

Australian/New Zealand Standard™

Timber—Classification into strength groups



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Australian/New Zealand Standard™

Timber—Classification into strength groups

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PREFACE

This Standard was prepared by the joint Standards Australia/Standards New Zealand Committee TM/3, Timber Grading, to supersede AS 2878—1986.

The objective of this Standard is to provide producers and users of structural timber with procedures for establishing the strength group to which a species belongs for use in stress-grading structural timber and determining structural properties.

Strength grouping was introduced in 1939 and has since been developed and refined to simplify the presentation and utilization of the information obtained about some hundreds of timber species.

A strength group may be visualized as a nominal species with established clear-wood strength properties representing a collection of actual timber species that have similar or slightly higher mean strength values. The group limits have been chosen so that the ratio between representative strength values of groups is constant at approximately 1.2.

Where the wood of several species is virtually identical, they have been grouped under one standard trade name in AS 2543, *Nomenclature of Australian Timbers*. Because no purpose is served in separating them, timbers so grouped are regarded as a 'species group'. This is not to be confused with a 'species mixture' which is a marketing term for a mixture of species and for which the strength group is that of the lowest species strength group in the mixture.

To cater for normal commercial timber production, visual structural grading rules have been developed with the ratio of strength values between the grades being the same as that between the strength groups. Consequently the interaction of strength groups and visual grades leads to a limited number of sets of design values, termed stress grades.

The following changes have been made for this edition:

- (a) No consideration of species groups; only single species considered.
- (b) Index properties are included.
- (c) Compression test omitted (in line with International Standards).
- (d) Timber sample may now be taken from mill production.
- (e) Specimen size to be 20 × 20 mm in cross-section.
- (f) Specimens to be clear of corewood and brittle heart.
- (g) Minimum sample size for positive grouping is increased to 30.
- (h) Tighter specification of moisture content conditions.
- (i) Test report required.
- (j) Slight modification in specified test procedures.

The term 'normative' has been used in this Standard to define the application of the appendix to which it applies. A normative appendix is an integral part of a Standard.

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Australian/New Zealand Standard
Timber—Classification into strength groups

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard establishes a procedure for the classification of timber species into strength groups based either on the values obtained from testing small clear specimens or on the species mean density at 12 percent moisture content. It specifies the unseasoned and seasoned strength groups of most of the timber species used in Australia.

NOTE: This Standard does not deal with the role that these strength groups play in the determination of stress grades, basic working stresses and characteristic properties, nor does it cover alternative means of determining stress grades of timber.

This Standard describes procedures for single species and does not cover species groups except where strength groups are given in Tables 3.1 and 3.2.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

- | | |
|---|---|
| AS | |
| 1148 | Nomenclature of commercial timbers imported into Australia |
| 2543 | Nomenclature of Australian timbers |
| ISO | |
| 3133 | Wood—Determination of ultimate strength in static bending |
| 3349 | Wood—Determination of modulus of elasticity in static bending |
| BS | |
| 373 | Methods of testing small clear specimens of timber |
| CSIRO | Division of Building Research |
| Mack, J.J. (1979) Australian Methods for Mechanically Testing Small Clear Specimens of Timber, Technical Paper (Second Series) No. 31 | |

1.3 DEFINITIONS

For the purpose of this Standard the definitions below apply.

1.3.1 Species mean

Mean value of a given property estimated from a representative sample (see Appendix A).

1.3.2 Strength group

Classification into which a timber species or species group, as listed in Tables 3.1 and 3.2, is assigned on the basis of the mechanical properties of material free of strength-reducing characteristics or density determination of the species.

NOTE: In descending order there are seven strength groups for unseasoned timber (S1 to S7) and eight strength groups for seasoned timber (SD1 to SD8). Depending on the nature and amount of data on which the classification is made, a strength group may be termed 'positive' or 'provisional' (see Clauses 1.3.4 and 1.3.5).

1.3.3 Positive strength group

Group to which a timber species is assigned on the basis of the testing of small clear specimens to determine mechanical strength properties for five or more trees (see Appendix A) and tested in accordance with the standard methods referred to in Appendix B.

1.3.4 Provisional strength group

Group to which a timber species is assigned on the basis of density or limited mechanical test data.

NOTE: In Tables 3.1 and 3.2, the provisional strength groups are shown within brackets, e.g. (S6).

1.3.5 Seasoned density

Seasoned density refers to the density of timber (including internal moisture) when the moisture content of the timber is 12 percent.

1.3.6 Seasoned timber

For the purposes of this Standard, seasoned timber will be taken to be timber at a moisture content of 12 percent.

1.3.7 Unseasoned timber

For the purposes of this Standard, unseasoned timber will be taken to refer to timber with a moisture content in excess of 30 percent.

1.3.8 Index properties

For the purposes of this Standard, the term 'index properties' is taken to refer to properties that are easily measured and which may be used to verify that a resource has not changed over a period of time. Typical examples of such properties are clear wood density, width of growth rings, knot frequency and log size.

SECTION 2 PROCEDURES FOR THE STRENGTH GROUPING OF A SPECIES

2.1 GENERAL

A seasoned and an unseasoned strength group shall be established as being appropriate for use in the structural design of timber of a species in accordance with Clauses 2.2 and 2.3. Where a strength group is established in accordance with Clause 2.3, it shall be placed in brackets to indicate its provisional nature.

A species shall be given either a positive or a provisional strength grouping depending on the amount and reliability of the information available for the species. Provisional strength groupings are conservative, and desirably so, because of the predictive relationships in making the assessment. When adequate information is available on the strength of the species in one moisture state, i.e. unseasoned or seasoned, but not in the other, a positive strength group shall be assigned for the one that is well documented and a provisional strength group for the other.

2.2 PROCEDURE FOR POSITIVE STRENGTH GROUPING

2.2.1 Sampling

Test specimens shall be taken from a minimum of five properly selected trees of the species being evaluated in accordance with Appendix A.

2.2.2 Testing

A minimum number of 30 test specimens shall be tested in accordance with Appendix B.

NOTE: Values for bending strength and modulus of elasticity are obtained from the tests and the calculated species mean values.

2.2.3 Unseasoned material

Species mean values obtained from tests on unseasoned material will allow the species to be strength grouped in accordance with Clauses 2.2.5 and 2.2.6 for use in the unseasoned condition (i.e. assigned to an 'S' group).

2.2.4 Seasoned material

Specimens used to assess the properties of seasoned timber must have a moisture content within the range of 10–14 percent at the time of test.

For each one percent difference in moisture content from 12 percent, the test data for bending strength shall be adjusted by 4 percent and the test data for modulus of elasticity by 1.5 percent. For test moisture contents above 12 percent the adjustments are positive and for test moisture contents below 12 percent the adjustments are negative.

Species mean values obtained by adjustment to 12 percent moisture content of the results obtained from tests on kiln-dried or air-dried material will allow the species to be strength grouped in accordance with Clauses 2.2.5 and 2.2.6 for use in the seasoned condition (i.e. assigned to an 'SD' group).

2.2.5 Preliminary comparison based on individual critical properties

The species mean values for bending strength and modulus of elasticity are first compared separately with the minimum values listed for each strength group (see Tables 2.1 and 2.2).

The value of a property measured in the seasoned state shall be adjusted to the reference moisture content of 12 percent (see Clause 2.2.4) before it is compared with the tabulated values of SD1 to SD8 in Table 2.2.

TABLE 2.1
PRELIMINARY CLASSIFICATION VALUES FOR UNSEASONED* TIMBER

Minimum species mean	Strength group						
	S1	S2	S3	S4	S5	S6	S7
Bending strength, MPa	103	86	73	62	52	43	36
Modulus of elasticity, MPa	16 300	14 200	12 400	10 700	9 100	7 900	6 900

* As measured or estimated at a moisture content above fibre-saturation point.

TABLE 2.2
PRELIMINARY CLASSIFICATION VALUES FOR SEASONED* TIMBER

Minimum species mean	Strength group							
	SD1	SD2	SD3	SD4	SD5	SD6	SD7	SD8
Bending strength, MPa	150	130	110	94	78	65	55	45
Modulus of elasticity, MPa	21 500	18 500	16 000	14 000	12 100	10 500	9 100	7 900

* As measured or adjusted to a moisture content of 12 percent.

2.2.6 Positive strength classification based on the combination of properties

Where both properties in the unseasoned state have the same classification derived in accordance with Clauses 2.2.1, 2.2.2, 2.2.3 and 2.2.5, the species is assigned to that strength group (prefix S).

Where both properties in the seasoned state have the same classification derived in accordance with Clauses 2.2.1, 2.2.2, 2.2.4 and 2.2.5, the species is assigned to that strength group (prefix SD).

Where both properties listed in Tables 2.1 and 2.2 do not have the same classification, the following procedure as outlined in Table 2.3 shall be applied (see Note):

- Where the lowest group is that obtained from the bending strength, the overall species strength group shall be raised one step above that minimum group only if the modulus of elasticity is in a group at least two steps above that for the bending strength.
- Where the lowest group is that of the modulus of elasticity, the overall species strength group shall be raised one step above that minimum only if the bending strength is in a group at least two steps above that for the modulus of elasticity.

NOTE: A conservative approach would be to assign the species to the lowest group obtained from the individual properties.

TABLE 2.3
COMBINATIONS OF PRELIMINARY CLASSIFICATIONS THAT
PERMIT THE OVERALL STRENGTH GROUP ASSESSMENT
TO BE ONE STEP ABOVE THE LOWEST IN THE COMBINATION

Preliminary classification*		Strength group assessed as S or SD
Bending strength	Modulus of elasticity	
x	x	x
x	$x - 2$	$x - 1$
x	$x + 2$	$x + 1$

* Strength group $x - 1$ is stronger than strength group x ; e.g. if strength group S4 is denoted by x then strength group S3 is denoted by $x - 1$.

2.2.7 Test report

Each positive strength grouping shall be associated with a publicly available test report that includes the following:

- (a) Timber species.
- (b) Timber resource.
- (c) Specified moisture condition, seasoned or unseasoned.
- (d) Sampling procedure used.
- (e) Name of test laboratory.
- (f) Test data obtained including bending strength, modulus of elasticity and moisture content.
- (g) Any index properties measured (see Clause 1.3.8).

2.3 PROCEDURE FOR PROVISIONAL STRENGTH GROUPING

2.3.1 Data available from mechanical testing

Where there is inadequate evidence for positive strength grouping but there are mechanical test results available from a minimum of three representative trees (see Clause 2.2.1), the procedure shall follow that for positive strength grouping (see Clause 2.2) and the strength group shall be lowered by one strength group and placed in brackets to indicate that the grouping is provisional.

2.3.2 Data available only for seasoned density

Where density alone is used to establish the provisional strength group, values of density at 12 percent moisture content are required from at least five representative trees sampled in accordance with Appendix A. The provisional strength group shall be determined from Table 2.4, according to the condition of seasoning. These strength groups shall be placed in brackets to indicate that the grouping is provisional.

NOTE: Because of the imperfect correlation of strength with density, the values listed in Table 2.4 are conservative and it should not be expected that a species positively grouped from its strength properties would necessarily have a density as high as that listed in Table 2.4.

2.3.3 Acceptable difference between unseasoned and seasoned strength groups

For any one species the provisional strength grouping for unseasoned and seasoned material shall not vary by more than one strength group. Any adjustment required shall be on the conservative side, e.g. for a species initially classified as say (S5), (SD3), its final assessment will be (S5), (SD4).

NOTE: This restriction does not apply to positive grouping.

TABLE 2.4
MINIMUM DENSITY VALUES, AT 12 PERCENT MOISTURE CONTENT
FROM FIVE OR MORE TREES FOR ASSIGNING SPECIES TO STRENGTH
GROUPS IN THE ABSENCE OF ADEQUATE STRENGTH DATA

(a) Unseasoned material

Strength group	S1	S2	S3	S4	S5	S6	S7
Based on mean density at 12 percent moisture content, kg/m ³	1180	1030	900	800	700	600	500

(b) Seasoned material

Strength group	SD1	SD2	SD3	SD4	SD5	SD6	SD7	SD8
Based on mean density at 12 percent moisture content, kg/m ³	1200	1080	960	840	730	620	520	420