry.

3.9 hardener

Curing agent for use with resins that yield rigid (hard) products.

NOTE. It may be supplied in either liquid or powder form, or may be incorporated in the adhesive by the manufacturer. It is an essential part of the adhesive, the properties of which depend on using the constituent parts of the adhesive as directed.

3.10 jigs

Formers that are used at the time of manufacture to give the member its finished shape.

3.11 pot life

Period during which the adhesive can be used after mixing the constituents.

NOTE. This varies with the volume and temperature of the mixed adhesives and the ambient temperature.

3.12 run off

Reduction of a finished cross-sectional dimension at the end of a piece of timber that occurs during a machining operation.

3.13 setting temperature

Temperature of the adhesive during the setting process.

3.14 setting time

Time interval between the commencement of the setting process, e.g. the application of heat and/or pressure to an assembled joint, and the attainment of sufficient bond strength to enable the components to be handled.

3.15 storage life (shelf life)

The time of storage under stated conditions during which an adhesive may be expected to retain its working properties.

3.16 synthetic resin adhesive

Adhesive substantially composed of a synthetic resin or resins, including any hardener or modifier that may have been added by the manufacturer or that may be required to be added before use according to the adhesive manufacturer's instructions.

4 Design parameters to be established prior to production

4.1 Service conditions

The manufacturer shall obtain details of the anticipated service conditions and moisture content prior to production.

4.2 Manufacturing specification

Those elements of the specification which can affect manufacture shall be established before commencing production. The following are examples of such elements:

a) the types of material (see clause **5**);

b) preservative and flame retardant treatments (see **4.3**);

c) the moisture content of the component in service;

d) the dimensions of individual pieces and the component;

e) the location of joints and splices;

f) the camber;

g) the surface finishes.

4.3 Preservative and flame retardant treatments

The manufacturer of the structural components shall obtain and follow advice from the manufacturer of the preservative or flame retardant and from the adhesive manufacturer on the compatibility of materials, both where treatment of individual pieces is to take place before gluing and where treatment of a component is to take place after gluing. This shall be done at the earliest possible opportunity.

5 Materials

5.1 Timber and wood based materials

The species or type and strength class of timber, and wood based panels shall be those specified in the design of the component and shall be selected either from those for which mechanical properties are given in BS 5268 : Part 2 or for which there is a European Technical Approval.

NOTE. Other materials may be used which have been established as suitable by prototype testing.

5.2 Mechanical fasteners

Unless otherwise specified by the designer the following mechanical fasteners shall be used to apply glue line pressure (see the note in **7.1.3**):

a) nails;

b) woodscrews;

c) staples.

5.3 Adhesives

Adhesives shall conform to either type I or type II of BS EN 301. The choice of type I or type II shall be determined by the service class intended for the finished component as given in table 1.

Table 1. Selection of adhesive for service classes

Service class[1)]	BS EN 301 Adhesive type
1	II
2	I
[1)] As defined in DD ENV 1995-1-1 and BS 5268 : Part 2.	
The types of components defined in this standard may not be suitable for use in service class 3.	

6 Joints

6.1 General

The type of materials shall be chosen from those specified in **5.1** and shall have the appropriate moisture content determined in accordance with **9.3.1**.

NOTE 1. The materials specified in **5.1** are the basis for the construction of a wide range of structural components.

NOTE 2. When there are differing changes of moisture content in the pieces forming a joint, distortion occurs and stresses are induced in the glue line. Limits are therefore placed on the maximum change of moisture content in a piece between the time of manufacture and when in service, as well as the maximum difference of moisture content between adjacent pieces at the time of manufacture. Unless the limits given are observed there could be failure of the joint.

6.2 Component thickness

The maximum material thickness should relate to its stiffness and to the method of cramping to ensure that correct pressure is transmitted to all parts of the glue line (see **7.1.3**).

6.3 Moisture content

At the time of manufacture the moisture content of timber shall be within 5 % moisture content of the anticipated equilibrium value (see **4.1**) of the timber in service. The maximum difference between the moisture contents of adjacent pieces of the timber at the time of manufacture shall be 4 % moisture content. The equilibrium moisture content of wood based panels is less than that of solid timber. This should be allowed for when calculating the differential moisture content at the time of bonding (see table 2).

Table 2. Moisture content enhancement factors for wood based **panels**

Material	Multiplication factor
Solid wood	1.00
Tempered hardboard	1.67
Particle board	1.42
Plywood	1.25

7 Preparation of timber and wood based panel products

7.1 Timber

7.1.1 *Moisture content*

The moisture content of the timber, at the time of machining the gluing surfaces, shall be in accordance with **6.1**.

7.1.2 *Gluing surface*

7.1.2.1 The gluing surfaces shall be machined not more than 24 h before assembly. The surfaces shall be cleanly and accurately cut with no compression or damage of the fibres, hit and miss planing, or run off at the ends. The depth of cutter marks shall not exceed 0.5 mm.

NOTE. For non-rectangular cross-sections, special care should be taken to ensure that the required profile is achieved on machining and is maintained during storage until assembly.

7.1.2.2 At the time of assembly the gluing surfaces shall be clean and free from oil, dust, excessive natural resin or any substance which may affect the adhesive bonding.

NOTE. The gluing of resinous softwood (e.g. pitch pine) and many hardwoods is difficult and advice should be sought from the adhesive manufacturer before production of the glued components commences.

7.1.3 *Warping*

Bow, spring, twist or cup of individual pieces which would result in a localized glue line thickness in excess of 1.3 mm shall be rejected.

NOTE. Limiting values of warping cannot be defined as they are dependent upon the stiffness of the materials being joined and the methods of applying glue line pressure. An indication of the maximum cup for pieces of timber of equal thickness being joined under a glue line pressure of 0.7 N/mm^2 is given in table 3. For glue line pressure provided by mechanical fasteners it is recommended that the maximum cup should not exceed 1.0 mm for thickness up to 17 mm and 0.5 mm for other thicknesses irrespective of width.

Table 3. Recommended limits of cupping when cramping pressure is used

Dimensions in millimetres

Finished thickness of each piece	Width of glue surface	
	Up to 150 mm	Over 150 mm
t	Maximum cup	Maximum cup
Under 17	1.5	1.5
17 to 30	1.0	1.5
31 to 50	0.5	1.0

7.2 wood based panels excluding tempered hardboard

7.2.1 *Moisture content*

The moisture content of the panels, at the time of assembly, shall be as specified in **6.3**.

7.2.2 *Gluing surface*

The gluing surface of panels shall be sound, and free from contamination (see **7.1.2.2**). Light sanding shall be permitted to remove contamination or to improve the gluing surface.

7.3 Tempered hardboard

7.3.1 *Moisture content*

The moisture content of tempered hardboard, at the time of preparing the gluing surfaces, shall be in accordance with **6.1**. If necessary, boards shall be conditioned with water by wetting the screen side and stacked, screen side to screen side, on a flat surface away from sunlight and heat for at least two days. The board faces shall then be exposed to air for 24 h before gluing.

7.3.2 *Gluing surface*

The gluing surface shall be free from contamination (see **7.1.2.2**). When the smooth face is the gluing surface it shall be lightly sanded prior to gluing to improve its bonding characteristics. When the screen side is the gluing surface, it shall be free of contamination and any contaminated sheets shall be rejected. The rough face shall not be sanded to remove contamination.

NOTE. Both the smooth and rough (screen) faces of tempered hardboard may be used as gluing surfaces.

8 Permissible deviations on assembled component dimensions

At the time of manufacture the deviations on assembled dimensions of a component shall not exceed the values given below:

Width	± 2 mm
Depth up to 400 mm	$^{+4}_{-2}$ mm
Depth over 400 mm	$^{+1}_{-0.5}$ mm per 100 mm
Max. deviation from right angle	-2 mm per 100 mm

9 Requirements for production facilities, manufacturing processes and production control

9.1 Production facilities

9.1.1 *General*

The production area shall be enclosed and shall be maintained at a minimum temperature of 15 °C. Covered storage space for materials and components and facilities for the production of test pieces shall be provided. The production area shall be kept clean.

9.1.2 *Handling of adhesives*

A separate area within the production space shall be provided for the storage, mixing and dispensing of adhesives. This area shall be equipped to:

a) measure the constituent parts of adhesives by mass or volume;

b) mix the adhesives;

c) clean containers, mixers and glue spreaders.

Means of spreading and controlling the spread of adhesives shall also be provided.

9.1.3 *Measuring equipment and means of assessment*

Equipment shall be provided to:

a) measure the moisture content of the materials being bonded;

b) measure the temperature of the materials being bonded;

c) measure and record the temperature of all the storage and production areas;

d) measure and record the humidity in the production area;

e) assess the pressure applied by presses, cramps, air bags or similar devices;

f) measure the temperature at the centre of a glue line furthest from the surfaces of the component, where setting of a glue line is accelerated at temperatures significantly above the temperature of the production area;

g) assess the spread of adhesive per unit area of joint.

9.2 Gluing processes

9.2.1 *Adhesives*

The following information shall be obtained from the adhesive manufacturer and the manufacturer's advice with regard to the optimum conditions shall be followed:

a) moisture content of the materials appropriate for the adhesive at the time of gluing;

b) storage conditions and shelf life;

c) mixing proportions of components;

d) pot life;

e) rate of spread;

f) open and closed assembly times;

g) glue line cramping pressure and setting temperature;

h) setting and curing times;

i) any other relevant information.

The assembly of a component shall be achieved within the time limit set by either the pot life or the open and the closed assembly times of the adhesive being used.

9.2.2 *Conditioning of components*

At the time of gluing, the components parts shall have a moisture content which is in accordance with **6.3** and **9.2.1** a) and at the temperature of the production space (see **9.1.1**), or as required by the adhesive manufacturer.

9.2.3 glue line *pressure*

9.2.3.1 *General*

The method used to achieve close contact between gluing surfaces shall produce an even pressure over the surface with a continuous 'squeeze out' or, 'bead' along the edge of each glue line and a maximum glue line thickness of 1.3 mm.

Either cramping or mechanical fasteners shall be used to produce and maintain close contact during manufacture and the setting time of the adhesive. However, where accelerated setting of the adhesive is achieved by significantly raising the glue line temperature, occasional mechanical fasteners may be used for location purposes, but they shall not be used to produce glue line pressure.

NOTE. Where the geometry or stiffness of the pieces of a joint is such that close contact can only be achieved by clamps, presses or similar devices, a glue line pressure of 0.7 N/mm^2 or more may be required.

Application of pressure by cramping or mechanical fasteners may start at any point but shall progress to an end or ends.

9.2.3.2 *Nails*

Where pressure is applied by nails, the sizes and maximum spacing shall be in accordance with table 4. Figure 1 gives examples of various applications.

To avoid undue splitting of the timber or wood based panel, the minimum spacings of nails given in BS 5268 : Part 2 shall be observed.

When there is a requirement to nail from both sides of a component, and the nails penetrate more than half the overall thickness of the component, the nails shall be staggered.

The minimum projection for clenching by hand nailing shall be 15 mm and the clenched end shall not lie along the surface grain. Clenching shall not disturb or re-open any glue lines in the joint.

NOTE. Clenching of nails should be avoided where possible.

Where nails are clenched the pointside penetration, p, given in table 4, shall include not more than 15 mm of the clenched length.

9.2.3.3 *Wood screws*

Where wood screws are used which have an equivalent withdrawal force to the nails given in table 4, when calculated in accordance with BS 5268 : Part 2, the spacings given in table 4 shall apply.

9.2.3.4 *Staples*

Where power driven staples are used to achieve glue line pressure the crown side thickness of timber, or wood based panels, shall not exceed 20 mm. The spacings and minimum penetration shall be in accordance with the requirements for either of the 2.65 mm diameter nails given in table 4. Staples shall not be clenched.

Staples shall be driven so that the crowns are approximately at right-angles to the surface grain and approximately 0.5 mm below the surface.

9.2.4 *Curing*

Throughout the setting time of the adhesive the assembled component shall be kept at the setting temperature (see **9.2.1**g)) without distortion and disturbance of the glue lines.

NOTE. Where components are moved from jigs to a storage area for curing, they should be supported so that there is no deformation under their own weight or from the weight of other components. The minimum setting temperature for cold setting adhesives should be maintained, as a fall in temperature will arrest the setting of the adhesive and this could lead to a weak adhesive bond, even if the setting temperature is subsequently restored.

Table 4. Sizes and maximum spacings of nails for nail pressure on glue line

Headside thickness *t* mm	**Nail diameter** mm	**Minimum pointside penetration** *p* mm	**Maximum spacing**[1] *s* mm	**Maximum edge distance** *e* mm	**Average glue line area per nail** mm^2
Under 10	2.65	30	75	30	7500
10 to 20	2.65	40	100	30	7500
Over 20	3.35	40	100	30	7500

[1] Where the headside thickness is 30 mm or over and the gluing surfaces are brought into close contact by cramping only whilst nail pressure is applied, the maximum spacing may be increased by 50 %.

9.2.5 *Conditioning*

After the setting time of the adhesive has elapsed the assembled component shall be further cured (see **9.2.1** h)) before any machining or finishing of the component takes place.

NOTE. Full water resistance is not attained for considerably longer. The glue lines of components should therefore be protected from wetting (e.g. due to weather or by water-based finishes) for at least 7 days after assembly.

9.2.6 glue line *shear strength*

glue line shear strength shall be established from test pieces taken in accordance with **9.3.2**. Three test specimens shall be cut from each test piece and their shear strength determined in accordance with annex A. The average shear strength of the three specimens shall not be less than three times either a) or b), whichever is lower, and no individual result shall be less than twice a) or b), whichever is lower:

a) the dry grade stress given in BS 5268 : Part 2 for the timber with due allowance for the angle of the test load to the grain.

b) the dry grade rolling shear stress for the type of wood based panel being used.

No adjustment shall be made to the minimum shear strength for variation of moisture content.

9.3 Production control and records

9.3.1 *Moisture content* (see **6.1**)

Determination of the moisture content of softwoods and hardwoods shall be in accordance with clause **6** of BS EN 336 : 1995 and clause **4** of BS 5450 : 1997 respectively. Moisture meters may not give representative results on some types of wood based panels. If there is any doubt, moisture content shall be determined in accordance with the oven drying method given in BS EN 322. Moisture meters shall be calibrated at intervals of not more than six months and a record maintained for each instrument.

9.3.2 glue line *shear strength* (see **9.2.6**)

Test pieces shall be prepared using the materials, adhesives, setting temperatures, cramping pressures etc. which are representative of the production process. The test pieces shall be made, conditioned and stored in the same manner as for normal production.

Initially, three test pieces shall be made for each of the above sets of conditions. For subsequent days, when the conditions are unchanged, a further test piece shall be prepared and tested per day of production.

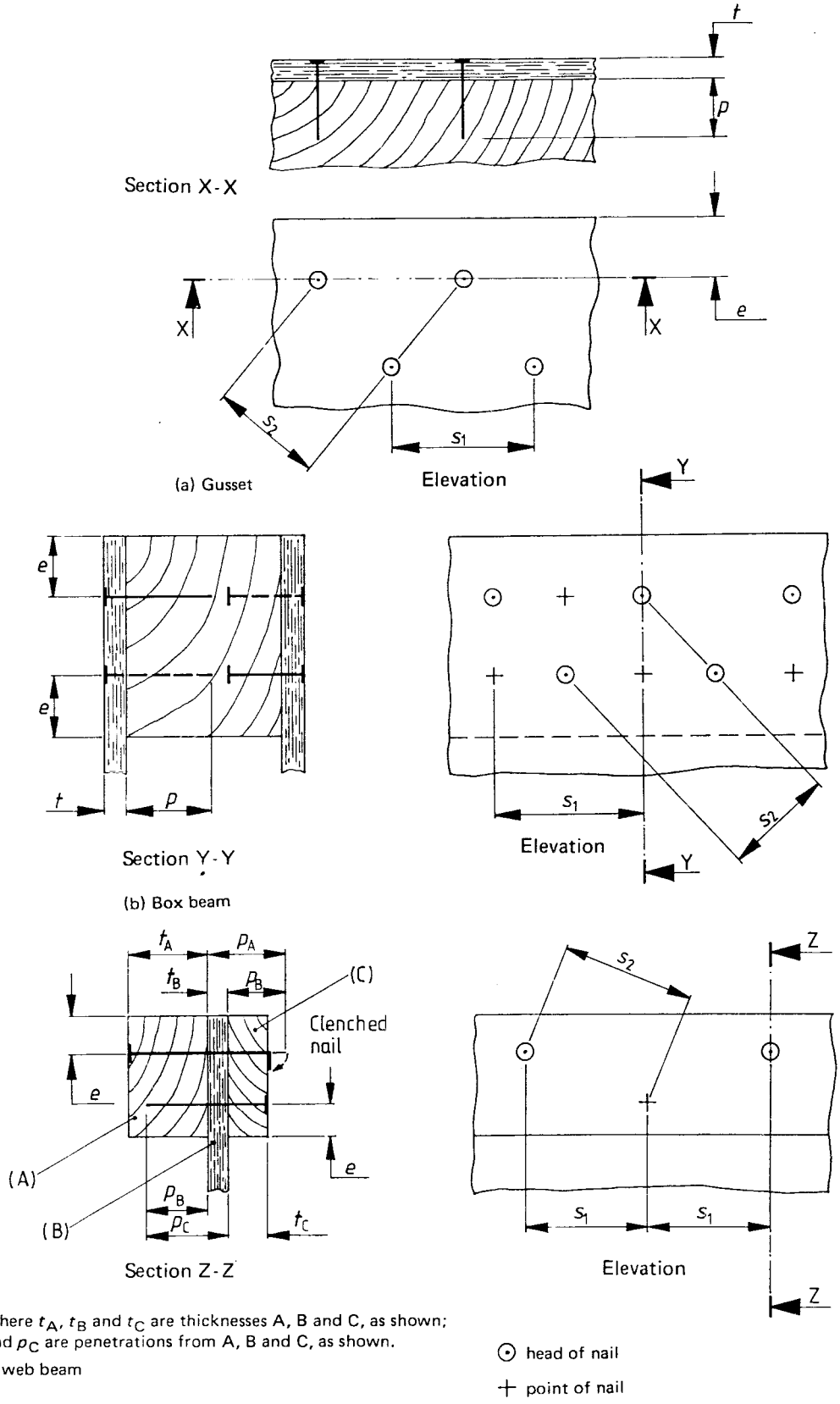
9.3.3 pot life *and assembly times*

Where the limits of pot life and open and closed assembly times will be approached in normal production procedures, e.g. due to high ambient temperatures, or to the size of the component being made, the adhesive shall be examined to ensure that it remains usable (see **9.2.1**).

NOTE 1. The most reliable way of ensuring that the adhesive is still usable is to measure its temperature in bulk and work well within the pot life given at this value. As a guide, the maximum life on a mechanical glue spreader is about 60 % of the pot life at any given temperature.

NOTE 2. The maximum closed assembly time is also about 60 % of the pot life but may be reduced by low adhesive spreads. Open assembly times are much less and can be assessed by touching the adhesive coated surface which should be tacky, and have an even squeeze out when pressure is applied.

NOTE 3. Accelerating the setting by heating a small sample from each batch of a cold setting adhesive will provide an indication as to whether the mixing of the adhesive was satisfactory.



NOTE 1. Alternative spacings s_1 and $s_2 \leq s$ (see table 4). NOTE 2. These figures are diagrammatic only (see **9.2.3**).

Figure 1. Examples of nail spacing (see table 4)

9.3.4 ***Production records***

9.3.4.1 The manufacturer shall maintain records of daily production to show:

a) the manufacturer, type and batch number(s) of the adhesive used;

b) the mass or volume of adhesive constituents used in each mix;

c) the identification mark(s) of components for which each particular mix of adhesive was used;

d) the range of moisture content of the materials used;

e) the temperature of the materials used;

f) the temperature and humidity in the production area;

g) the results of glue line shear tests.

9.3.4.2 The manufacturer shall maintain general records of production to show:

a) the methods employed for applying and maintaining glue line pressure and, if presses, clamps, etc. are used, the assessed glue line pressure and the duration of the applied pressure.

b) the method of achieving the required setting temperature of the adhesive (e.g. ambient temperature, radio frequency heating);

c) action taken in case of any non-compliance.

9.3.4.3 Records shall be retained by the manufacturer for a minimum of 10 years.

NOTE. If requested by the client, the manufacturer should supply a copy of the records.

10 Storage

The finished component shall be stored so that it is maintained in an environment not more severe than that for which it is designed. It shall be protected from the adverse effects of weather and not unduly stressed or deformed by the method of handling, stacking or storage.

11 Testing of components

When components are to be load tested, then this shall be in accordance with section **8** of BS 5268 : Part 2 : 1996.

12 Marking

Each component shall be marked with the following:

a) the name, or other means of identification of the manufacturer;

b) a reference which relates the component to the records of production;

c) the number of this standard.

The mark shall be positioned so that it is accessible in the final construction except where visual appearance requirements dictate otherwise.

Components shall be marked to show the orientation of the component in service where this is critical.

Annex A (normative)
Determination of glue line shear strength

A.1 Principle

The glue line of a test specimen is loaded in shear until failure occurs. The failing load, divided by the glue line area is expressed as the shear strength of the specimen in N/mm^2.

A.2 Apparatus

A.2.1 ***Sliding caliper***, or similar instrument capable of measuring the length and width of the glued area to the nearest 0.5 mm.

A.2.2 ***Shearing tool***, as shown in figure A.1.

A.2.3 ***Calibrated testing machine***, capable of applying a compressive force to the shearing tool (see **A.2.2**) and of measuring the maximum applied load to an accuracy of better than 3 %.

A.3 Test specimens

A.3.1 *Preparation*

Three test specimens shall be cut from each test piece prepared and conditioned as described in **9.3.2**. They shall be of the dimensions and type shown in figure A.2 and cut so that the glue line is stressed in a similar manner to the component in service, relative to the grain direction of the two faces either side of the glue line.

A.3.2 *Mechanical fasteners*

Test specimens shall be cut as far as possible from areas without mechanical fasteners; where this is not possible, mechanical fasteners shall be carefully withdrawn before the specimen is tested.

A.3.3 *Dimensions*

The thicknesses t_1 and t_2 and the width w (see figure A.2) shall be at least 20 mm and 50 mm respectively, unless the dimensions of the materials used are less (e.g. 10 mm thick plywood glued to 38 mm timber). Care should be taken to ensure that the surfaces to which the test load is applied are smooth, parallel to each other and at right angles to the plane of the glue line.

A.4 Procedure

Place the shearing tool between the table and the cross-head of the testing machine.

Measure the length and width of the glue line of the test specimens to the nearest 0.5 mm. Calculate and record the area A to the nearest square millimetre.

Insert the specimen in the shearing tool, taking care that the glue line is vertical and in the shearing plane. Apply a compressive force to the specimen at a rate of cross-head movement which produces failure in (60 ± 30) s. Record the failing load, F, of the specimen to the nearest 1 %.

A.5 Calculation and expression of results

The glue line shear strength is given by the equation:

$$\delta = \frac{F}{A}$$

where

δ is the glue line shear strength (in N/mm^2);

F is the failing load of the specimen (in N);

A is the area of the specimen (in mm^2).

NOTE. The results are not adjusted for specimen moisture content (see **9.2.6**).

A.6 Test report

The test report shall contain at least the following information:

a) the measured gluse line shear strength as the arithmetic mean of the shear strength of the three test specimens;

b) the value of the individual test results;

c) the materials, glue system, method of applying pressure, clamping and conditioning times used to prepare the test pieces;

d) the date of preparation and records linking the test piece to a particular batch of components.

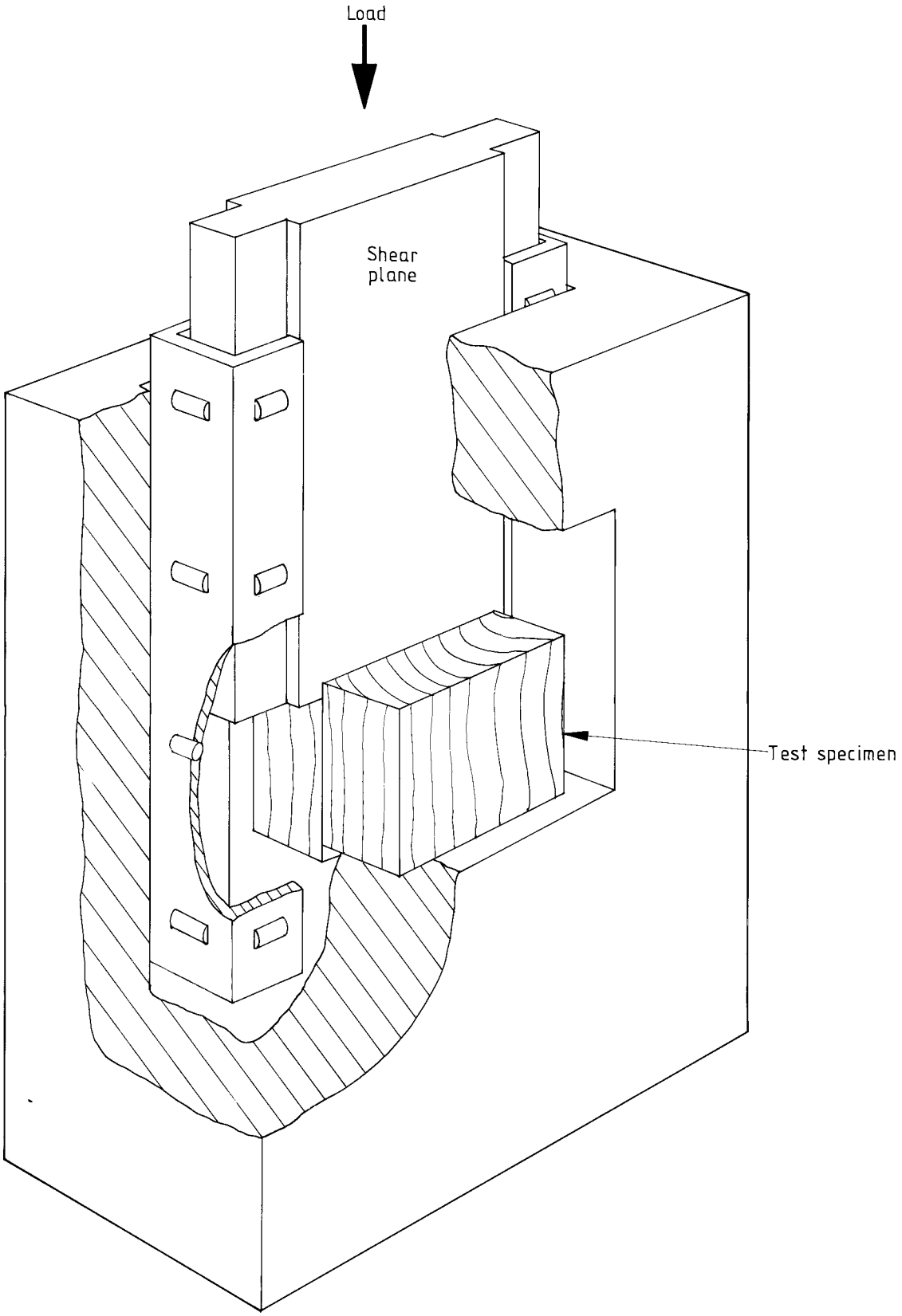
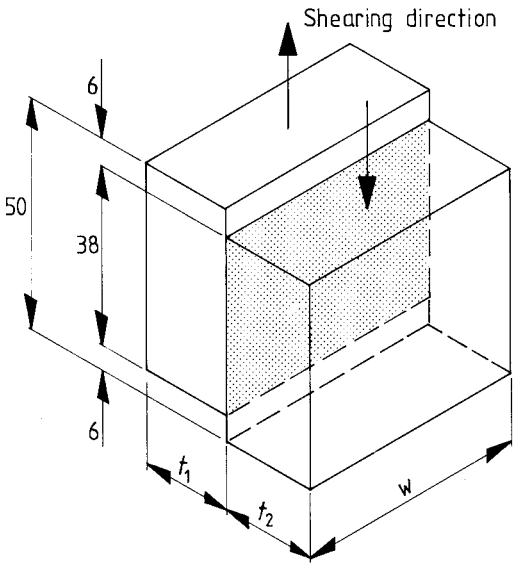


Figure A.1 Shearing tool



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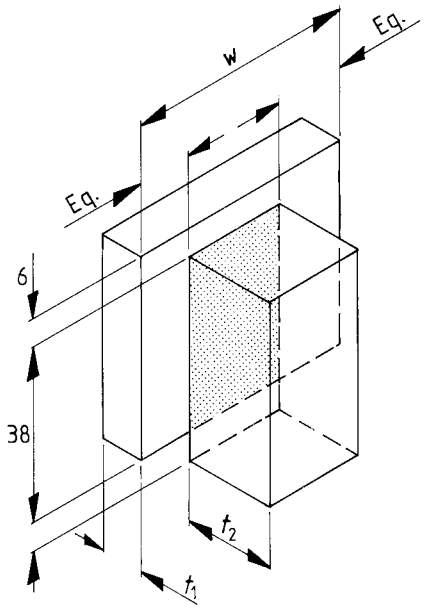
A Alternative



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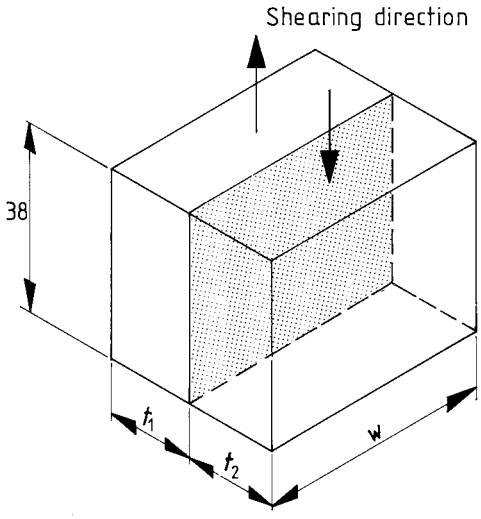
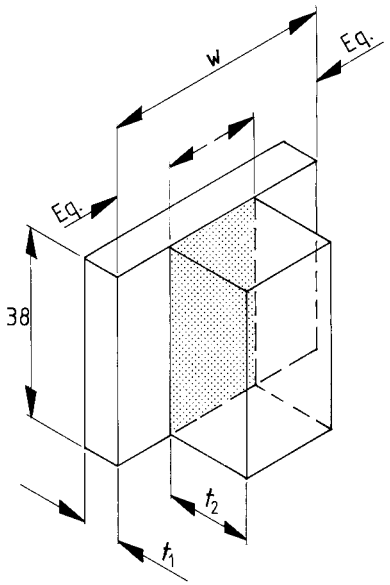


B1
B Alternative



B2

NOTE 1. A1 or B1 to be used for timber/timber specimens. A2 or B2 to be used when one member is less than 50 mm wide.
NOTE 2. t_1 and t_2 are the thicknesses >20 mm; w is the width >50 mm (see **A.2**).

All dimensions are in millimetres.

Figure A.2 Dimensions of test specimens

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List of references

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 5268	*Structural use of timber*
BS 5268 : Part 2 : 1996	*Code of practice for permissible stress design, materials and workmanship*
BS 5268 : Part 5: 1989	*Code of practice for the preservative treatment of structural timber*
BS 5450 : 1977	*Specification for sizes of hardwoods and methods of measurement*
BS 6100	*Glossary of building and civil engineering terms*
BS 6100 : Part 4	*Forest products*
BS 6138 : 1989	*Glossary of terms used in the adhesives industry*
BS EN 301 : 1992	*Adhesives, phenolic aminoplastic, for load-bearing timber structures: classification and performance requirements*
BS EN 322 : 1993	*Wood-based panels — Determination of moisture content*
BS EN 336 : 1995	*Structural timber — Coniferous and poplar — Sizes — Permissible deviations*
BS EN 385 : 1995	*Finger jointed structural timber — Performance requirements and minimum production requirements*
BS EN 386 : 1995	*Glued laminated timber — Performance requirements and minimum production requirements*
DD ENV 1995	*Eurocode 5: Design of timber structures*
DD ENV 1995-1-1 : 1994	*General rules and rules for buildings*

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