BRITISH STANDARD

Visual A1 strength A1 grading of hardwood – Specification

ICS 79.040

British Standards

Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 14, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard was published by BSI and came into effect on 31 May 2007. It was prepared by Technical Committee B/518, *Structural timber*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

BS 5756:1997+A1:2011 supersedes BS 5756:2007, which is withdrawn.

Information about this document

The start and finish of text introduced or altered by Amendment No 1 is indicated in the text by tags ▌A1⟩ ⟨A1▐. Minor editorial changes are not tagged.

This British Standard conforms to the requirements of BS EN 14081-1.

This British Standard specifies the means of assessing visually the quality of hardwood for which characteristic values as strength classes are given in BS EN 338. Assignments of species/grade combinations to those strength classes are given in BS EN 1912, which incorporates the grades defined in this standard for which design values are given in BS 5268-2 [1)] and BS EN 1995-1-1. Additional assignments for grades of UK oak and sweet chestnut are given in PD 6693 [2)].

To ensure that each piece has certain minimum strength properties, this British Standard specifies for tropical hardwoods a single visual strength grade (Structural Tropical Hardwood, HS). For temperate hardwoods, this British Standard specifies two visual strength grades (General Structural Temperate Hardwood, TH1 and TH2) for timber with a thickness less than 100 mm or cross-sectional area less than 20 000 mm^2, and two visual strength grades (Heavy Structural Temperate Hardwood, THA and THB) for timber with a thickness and cross-sectional area equal to or greater than these values.

A number of characteristics of hardwoods which might be considered defects from an appearance grading point of view, such as stain not associated with decay, and pin holes, can be accommodated in structural material with little or no loss in strength. Certain characteristics such as slope of grain, however, require careful limitation. Consequently, specific rules for structural grading are desirable for efficient use.

Annex A specifies the minimum requirements for the control of strength grading operations.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

▌A1⟩ 1) BS 5268-2 has been withdrawn and superseded by BS EN 1995-1-1 but is currently referred to in Building Regulations Approved Document A.

2) In preparation ⟨A1▐

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

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.

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1 Scope

This British Standard specifies a method of strength grading tropical and temperate hardwood visually for structural use.

For tropical hardwoods, the permissible limits of characteristics for a single visual strength grade of timber are specified, designated "Structural Tropical Hardwood" (HS) grade. For temperate hardwoods, the permissible limits of characteristics are specified for two visual strength grades for large size timber, designated "Heavy Structural Temperate Hardwood" (THA and THB), and two visual strength grades for smaller size timber, designated "General Structural Temperate Hardwood" (TH1 and TH2).

This British Standard applies to hardwoods, graded for use in the United Kingdom, for both within the United Kingdom and abroad.

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 5268-2, *Structural use of timber – Part 2: Code of practice for permissible stress design, materials and workmanship* [3)]

〉A1〈 *Text deleted* 〉A1〈

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

〉A1〈 *Text deleted* 〉A1〈

BS EN 1310:1997, *Round and sawn timber – Method of measurement of features*

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

〉A1〈 BS EN 1995-1-1, *Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings* 〉A1〈

BS EN 13183-2, *Moisture content of a piece of sawn timber – Part 2: Estimation by electrical resistance method*

BS EN 13556:2003, *Round and sawn timber – Nomenclature of timbers used in Europe*

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

BS EN 14081-4, *Timber structures – Strength graded structural timber with rectangular cross section – Part 4: Machine grading – Grading machine settings for machine controlled systems*

〉A1〈 [3)] BS 5268-2 has been withdrawn and superseded by BS EN 1995-1-1 but is currently referred to in Building Regulations Approved Document A 〉A1〈

3 Terms and definitions

For the purposes of this British Standard, the nomenclature in BS EN 13556 and the terms and definitions given in BS 5268-2, BS EN 336 and BS EN 14081-1 and the following apply.

3.1 fissure
longitudinal separation of the fibres, appearing on a face, edge or end of a piece of timber, and including checks, shakes and splits

3.2 parcel
quantity of sawn timber of the same target size, quality and description

3.3 pin knot
round or oval knot, sound, intergrown or partially intergrown, with a maximum size of 5 mm

3.4 sample
number of specimens of one cross-section size and from one parcel

3.5 strength class
classification of timber based on particular values of mechanical properties and density

3.6 thickness
lesser dimension perpendicular to the longitudinal axis of a piece of timber

3.7 width
greater dimension perpendicular to the longitudinal axis of a piece of timber

4 Strength graded timber

4.1 Supervision of strength grading operations

Visual strength grading operations shall be carried out by a grader and/or grading company, in accordance with Annex A and factory production control requirements as specified in BS EN 14081-1:2005, **6.3** and ZA2.1.

NOTE Hardwood, that is graded abroad under the supervision of an EU Notified Body and marked in accordance with this British Standard, need not be regraded in the United Kingdom, ⟨A1⟩ *unless* ***4.4*** *applies* ⟨A1⟩.

4.2 Sizes

Unless otherwise specified, timber graded to this standard shall conform to BS EN 336 with respect to permissible deviations and processing reductions applicable to constructional timber. It shall have a minimum cross-sectional area of 2 000 mm^2 and a minimum thickness of 20 mm.

NOTE For temperate hardwoods, additional requirements are given in ⟨A1⟩ ***5.2*** ⟨A1⟩.

[A1] 4.3 Processing of visually graded timber

Visually graded timber shall no longer conform to this standard if it is reduced in size through subsequent processing by more than:

a) 5 mm for dimensions ≤ 100 mm; or,

b) 10 mm for dimensions > 100 mm.

*NOTE Timber processed after grading is described based on the final reduced size (see **4.2**).* [A1]

4.4 Resawing or surfacing

Where graded timber is resawn or surfaced to an extent beyond the limits of **4.3**, the hardwood shall be regraded if it is to conform to this British Standard.

4.5 Cross-cutting

Where pieces are cross-cut each resulting piece shall conform to the requirements of this British Standard.

4.6 Moisture content

4.6.1 Determination

The moisture content shall be determined in accordance with BS EN 13183-2.

4.6.2 Dry graded timber

The fissures and distortion of a batch of timber being strength graded shall be assessed when the batch has an average moisture content of 20% or less, [A1] and no moisture content greater than 24%. [A1].

4.6.3 Wet graded timber

Because thick timber is difficult to dry, **4.6.2** shall not apply to timber that has a target thickness of 100 mm or more. Neither shall **4.6.2** apply to timber that is specified for use in contact with water or in climatic [A1] conditions leading to a moisture content greater than 20% (corresponding to service class 3, as defined in BS 5268-2 and EN 1995-1-1). [A1]

4.7 Acceptance limits for visually graded timber

A representative sample of a parcel of graded hardwood shall be deemed as conforming to a particular grade provided that not more than 10% of the pieces exceed the permissible limits of the grade and that not more than 3% of the pieces in the sample exceed the permissible limits by more than one third. Where the parcel contains less than 10 pieces, the permissible limits shall not be exceeded.

4.8 Abnormal defects

Any piece which contains abnormal defects such as brittleheart, compression failure, tension wood, damage, combinations of knots, insect damage, fungal decay and/or other characteristics, that might cause a decrease in strength properties to an amount which threatens its serviceability, shall be excluded from the grade.

Any piece which contains an abnormal defect or defects shall be accepted to the grade if the reduction in strength caused by the abnormal defect or defects is obviously less than that caused by the defects admitted by the grade, as long as these abnormal defects are of a type which does not progress after conversion.

A1 5 Grade requirements

5.1 Requirements for the structural tropical hardwood grade (HS)

A piece of tropical hardwood shall be assigned to the Structural Tropical Hardwood (HS) grade if its characteristics are in accordance with the limits given in Table 1 when measured or assessed in accordance with Clause **7**.

5.2 Requirements for the structural temperate hardwood grades (TH1, TH2 and THA, THB)

A piece of temperate hardwood shall be assigned to the Structural Temperate Hardwood grades if its characteristics are in accordance with the limits given in Tables 2 and 3 when measured or assessed in accordance with Clause **7**. A piece shall be assigned to the TH1 or TH2 grade unless its cross-sectional area is equal to or greater than 20 000 mm^2 and its thickness is equal to or greater than 100 mm, in which case it shall be assigned to the THA or THB grade.

5.3 Abnormal defects

Any piece shall be excluded from the grades if it contains defects that are not regulated in Tables 1, 2 or 3 to an extent that may cause a decrease in strength properties sufficient to threaten the serviceability of the piece.

The following shall be considered as defects:

a) brittleheart;

b) compression failure;

c) tension wood;

d) mechanical damage;

e) combinations of knots and/or other characteristics;

f) insect damage (e.g. worm holes, pin holes); and

g) damage from fungi that only survive in the standing tree.

NOTE *This list is not exhaustive.*

Any piece of unusually low density for the species, taking due account of the moisture content, shall be excluded from the grade. A1

6 〈A1〉 *Text deleted* 〈A1〉

7 Measurement of characteristics

7.1 Knots

7.1.1 General

The limiting dimension of any type of knot shall be taken as the distance between lines containing and touching the knot and parallel to the arris (see Figure 1a), except that where a knot can be seen on both edge and face, the appropriate method shall be used (see **7.1.2** and **7.1.3**).

7.1.2 Knots from within the cross-section

If the knot emerges from within the cross-section onto an arris, and neither of the exposed sections of the knot is definitely elongated, the knot shall be measured on both edge and face by taking the distance between the arris and lines touching the knot and parallel with the arris. The greater of the two measurements shall be the limiting dimension and this shall be related to the thickness of the piece (see Figure 1b).

7.1.3 Knots on the edge and face

A knot showing on both edge and face but cut so that one of its exposed sections is definitely elongated shall be measured only on the surface upon which the elongated portion does not appear, using one of the methods described in **7.1.2**. The limiting dimension shall be related to the thickness or width upon which the knot measurement is taken (see Figures 1c and 1d).

Tightly grouped pin knots shall be treated as a single knot with the same outer dimensions as those described by the grouped pin knots.

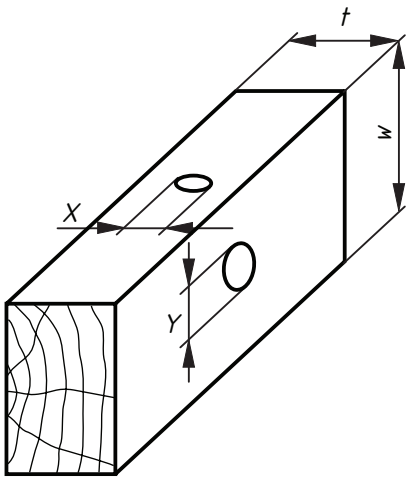
NOTE Single pin knots may be ignored.

7.2 Slope of grain

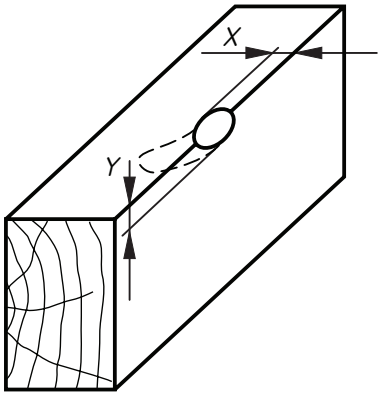
Slope of grain shall be assessed as the inclination of the wood fibres (grain) to the longitudinal axis of the piece. The slope shall be expressed as the number of units of length over which unit deviation occurs. It shall be measured over a distance sufficiently great to determine the general slope, disregarding local deviations. The slope of grain shall be measured in accordance with BS EN 1310:1997, **4.4.1**.

NOTE Interlocked grain is a normal feature of certain tropical hardwoods and care should be taken to avoid confusing it with sloping grain. However, in doubtful cases, where, in the grader's judgement, interlocked grain occurs to an undesirable extent in relation to the cross-sectional dimension of the piece, bearing in mind the normal slope of grain limitation, the piece should be rejected. In addition, Table 1 requires the piece to be rejected (see Annex A) when the slope of the interlocked grain exceeds 1 in 4.

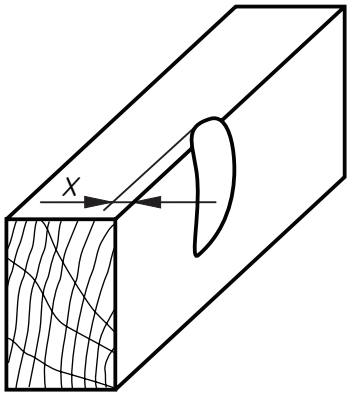
Figure 1 **Knots**



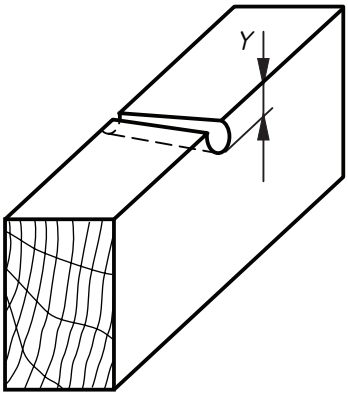
a) *X* is measured and related to the thickness. *Y* is measured and related to the width.



b) *X* and *Y* are measured. The greater of the two is related to the thickness.



c) *X* is measured and related to the thickness.



d) *Y* is measured and related to the width.

7.3 Wane

Conformity to the limits of wane given in Tables 1, 2 and 3 shall be determined using the formulae given in items a) and b).

a) The ratio of full face dimension relative to the target width is given by the formulae:

$$\frac{h - V_1}{h} \text{ or } \frac{h - V_2 - V_3}{h}$$

b) The ratio of full edge dimension relative to the target thickness is given by the formulae:

$$\frac{b - K_1}{b} \text{ or } \frac{b - K_2 - K_3}{b}$$

where h, b, V_1 to V_3 and K_1 to K_3 are as given in Figure 3.

7.4 Fissures

A1 *NOTE 1 The depth of a fissure may be taken as the maximum depth to which a 0.2 mm feeler gauge conforming to BS 957 can be inserted without using excessive force.* A1

Measurement of fissures shall be taken at the time of grading. Fissures shall be measured in accordance with BS EN 1310:1997, **4.9.1** a).

NOTE 2 The length of a fissure is influenced by moisture content.

NOTE 3 Precise limits to cover all conditions and applications cannot therefore be given and guidance only is provided as to what might be considered acceptable limits at 20% moisture content.

7.5 Brittleheart

NOTE Brittleheart at the ends of a piece can be detected by a pitted appearance. Detection of brittleheart on a face is more difficult, but in general appears as compression creases. It is often associated with abnormally low density.

If the presence of brittleheart is suspected, the piece shall be rejected even if the defect is not evident at the ends.

7.6 Distortion

NOTE 1 The methods of assessing distortion are shown in Figure 2.

Bow, spring and twist shall be assessed over a 2 m length. Longitudinal curvature in square section pieces shall be assessed using the limits for bow. Measurement shall be taken at the time of grading. Bow and spring shall be measured in accordance with BS EN 1310:1997, **4.10.1**. Twist shall be measured in accordance with BS EN 1310:1997, **4.10.3**.

NOTE 2 The amount of distortion is influenced by moisture content. Precise limits to cover all conditions and applications cannot therefore be given and guidance only is provided as to what might be considered acceptable limits at 20% moisture content.

Table 1 **Permissible limits for Structural Tropical Hardwood (HS) visual strength grades (see Clause 5)**

Characteristic	Value
Dimensions	Cross-section minimum 2 000 mm^2. Thickness minimum 20 mm.
Knots:	
Size	Not greater than ¼ of the thickness or width to which it relates.
Longitudinal separation	Knots accumulative if longitudinal separation is either less than twice the width or 300mm (whichever is the lesser), or when grain has not fully recovered.
Slope of grain	Not greater than 1 in 11. Interlocked grain not to be steeper than 1 in 4.
Fissures:	
not through the thickness	Not greater than 1 m or ¼ the length of the piece, whichever is the lesser
through the thickness	Only permitted at the ends with a length not greater than the width of the piece.
Wane	Full edge and face dimensions not to be reduced to less than ⅔ of the dimensions of the piece. Length of wane is unlimited.
Distortion:	
Bow	Not greater than 10 mm over a length of 2 m.
Spring	Not greater than 8 mm over a length of 2 m.
Twist	Not greater than 1 mm per 25 mm width over a length of 2 m.
Cup	Unlimited.
Bark pockets	
intersecting the end	Not greater than the width of the piece.
not intersecting the end	Not greater than 1½ times the width, or not greater than ⅙ of the length of the piece, whichever is the lesser.
Boxed heart	Not permitted if the thickness of the piece is 100 mm or less, or if the width is 225 mm or less.
Biological damage and other defects	Worm holes and pin holes are permitted provided they conform to the requirements in **5.3**. No active infestation is permitted. No decay is permitted other than in unsound knots. Stain free from decay permitted (see **5.3**).
Other defects	See **5.3**.

NOTE The length of fissures and the amount of distortion are linked with moisture content, therefore the limits given can only be applicable at the time of grading.

Table 2 **Permissible limits for General Structural Temperate Hardwood (TH1 and TH2) visual strength grades (see Clause A1 5.2 A1)**

Characteristic	Grade	
	TH1	**TH2**
Dimensions	See Clause **7**.	
Knots	Not greater than ¼ of the thickness or width to which it relates.	Not greater than ¾ of the thickness or width to which it relates.
Longitudinal separation of knots	Knots accumulative if longitudinal separation is less than twice the width or when the grain has not fully recovered.	
Slope of grain	Not greater than 1 in 10; within 500 mm of ends, not greater than 1 in 5.	Not greater than 1 in 4.
Fissures:		
not through the thickness	Not greater than 1 m or ¼ the length of the piece, whichever is the lesser.	
through the thickness	Only permitted at the ends with a length not greater than the width of the piece.	
Wane	Full edge and face dimensions not to be reduced to less than ⅔ of the dimensions of the piece. Length of wane is unlimited.	
Distortion:		
Bow	Not greater than 10 mm over a length of 2 m.	
Spring	Not greater than 8 mm over a length of 2 m.	
Twist	Not greater than 1 mm per 25 mm width over a length of 2 m.	
Cup	Unlimited.	
Bark pockets	A1 Within 500 mm of the ends, not greater than the width of the piece. Elsewhere not greater than 1½ times the width or **⅕** of the length of the piece whichever is the lesser. A1	
Biological and other defects	Worm holes and pin holes are permitted provided they conform to the requirements of **4.8**. No active infestation is permitted. No decay is permitted other than unsound knots. Stain free from decay is permitted.	

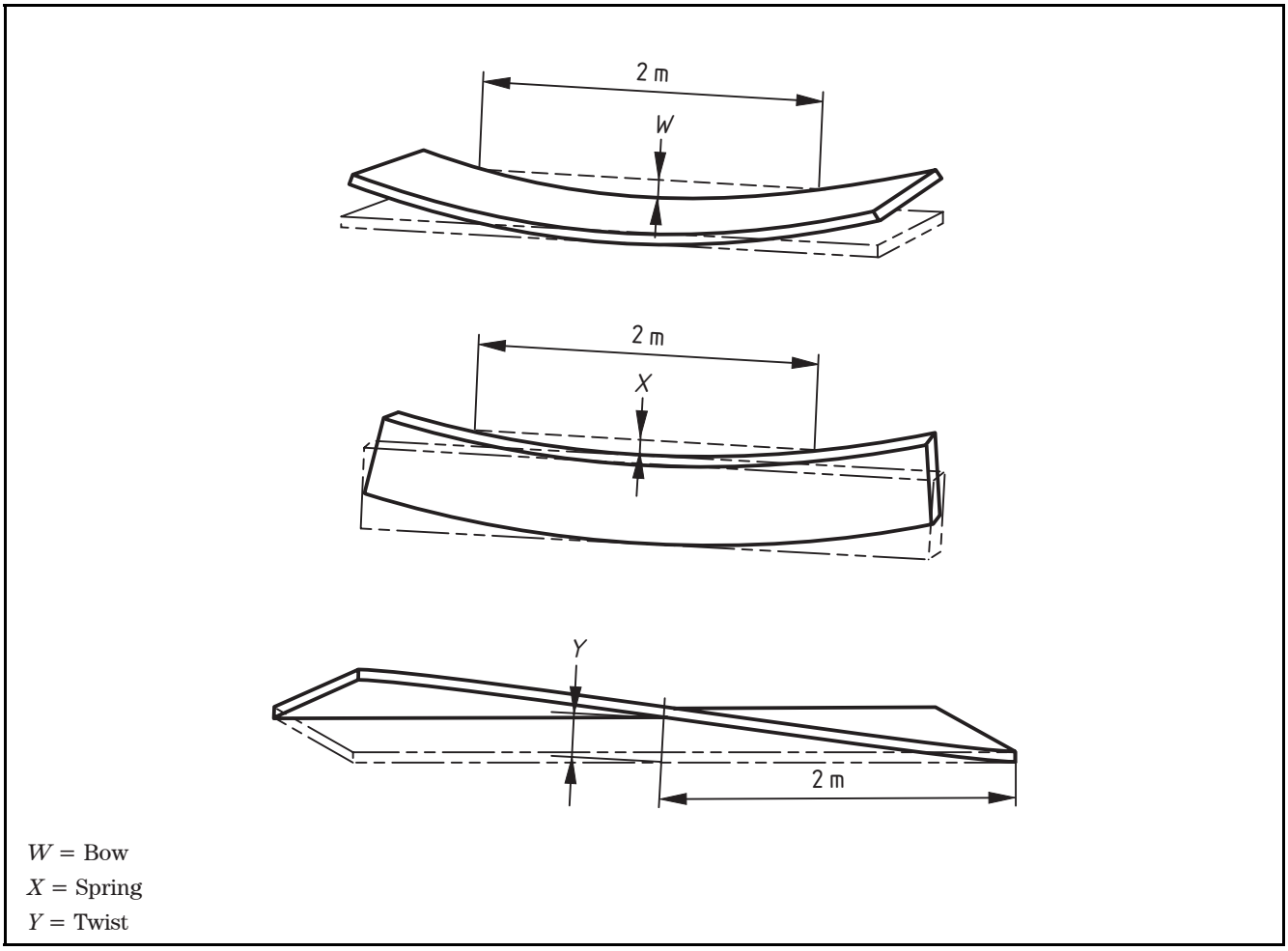
NOTE The length of fissures and the amount of distortion are linked with moisture content, therefore the limits given can only be applicable at the time of grading.

Table 3 **Permissible limits for Heavy Structural Temperate Hardwood (THA and THB) visual strength grades (see Clause 5.2)**

Characteristic	Grade	
	THA	**THB**
Dimensions	See **5.2**	
Knots	Not greater than **⅕** of the thickness or width to which it relates.	Not greater than ¾ of the thickness or width to which it relates.
Longitudinal separation of knots	Knots accumulative if longitudinal separation is less than either twice the width or 300 mm (whichever is the lesser), or when the grain has not fully recovered.	
Slope of grain	Not greater than 1 in 12; within 500 mm of ends, not greater than 1 in 6.	Not greater than 1 in 4.
Fissures:		
not through the thickness	Not greater than 1 m or ¼ the length of the piece, whichever is the lesser.	
through the thickness	Only permitted at the ends with a length not greater than the width of the piece.	
Wane	Full edge and face dimensions not to be reduced to less than **⅔** of the dimensions of the piece. Length of wane is unlimited.	
Distortion:		
Bow	Not greater than 10 mm over a length of 2 m.	
Spring	Not greater than 8 mm over a length of 2 m.	
Twist	Not greater than 1 mm per 25 mm width over a length of 2 m.	
Cup	Unlimited.	
Bark pockets	Within 500 mm of the ends, not greater than the width of the piece. Elsewhere not greater than 1½ times the width or **⅕** times the length of the piece whichever is the lesser.	
Biological and other defects	Worm holes and pin holes are permitted provided they conform to the requirements of **5.3**. No active infestation is permitted. No decay is permitted other than unsound knots. Stain free from decay is permitted.	

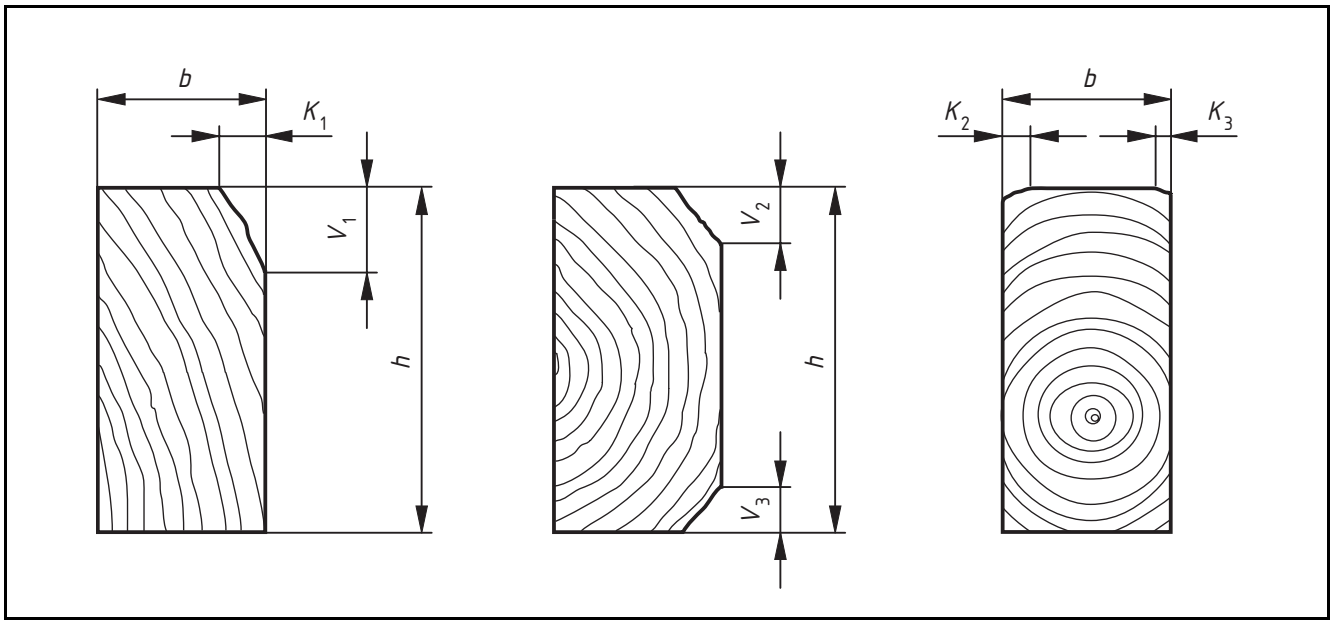
NOTE The length of fissures and the amount of distortion are linked with moisture content, therefore the limits given can only be applicable at the time of grading.

Figure 2 **Measurement of bow, spring and twist**



W = Bow
X = Spring
Y = Twist

Figure 3 **Wane**



8 Marking[1)]

8.1 General

Each piece of graded timber shall be clearly and indelibly marked to provide the information given in **8.2**. The information given in **8.3** shall also be marked on each piece of timber or given in accompanying documentation. If the end use of the timber requires marking to be omitted for aesthetic reasons, each batch of timber shall be accompanied by a commercial document bearing all the information given in **8.2** and **8.3**.

If timber is to be CE marked then additional marks are required according to Annex A and BS EN 14081-1:2005, Annex ZA.

8.2 Information to be marked on the product

The following information shall be marked on the product (except if omitted for aesthetic reasons):

- Name or identifying mark of grader and/or producer.
- The strength class as assigned in BS EN 1912, or, if not included in BS EN 1912**,** the strength grade and the number of this grading standard.
- The words “DRY GRADED” if appropriate (see **4.6.2**).
- The certification body.
- Either, the information required in **8.3** or a reference number that identifies the documentation containing the information required in **8.3**.

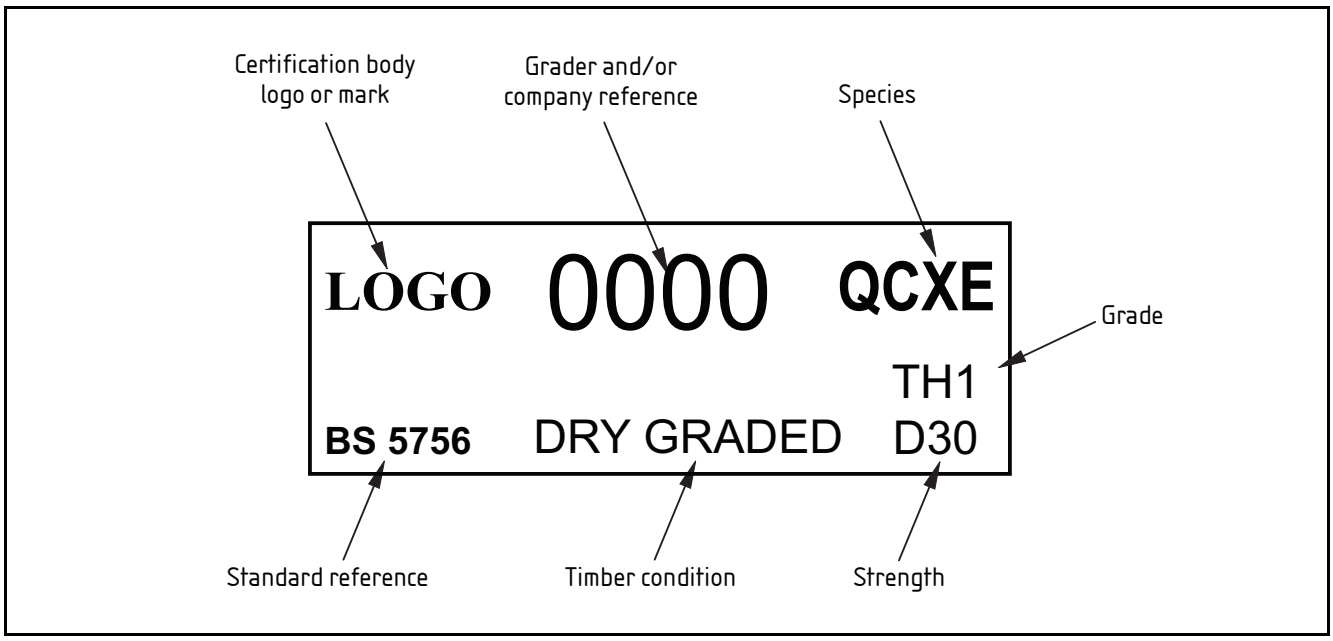
8.3 Information to be marked on the product or in accompanying documentation

The following information shall be marked on the product or in accompanying documentation:

- The species code in accordance with BS EN 13556:2003, Table 1.
- If marked with strength class (see **8.1**), the grade and grading standard.

1) Marking BS 5756:2007 on or in relation to a product represents a manufacturer’s declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant’s responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Figure 4 **Example of a mark on visually strength graded hardwood**



Annex A (normative)

The control and supervision of visual strength grading operations

The control and supervision of visual strength grading shall be carried out as follows:

a) All grading shall be in accordance with the National Annex to BS EN 14081-1;

b) The company carrying out the grading shall nominate a representative responsible for the operation of the graders and review the grading records on a weekly basis.

c) The company carrying out the grading shall be responsible for seeing that steps are taken to ensure that rejected timber is not regraded and is stored separately from timber conforming to this British Standard.

d) Graded timber shall be protected in storage and transport to the extent necessary to minimize downgrading of the timber.

e) Where a company is strength grading for a specific order, the following records shall be kept for each parcel of graded timber:

   1) the job or order number;

   2) the customer's name, if known, or identifying reference;

   3) the timber species and its source

   NOTE For source it is sufficient to record the shipper's or supplier's end mark where this exists.

   4) timber size and surface finish (planed or sawn);

   5) the number of pieces in each grade and the number of rejects;

   6) the date of grading;

   7) the grader's name or identification number;

   8) the average moisture content;

   9) the highest moisture content reading.

NOTE Where the company is strength grading for stock or in a continuous process, the requirements to keep records as in 1), 2) and 5) can be modified in consultation with the certification body.

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