

Australian Standard[®]

**Timber—Hardwood—Visually stress-
graded for structural purposes**



This Australian Standard® was prepared by Committee TM-003, Timber Grading. It was approved on behalf of the Council of Standards Australia on 4 January 2007. This Standard was published on 7 December 2007.

The following are represented on Committee TM-003:

- A3P
 - Australian Timber Importers Federation
 - BRANZ
 - CSIRO Manufacturing, and Infrastructure Technology
 - Forest and Forest Products Employment Skills Company
 - Forest and Wood Products Research and Development Corporation
 - Forests New South Wales
 - Master Builders Australia
 - New Zealand Timber Industry Federation
 - New Zealand Timber Suppliers Group
 - Scion
 - Tasmanian Timber Promotion Board
 - Timber Queensland
 - University of Technology, Sydney
-

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Australian Standard[®]

Timber—Hardwood—Visually stress-graded for structural purposes

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PREFACE

This Standard was prepared by the Standards Australia/Standards New Zealand Committee TM-003, Timber Grading, to supersede AS 2082—2000. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide timber manufacturers, suppliers and users with requirements for visual stress grading of sawn hardwood, which is intended for structural purposes.

The objective of this revision is to align this Standard with other structural timber product Standards and incorporate recent research outcomes.

AS 2082 was first prepared in 1977 as an amalgamation of AS O81—1966, AS O135—1972, AS 1483—1973 and parts of AS O82—1965, AS O83—1963 and AS O84—1967. It drew together these grading rules which had been written for different timber groups such as Western Australian timbers (AS 1483, originally AS O7—1937). AS O82, AS O83 and AS O84 were revisions of grading rules for Eastern Australian timbers originating as interim numbers 360, 361 and 362 published in 1952 and number 366 first published in 1963.

In 1998, the AS 3818 series was prepared to cover a broad group of visually graded heavy structural products. After the publication of AS 3818.6—2003 for decking for wharves and bridges and AS 3818.7—2006 for large cross-section sawn hardwood engineering timbers, these products are no longer covered by AS 2082.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Timber—Hardwood—Visually stress-graded for structural purposes

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for visually stress-graded sawn hardwood intended for structural purposes, at the time of grading.

NOTES:

- 1 The coverage of hardwood species or species mixtures listed in this Standard does not imply their availability, or the availability of any particular grade of any species or species mixture.
- 2 This Standard may be used as a basis for certification of conformity under a product certification program.

1.2 APPLICATION

The specification of timber graded to this Standard shall consist of the requirements of this Section together with the relevant grade description given in Section 2 or Section 3, where appropriate.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|--------|--|
| 1604 | Specification for preservative treatment |
| 1604.1 | Part 1: Sawn and round timber |
| 1684 | Residential timber-framed construction (all parts) |
| 1720 | Timber structures |
| 1720.1 | Part 1: Design methods |

AS/NZS

- | | |
|--------|--|
| 1080 | Timber—Methods of test |
| 1080.1 | Method 1: Moisture content |
| 1080.2 | Method 2: Slope of grain |
| 1148 | Timber—Nomenclature—Australian, New Zealand and imported species |
| 2878 | Timbers—Classification into strength groups |
| 4063 | Timber—Stress-graded—In-grade strength and stiffness evaluation |
| 4491 | Timber—Glossary of terms in timber-related Standards |

1.4 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 4491 and those below apply. Where the definitions below differ from those in AS/NZS 4491, for the purpose of this Standard those below apply.

1.4.1 Check

Separation of the fibres radially across growth rings and along the grain forming a fissure, but not extending through the piece from surface to surface.

1.4.2 Check, internal

A check confined to the interior of a piece.

1.4.3 Exceptionally low density material

Pieces that are abnormally low in density for the particular species, i.e., below 75 percent of the average density at 12 percent moisture content as listed in Appendix A or 300 kg/m³, whichever is the greater.

1.4.4 Heart

The growth centre (pith) of the tree and/or timber adjacent to the growth centre of the tree that exhibits fungal attack, brittle heart and compression failure.

1.4.5 Hit and miss

A series of dressed surfaces with skipped areas between.

1.4.6 Included bark

Strands of bark tissue occurring in concentric arcs.

1.4.7 Knot cluster

Two or more knots grouped together as a unit where the grain of the timber is deflected around the entire unit (not to be confused with a knot group).

1.4.8 Knot group

Two or more knots grouped together as a unit but the grain of the timber passes between them (not to be confused with a knot cluster).

1.4.9 Mixed species

A parcel of timber that contains more than one species (not to be confused with a species mixture which has a designated list of species).

1.4.10 Parcel

A quantity of timber assembled for inspection or for delivery against an order.

1.4.11 Primary rot

Decay originally present in the living tree.

1.4.12 Shake

A partial or complete dislocation, breakage or longitudinal separation of wood fibres due to causes other than drying, and usually originating either in the standing tree or in the log during felling or conversion, which includes the following:

- (a) *Cross shake* A fracture not in the direction of the fibres and resembling a breakage of the fibre.
- (b) *Heart shake* A shake extending from the pith of a tree (not to be confused with a check).
- (c) *Radial shake* A shake originating on the circumference of a log and extending inwards along the radius (not to be confused with a check).
- (d) *Ring or water shake* A shake following a growth ring. It is also referred to as a shell shake or cup shake and the timber may be described as shelly.
- (e) *Star shake* A number of adjoining heart shakes in the form of a star.

1.4.13 Sized

Timber machined by fine sawing or dressing to a more consistent dimension than 'sawn' timber (also referred to as gauged).

1.4.14 Species mixture

A parcel of timber that contains timber of one or more species from a designated group of species. One particular parcel may consist of only one of the species in the group.

1.4.15 Stress-grading, visual

Inspection of each piece of timber or wood product in its final size and assignation of a structural grade according to a set of limits on visual characteristics. The type and extent of visual characteristics are used as indicators of material properties and the limits are based on their effect on strength, appearance or utility.

1.4.16 Surface

The outside of a piece of sawn timber, but not including an end (see Figure 1).

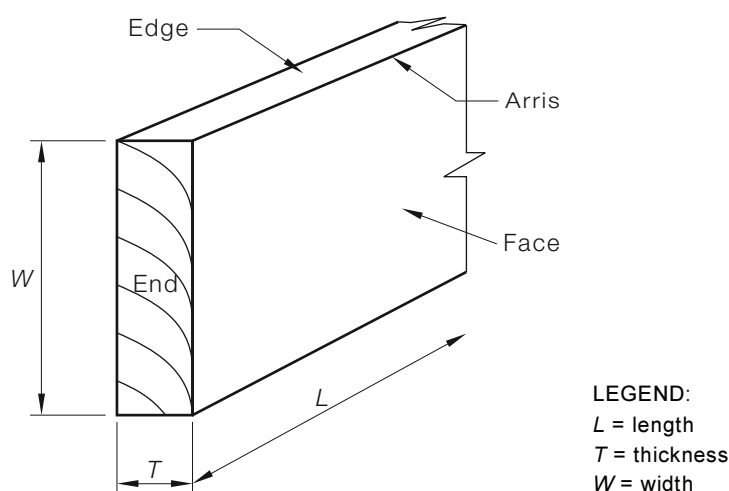


FIGURE 1 ILLUSTRATION OF TERMS—SURFACES AND ARRIS

1.4.17 Termite gallery

An irregularly shaped passage or burrow excavated by termites in the bark or wood. An enclosed termite gallery is one that is not completely open to visual inspection throughout its entire length.

NOTE: An enclosed termite gallery may extend well beyond the visible portion of the gallery.

1.5 TIMBER SPECIES AND STRESS GRADES

1.5.1 Species and species mixtures other than A17 grade

The standard trade names of species covered by this Standard shall be interpreted in accordance with AS/NZS 1148 (see Notes 1, 2 and 3).

No timber species with an average density at 12 percent moisture content below 360 kg/m^3 shall be accepted, nor shall any piece with a density at 12 percent moisture content below 300 kg/m^3 (see Note 8).

This Standard may be used for the grading of a species other than those listed in Appendix A, provided the appropriate strength group for the species has been determined in accordance with AS 2878, or the appropriate stress grade has been determined by in-grade testing in accordance with AS/NZS 4063 (see Note 9). For material of exceptionally low density, strength groups shall be established in accordance with AS 2878, without assuming the strength group given for the species.

NOTES:

- 1 A list of species and species mixtures, together with properties such as density and Lyctid susceptibility, is given by standard trade name in Appendix A.
- 2 The stress grades applicable to the structural grades for a range of seasoned and unseasoned hardwood species and species mixtures are listed in Appendix A (see Notes 6 and 7).
- 3 The stress grades applicable to the structural grades for mixed species, where the mixture is not specifically listed in Tables A2 and A4 of Appendix A, should be based on the species in the mix that has the lowest stress grades when assessed in accordance with Tables A1 and A3 of Appendix A or, if not listed in Appendix A, Tables B1 and B2 of Appendix B.
- 4 If it is necessary to grade a species not listed in Appendix A, then, provided the strength group can be established by the application of AS 2878, Tables B1 and B2 of Appendix B may be used to establish the stress grade.
- 5 The stress grade values in Tables A1 to A4 of Appendix A should take precedence over the stress grade values determined through the application of Tables B1 and B2 of Appendix B.
- 6 The stress grades given in this Standard do not preclude the specific mechanical properties of a species being used for design purposes (see AS 1720.1).
- 7 Information on the relationship between strength groups, structural grades and stress grades is given in Appendix B.
- 8 The lower density species need extra care in regard to assessing nail and connector holding capacity.
- 9 Information on the identity and properties of species is available from timber associations, State forestry departments and the Division of Building Research, CSIRO.

1.5.2 A17 grade

A17 grade shall be as given in Section 3.

NOTE: Strength properties and verification requirements are defined in AS 1720.1.

1.6 STRUCTURAL GRADES OF HARDWOOD

The structural grades of hardwood shall be as follows:

- (a) Structural Grade No. 1.
- (b) Structural Grade No. 2.
- (c) Structural Grade No. 3.
- (d) Structural Grade No. 4.
- (e) Structural Appearance Grades.

NOTES:

- 1 A piece of timber is graded to a structural grade to determine its stress grade. The assumed relationships between the visual structural grade classifications, the stress grades (F ratings) and the strength groups are given in Appendix B. The assumed relationships in Appendix B do not apply to A17 grade as A17 grade is a stress grade (similar to an F rating). See Clause 1.5.2.
- 2 Structural appearance grades are derived from the visual structural grades by tightening the allowances for those factors affecting appearance (see Clause 2.5).
- 3 The summary of the grade descriptions given in Appendix D is for information only as it is not exhaustive and does not take the place of the requirements given in this Standard. Reference should be made to the appropriate clauses of this Standard for a complete description of the grades.

1.7 SIZES AND TOLERANCES

1.7.1 Dimensions

Deviation of the actual dimensions of the timber from the specified dimensions by more than the following are not permitted:

- (a) The length shall be not less than the specified length.
- (b) For width and thickness, except where permitted want, wane or hit and miss occurs, measured at any point in the length of a piece—
 - (i) *for unseasoned timber*— ± 3 mm;
 - (ii) *for seasoned timber*— $+5$, -0 mm;
 - (iii) *for sized timber*—as for Items (i) and (ii) with an additional requirement of a maximum 2 mm difference between all pieces within a parcel for the sized dimension of the timber; and
 - (iv) *for dressed timber*— $+2$, -0 mm of the specified finished size.

NOTES:

- 1 When timber is supplied as dressed, the nominal size may be reduced due to the process of dressing to a 'finished dimension' or 'finished size'. Design calculations should be based on the 'finished dimension'.
- 2 For the effect of shrinkage on tolerances when carrying out a grading check, see Clause 1.10.5.

1.7.2 Squareness

The tolerance on squareness shall be ± 2 degrees, i.e., the angle at the arrises shall be 90 ± 2 degrees.

1.7.3 Special straightness requirements

For certain applications such as studs, lintels and wall plates, an agreement may be reached between buyer and seller to adjust the limits of bow, spring or twist to suit the end use.

NOTE: The limits of bow, spring and twist in this Standard are based on utility considerations, which are more conservative than structural considerations.

1.8 MOISTURE CONTENT OF SEASONED TIMBER

1.8.1 Testing

The moisture content of the timber shall be determined in accordance with AS/NZS 1080.1.

1.8.2 Seasoned timber

Where seasoned timber is specified (see Note 1), at least 90 percent of the pieces being graded shall have a moisture content of not more than 15 percent and no piece shall have a moisture content greater than 18 percent.

NOTES:

- 1 Attention is drawn to the consumer protection provisions of the *Queensland Timber Utilization and Marketing Act* and the *New South Wales Timber Marketing Act* regarding the special considerations applying to seasoned timber in those States. The requirements of these Acts may be more stringent than those in this Standard.
- 2 Where the maximum moisture content of 15 percent is unsuitable for a particular location or purpose, the required moisture content is a matter for agreement between the purchaser and the supplier.
- 3 AS 1720.1 provides a modification factor for seasoned timber which may increase in moisture content from its seasoned state due to variations in equilibrium moisture content in use.

- 4 Attention is drawn to the need to consider any circumstances that may require seasoning to a particular moisture content, e.g., in areas of high or low equilibrium moisture content. Information on the equilibrium moisture content applicable to species under particular use conditions may be available from State timber associations, State forestry departments and the CSIRO.

1.9 CHARACTERISTICS

1.9.1 Measurement of characteristics

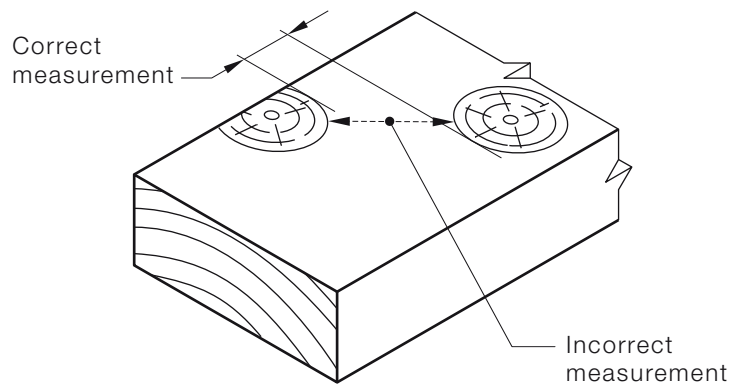
The measurement of characteristics shall be as given in Appendix C.

1.9.2 Combination of characteristics

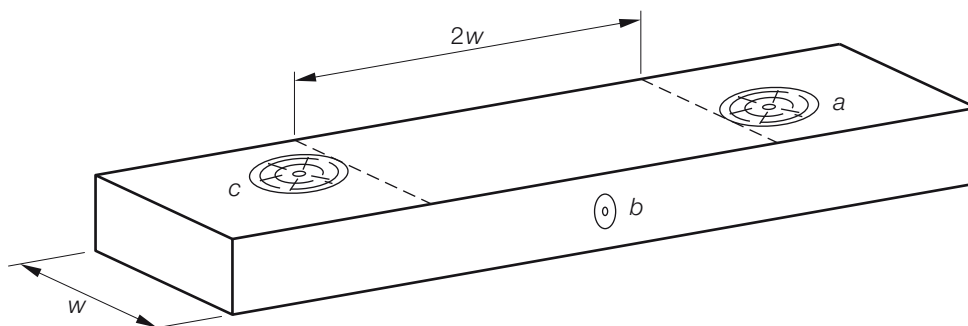
A combination of characteristics shall be permitted if the aggregate size of the combination is less than that of one characteristic of the maximum permissible size.

A combination exists when two or more characteristics occur in a length of the piece such that there is less than twice the width of the piece between them (see Figure 2). Characteristics in combination may not necessarily appear on the same surface.

The distance between characteristics shall be measured parallel to the length of the piece, between lines drawn at 90 degrees to the arrises (see Figure 2).



(a) Method of measurement of distance between characteristics



NOTES:

- 1 Given that *a* is 90 percent of its allowance, *b* is 15 percent of its allowance, and *c* is 85 percent of its allowance, the combination of *b* and *c* complies with the rules for combinations but the combination of *a* and *b* does not comply with the rules for combinations.
- 2 *c* and *b* are in combination; *a* and *b* are in combination; *a* and *c* are not in combination.

(b) Examples of combinations

FIGURE 2 COMBINATIONS OF CHARACTERISTICS

If bow, spring, twist or cup are present in the piece, each shall be measured separately and shall be deemed not to be in combination with each other or with any other characteristic.

Example 1:

Considering the case of a hole and a knot in combination, if the hole is only 50 percent of the maximum permitted size for a hole then the knot may be up to 50 percent of its maximum permitted size for a knot.

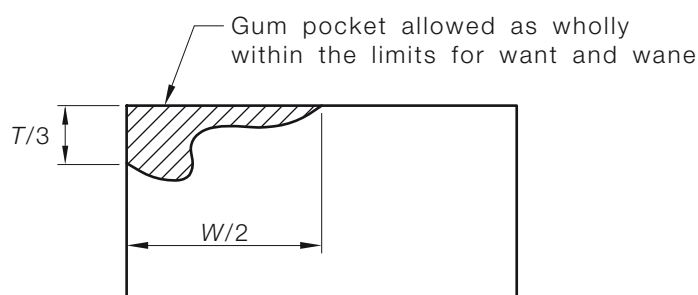
Example 2:

Considering the case of overgrowth of injury and a knot in combination, if the overgrowth of injury is only 70 percent of the maximum permitted allowance then the knot may be up to 30 percent of the maximum permitted size for a knot.

1.9.3 Characteristics occurring entirely within the prescribed limits for want and wane

Irrespective of the limits imposed by the grade descriptions, a characteristic or combination of characteristics, occurring wholly within the limits prescribed for want and wane and resulting in no greater reduction in effective dimension, shall be permitted (see Figure 3).

NOTE: This does not apply to enclosed termite galleries as they may extend well beyond the visible portion of the gallery.



Example showing 100 mm x 50 mm piece within Structural Grade 2

FIGURE 3 CHARACTERISTICS OCCURRING WITHIN LIMITS FOR WANT AND WANE

1.9.4 Mechanical damage

Damage caused by hooks, ropes, forklifts and the like shall be permitted, provided that its effect is no more serious than that of a permissible characteristic.

1.10 GRADE LIMITATION AND GRADING

1.10.1 Basis

Grading to the structural grades in this Standard is based on assessing the characteristic or group of characteristics within a piece that is considered to have the greatest limiting effect on the grade of that piece, when assessed in accordance with the grading rules. Each piece shall be inspected on all surfaces and the ends.

NOTE: In some instances the grade limits are expressed in terms of fractions to simplify the process of visual grading.

1.10.2 Limitations

The grade descriptions in Sections 2 and 3 limit all characteristics known to have a significant effect on strength and describe material on the lower limit of that grade. Each parcel shall contain a range of material such that not all of the material is near the lower limits of the grade.

1.10.3 Variations in assessment

Within any parcel a maximum variation of 5 percent between the gradings of pieces by individual inspectors or graders shall be acceptable, provided none of the pieces in the disputed 5 percent fall more than one grade below the designated grade. If grading to the lowest grade, no piece in the disputed 5 percent shall have characteristics that exceed the maximum allowed in the grade by more than 10 percent.

1.10.4 Re-sawing

If the cross-section of the piece of timber is reduced by longitudinal sawing or dressing, the original grading is nullified.

1.10.5 Grading check

A check of the grading of the timber may be required some time after the grading undertaken by the producer or supplier.

Where the purpose of the check is to estimate the accuracy of the previous grading, reasonable allowance shall be made for changes in characteristics of the timber, which result because of moisture change. These changes in characteristics may include but are not limited to—

- (a) reduction in dimensions (shrinkage);
- (b) increase in distortion (bow, spring, twist and cup);
- (c) increase in, or development of, seasoning checks, splits, end splits and shakes; and
- (d) increase in, or development of, loose gum veins.

NOTES:

- 1 Changes in the characteristics of timber due to moisture change can be minimized from the time that the timber is milled by correct downstream protection, handling, transport and storage until it is placed in service. Procedures may include end grain sealing, wrapping, maintaining block packs and level storage and sealing the timber with pale coloured sealers (paints, etc.) immediately upon removal from packs and placing in service.
- 2 Where timber is loosely packed or packs are broken and exposed to the weather, it is likely the timber will be adversely affected by moisture change.
- 3 Changes may arise due to moisture change. For example, the formation of large checks affecting the structural adequacy of the piece or excessive twist affecting the utility of the piece. Such changes in a piece may be cause for rejecting the piece with respect to its final application.

1.10.6 Moisture content of preservative-treated timber

Where timber is seasoned and subsequently preservative treated, the preservative treatment process may increase the moisture content of timber considerably and, therefore, affect the structural properties. Unless such timber is redried to the moisture content range for seasoned timber it does not conform to the requirements of this Standard for seasoned timber.

1.10.7 Docking of multiple lengths

When grading a piece of timber that is to be supplied as a multiple of a shorter ordered length it shall be graded as if it was in the shorter lengths.

1.11 SAPWOOD SUSCEPTIBLE TO LYCTID BORERS

The method for detection of lyctid-susceptible sapwood shall be as given in AS 1604.1.

NOTES:

- 1 Refer to Appendix A for the susceptibility of the sapwood of some hardwoods to attack by Lyctid borers.
- 2 Guidelines for the immunization of susceptible sapwood are given in AS 1604.1 and further information is available from State forestry departments and the Division of Building Research, CSIRO.
- 3 Attention is drawn to the consumer protection provisions of the *Queensland Timber Utilization and Marketing Act* and the *New South Wales Timber Marketing Act* regarding the sale and use in those States of timber containing Lyctid-susceptible sapwood and which may limit the sale and use of Lyctid-susceptible sapwood. The requirements of these Acts may be more stringent than those of this Standard.

1.12 PRESERVATIVE TREATMENT

When structural timber graded in accordance with this Standard is preservative treated, treatment shall be in accordance with AS 1604.1.

NOTES:

- 1 The purchaser should ensure that the appropriate hazard is specified for the intended end use.
- 2 The *New South Wales Timber Marketing Act* and the *Queensland Timber Utilisation and Marketing Act*, require prior approval of a preservative treatment and registration of a brand before timber offered for sale in either of those States can be described as preservative treated. Detailed information about the requirements of such legislation may be obtained from the State forestry departments concerned.

1.13 IDENTIFICATION OF GRADE

If the timber is branded, labelled, stamped or marked to indicate that it complies with this Standard, the information shall be legible and shall include the following:

- (a) The number of this Australian Standard, i.e., AS 2082.
- (b) Identification of the source of grading (optional).
- (c) If graded as seasoned, the word 'SEASONED' or the abbreviation 'S' (see Clause 1.8).
- (d) Stress grade of the timber.
- (e) If preservative treated, additional branding in accordance with AS 1604.1.

Timber marked with a species mixture name shall not include species other than those listed in the appropriate groups in Tables A1 to A4, Appendix A.

NOTES:

- 1 Legislation in some States of Australia requires one or more of Items (a) to (e) to be marked on each piece of timber.
- 2 Legislation in some States of Australia requires that if timber is marked with any or all of Items (a) to (e), the timber has to comply with the relevant requirements of this Standard.
- 3 Manufacturers making a statement of compliance with this Australian Standard on product, packaging or promotional material related to that product are advised to ensure that such compliance with the grading rules described in this Standard, is capable of being verified.
- 4 The marking of a stress grade on visually graded timber, as provided for in this Standard, gives a link to the stress grade structural properties specified in AS 1720.1. All stress grade marks are making a claim that the marked timber belongs to a graded population of timber with the structural properties that comply with the designated stress grade. Such compliance may need to be verified (see Appendix A).

SECTION 2 GRADE DESCRIPTIONS

2.1 STRUCTURAL GRADE NO. 1

2.1.1 General

Each piece of timber of Structural Grade No. 1 shall conform to the requirements of Section 1 and shall be free from compression failures and other fractures and splits other than end splits.

No piece shall be of exceptionally low density.

NOTE: See Appendix A for average species density.

2.1.2 Permissible characteristics

Where present in graded pieces, singly or in combinations, the following characteristics shall be within the limits prescribed (see also Clauses 1.9.3 and 1.9.4):

- (a) *Knots (tight or loose, sound or unsound, intergrown or not, round, oval or arris, single or in clusters) including occluded branch stubs, knot holes and holes other than those caused by insects—not exceeding one seventh of the width of the surface on which they occur.*
- (b) *Borer holes not associated with decay—*
 - (i) *diameter up to and including 3 mm—not exceeding 12 in any 100 mm × 100 mm or equivalent area of the surface on which they occur; and*
 - (ii) *diameter over 3 mm or where the distance between holes is less than twice their diameter—as for knots (see Item (a) above).*
- (c) *Termite galleries—*
 - (i) *where they are enclosed—not permitted; and*
 - (ii) *where not enclosed (fully open to inspection)—as for want and wane (see Item (n) below).*
- (d) *Slope of grain—*
 - (i) *for all species except jarrah—not exceeding 1 in 15; and*
 - (ii) *for jarrah—not exceeding 1 in 12.*
- (e) *Heart and heart shakes:*
 - (i) *For species NOT listed in Table A5—*
 - (A) *where the smaller dimension of the piece is less than 175 mm—not permitted; and*
 - (B) *where the smaller dimension of the piece is 175 mm or more—permitted provided they are within the central one third of the width and thickness of the piece (see Figure C3, Appendix C).*
 - (ii) *For species listed in Table A5—sound or unsound heart and pith and heart shakes are permitted provided they do not exceed one twentieth of the cross-sectional area*

NOTE: The allowance in Item (ii) only relates to the primary structural properties of the timber. For applications where appearance or other serviceability issues are important, it may be appropriate to restrict inclusion of heart, pith and heart shakes.
- (f) *Tight gum veins—*
 - (i) *aggregate length—not exceeding one and a half times the length of the piece*

- (ii) *individual length*—
 - (A) *not extending from one surface to another*—not exceeding one half of the length of the piece; and
 - (B) *extending from one surface of the piece to another*—not exceeding one quarter of the length of the piece.
- (g) *Loose gum veins and ring shakes*—
 - (i) *width (measured radially)*—not exceeding 3 mm;
 - (ii) *aggregate length*—not exceeding one tenth of the length of the piece; and
 - (iii) *extending from one surface of the piece to another*—not permitted.
- (h) *Gum pockets, latex pockets, resin pockets, and overgrowths of injury*—
 - (i) *extending from one surface to another and intersecting an end*—considered an end split (see Item (j) on end splits);
 - (ii) *otherwise*—
 - (A) *individual length*—not exceeding the lesser of three times the width of the piece and 300 mm; and
 - (B) *width (measured radially)*—
 - (1) *occurring on one surface only*—individually not exceeding the lesser of one quarter of the width of the surface on which it occurs and 12 mm; and
 - (2) *extending from one surface to another and not intersecting an end*—individually not exceeding the lesser of one-eighth of the width of the surface on which it occurs and 6 mm.
- (i) *Included bark*—as for loose gum veins.
- (j) *End splits; aggregate length at each end*—not exceeding the lesser of the width of the piece and 100 mm.
- (k) *Checks other than internal*—
 - (i) *width*—not exceeding 3 mm; and
 - (ii) *individual length*—not exceeding one quarter of the length of the piece.
- (l) *Internal checks*—not exceeding in aggregate a loss of one tenth of the cross-sectional area.
- (m) *Primary rot*—
 - (i) *depth*—not exceeding 3 mm; and
 - (ii) *aggregate area in any 2 m length*—not exceeding 150 mm × 100 mm or equivalent area of the surface on which it occurs.
- (n) *Want, wane and Lyctid-susceptible sapwood; in aggregate or individually*—
 - (i) not exceeding one tenth of the cross-sectional area; and
 - (ii) not exceeding one third of the width of the edge on which it occurs and not exceeding one half of the width of the face on which it occurs.
- (o) *Hit and miss*—
 - (i) *within the limits for want and wane*—permitted; and
 - (ii) *exceeding the limits for want and wane*—depth not exceeding 3 mm and individual length not exceeding 600 mm.

- (p) *Bow, spring and twist*—not exceeding the values given in Tables C1 and C2 of Appendix C.
- (q) *Cup*—not exceeding 1 mm per 50 mm of width.

2.2 STRUCTURAL GRADE NO. 2

2.2.1 General

Each piece of timber of Structural Grade No. 2 shall conform to the requirements of Section 1 and shall be free from compression failures and other fractures and splits other than end splits.

No piece shall be of exceptionally low density.

NOTE: See Appendix A for average species density.

2.2.2 Permissible characteristics

Where present in graded pieces, singly or in combinations, the following characteristics shall be within the limits prescribed (see also Clauses 1.9.3 and 1.9.4):

- (a) *Knots (tight or loose, sound or unsound, intergrown or not, round, oval or arris, single or in clusters) including occluded branch stubs, knot holes and holes other than those caused by insects*—not exceeding one quarter of the width of the surface on which they occur.
- (b) *Borer holes not associated with decay*—
 - (i) *diameter up to and including 3 mm*—not exceeding 20 in any 100 mm × 100 mm or equivalent area of the surface on which they occur; and
 - (ii) *diameter over 3 mm or where the distance between holes is less than twice their diameter*—as for knots (see Item (a) above).
- (c) *Termite galleries*—
 - (i) *where they are enclosed*—not permitted; and
 - (ii) *where not enclosed (fully open to inspection)*—as for want and wane (see Item (n) below).
- (d) *Slope of grain*—
 - (i) *for all species except jarrah*—not exceeding 1 in 10; and
 - (ii) *for jarrah*—not exceeding 1 in 8.
- (e) *Heart and heart shakes*:
 - (i) *For species NOT listed in Table A5*—
 - (A) *where the smaller dimension of the piece is less than 175 mm*—not permitted; and
 - (B) *where the smaller dimension of the piece is 175 mm or more*—permitted provided they are within the central one third of the width and thickness of the piece (see Figure C3).
 - (ii) *For species listed in Table A5*—sound or unsound heart and pith and heart shakes are permitted provided they do not exceed one ninth of the cross-sectional area

NOTE: The allowance in Item (ii) only relates to the primary structural properties of the timber. For applications where appearance or other serviceability issues are important, it may be appropriate to restrict inclusion of heart, pith and heart shakes.
- (f) *Tight gum veins*—unlimited.

- (g) *Loose gum veins and ring shakes*—
 - (i) *width (measured radially)*—not exceeding 3 mm;
 - (ii) *aggregate length*—not exceeding one-sixth of the length of the piece; and
 - (iii) *extending from one surface of the piece to another*—not permitted
- (h) *Gum pockets, latex pockets, resin pockets, and overgrowths of injury*—
 - (i) *extending from one surface to another and intersecting an end*—considered an end split (see Item (j) on end splits);
 - (ii) *otherwise*—
 - (A) *individual length*—not exceeding the lesser of three times the width of the piece and 300 mm; and
 - (B) *width (measured radially)*—
 - (1) *occurring on one surface only*—individually not exceeding the lesser of one third of the width of the surface on which it occurs and 20 mm; and
 - (2) *extending from one surface to another and not intersecting an end*—individually not exceeding the lesser of one quarter of the width of the surface on which it occurs and 12 mm.
- (i) *Included bark*—as for loose gum veins
- (j) *End splits, aggregate length at each end*—not exceeding the lesser of the width of the piece and 100 mm.
- (k) *Checks other than internal*—
 - (i) *width*—not exceeding 3 mm; and
 - (ii) *individual length*—not exceeding one third of the length of the piece.
- (l) *Internal checks*—not exceeding in aggregate a loss of one tenth of the cross-sectional area.
- (m) *Primary rot*—
 - (i) *depth*—not exceeding 3 mm; and
 - (ii) *aggregate area in any 2 m length*—not exceeding 150 mm × 100 mm or equivalent area of the surface on which it occurs.
- (n) *Want, wane and Lyctid-susceptible sapwood, in aggregate or individually*—
 - (i) not exceeding one fifth of the cross-sectional area; and
 - (ii) not exceeding one third of the edge on which it occurs and not exceeding one half of the face on which it occurs.
- (o) *Hit and miss*—
 - (i) *within the limits for want and wane*—permitted; and
 - (ii) *exceeding the limits for want and wane*—depth not exceeding 3 mm and individual length not exceeding 600 mm.
- (p) *Bow, spring and twist*—not exceeding the values given in Tables C1 and C2 of Appendix C.
- (q) *Cup*—not exceeding 1 mm per 50 mm of width.