

Australian/New Zealand Standard™

**Timber—Solid—Stress-graded for
structural purposes—Verification of
properties**



AS/NZS 4490:2011

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee TM-003, Timber Grading. It was approved on behalf of the Council of Standards Australia on 27 January 2011 and on behalf of the Council of Standards New Zealand on 17 December 2010.

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The following are represented on Committee TM-003:

A3P

Australian Timber Importers Federation

BRANZ

Forest and Forest Products Employment Skills Company

Forest and Wood Products Research and Development Corporation

Forests New South Wales

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Australian/New Zealand Standard™

Timber—Solid—Stress-graded for structural purposes—Verification of properties

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee TM-003, Timber Grading, to supersede AS/NZS 4490:1997, *Timber—Stress-graded—Procedures for monitoring structural properties*.

This Standard incorporates Amendment No. 1 (October 2012). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to provide procedures for the verification of properties of structural timber. A range of different verification methods are presented to fit with the range of scales of production and quality assurance programs in the industry.

This Standard specifies requirements for verifying the structural and other nominated properties of stress-graded timber. This document is referenced in AS/NZS 1748.1, *Timber—Solid—Stress-graded for structural purposes*, Part 1: *General requirements*, and its requirements are mandatory for timber produced in accordance with that Standard; however, it can also be used with other solid structural timber products.

The verification process provides confidence that the stress-graded timber complies with the relevant product requirements and is suitable for use in conjunction with the structural property design values for the specified stress grade.

Changes to the 1997 edition are as follows:

- (i) No initial evaluation is included as grading method qualification is now part of AS/NZS 1748.2, *Timber—Solid—Stress-graded for structural purposes*, Part 2: *Qualification of grading method*.
- (ii) Processes for periodic monitoring have been replaced with a check on the verification method.
- (iii) New procedures are included for verification monitoring.
- (iv) Demonstration of compliance. (A third party audit process may be suitable for this purpose.)

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.

CONTENTS

	<i>Page</i>
1 SCOPE	4
2 APPLICATION.....	4
3 NORMATIVE REFERENCES	4
4 DEFINITIONS	5
5 NOTATION	6
6 REQUIREMENTS	7
6.1 General	7
6.2 Structural properties.....	7
6.3 Check of verification method.....	9
6.4 Other properties	10
6.5 Records	10
7 DEMONSTRATION OF COMPLIANCE.....	10

APPENDICES

A TESTING AND ANALYSIS	11
B PROOF GRADING	13
C CONSERVATIVE PRODUCTION TARGETS.....	15
D CUSUM ANALYSIS	17
E DEEMED TO SATISFY USING NZS 3622.....	19
F GUIDANCE FOR SAMPLING AND ANALYSIS OF TEST RESULTS.....	20
G OTHER PROPERTIES	29

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Timber—Solid—Stress-graded for structural purposes—Verification of properties****1 SCOPE**

This Standard specifies the general principles for verification of the properties of sawn structural timber produced using any method of grading. It presents a range of specific methods that can be selected by manufacturers of structural sawn timber. The verification applies at the time of grading.

NOTES:

- 1 This Standard does not apply to market-place surveillance testing to confirm or establish structural properties.
- 2 This Standard does not lead to qualification of a grading method.

2 APPLICATION

This Standard shall be read in conjunction with the relevant product Standard.

This Standard is intended for use by manufacturers of structural timber to verify that the timber produced in a specified period complies with the relevant product Standard and is suitable for use in conjunction with the design properties of the stress grade to which it is assigned. Timber that satisfies the verification requirements may be designated as 'Verified' in accordance with this Standard.

This Standard may also be used as a reference in contractual arrangements for the sale of timber products. It shall be used as the basis for independent production audits.

NOTES:

- 1 Verified timber produced for end use in New Zealand should satisfy the provisions of the NZ Building Code, which has requirements in addition to this Standard.
- 2 Where timber is classified as 'Not verified', it cannot be claimed to be in compliance with this Standard. Normally, such timber is reprocessed with revised grading parameters and verification is repeated or if it meets the requirements of a lower grade, the timber may be re-branded.

3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

AS

- | | |
|--------|--|
| 1720 | Timber structures |
| 1720.1 | Part 1: Design methods |
| 2082 | Timber—Hardwood—Visually stress-graded for structural purposes |
| 2858 | Timber—Softwood—Visually stress-graded for structural purposes |
| 3519 | Timber—Machine proof grading |

AS/NZS

- | | |
|--------|--|
| 1748 | Timber—Solid—Stress-graded for structural purposes |
| 1748.1 | Part 1: General requirements |
| 1748.2 | Part 2: Qualification of grading method |
| 4063 | Characterization of structural timber |
| 4063.1 | Part 1: Test methods |

AS/NZS

4491 Timber—Glossary of terms in timber related Standards

NZS

3603 Timber Structures Standard

3622 Verification of timber properties

3631 New Zealand timber grading rules

4 DEFINITIONS

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

4.1 Batch

A quantity of structural timber of the same dimensions, moisture condition and grade produced and graded by the same process over a specified period of time.

4.2 Batch monitoring

Testing and analysis of a sample taken only from a specified batch of timber to infer the structural properties of the entire batch.

4.3 Characteristic value

A percentile value of a statistical distribution estimated with a specified level of confidence.

NOTE: Characteristic values generally apply to either a sample mean or fifth (5th) percentile values that are estimated with 75% confidence.

4.4 Continuous monitoring

Monitoring by testing and analysis of one or more characteristic properties that is intended to ensure that the product has the required specified structural properties by using a specified sampling rate from production.

4.5 Cumulative sum (*CUSUM*)

A quality control method/tool that may be used to verify the modulus of elasticity of timber.

4.6 Characteristic value for design

Characteristic value determined suitable for structural design in accordance with AS 1720.1 or NZS 3603.

4.7 Indicator property

A primary structural property used to verify the structural properties of stress-graded timber.

NOTE: For products produced in accordance with AS/NZS 1748.1, the indicator properties are identified during the qualification of the grading method.

4.8 Indicator property target value

The value of the indicator property used by manufacturers to verify that all of the properties related to the indicator property achieve specified characteristic values for a batch of stress-graded timber.

4.9 Proof grade

A grading process in which the timber is first sorted then passed through a machine that applies a proof load and breaks pieces that do not comply with the stress grade.

4.10 Proof load

Maximum load applied to a piece of timber, which—

- (a) in Section 4 and Appendix A, is the load at which the static test is terminated; and
- (b) in Appendix B, is the load at which the proof grading machine is set.

4.11 Proof test

A static test in which the test is terminated once the proof load has been reached and whereby only those pieces with strength less than the stress produced by the proof load will fail.

4.12 Sample

A producer-defined quantity of graded timber selected from production and considered representative of a batch or defined quantity of timber.

4.13 Specimen

A single piece of graded timber from a sample used for testing purposes.

4.14 Stress-grade

A classification of structural timber that indicates a suite of characteristic values for design for strength and stiffness properties.

4.15 Stress-graded timber

Timber that has been assigned to a stress grade.

4.16 Stress-grading method

A method of sorting timber into stress grades, including visual stress grading, machine stress grading, mechanical stress grading, acoustic stress grading and combinations of these methods.

4.17 Test comparison value (*TCV*)

4.17.1 *Verified test comparison value*

Minimum value for a test result to provide designated confidence that the property from the production represented by the sample is above the characteristic value for design.

4.17.2 *Not-verified test comparison value*

Maximum value for a test result that indicates with designated confidence that the property from the production represented by the sample is below the characteristic value for design.

4.18 Verification

A process for demonstrating that stress-graded timber complies with the relevant product standard and is suitable for use in conjunction with the structural property design values for the specified stress grade.

5 NOTATION

For the purpose of this Standard, the following notation applies:

$E_{0.05}$ = fifth percentile value of the modulus of elasticity of the data, in megapascals

E_g = factor for setting target production MOE value

E_{mean} = mean modulus of elasticity of the data, in megapascals

i = numerical ranking of a specimen or sample in a data set or series of samples (for *CUSUM*)

IPT = indicator property target value

IPT_E	= indicator property target value for MOE of the graded product
IPT_R	= indicator property target value for a strength of the graded product
k	= <i>CUSUM</i> constant
K	= <i>CUSUM</i> parameter
k_s	= sampling factor, which is a function of the test and analysis methods and the confidence level required
M_i	= mean value from the i -th sample (for <i>CUSUM</i>)
n	= number of tests performed
R	= test data (see Paragraph F2.2)
$R_{0.05}$	= fifth percentile value of strength of the data, in megapascals
R_g	= factor for setting target production strength value
TCV	= test comparison value
TV_E	= target production MOE value
TV_R	= target production strength value
V	= coefficient of variation
V_E	= coefficient of variation for MOE
V_R	= coefficient of variation for strength
y	= <i>CUSUM</i> constant
Y	= <i>CUSUM</i> parameter
z	= <i>CUSUM</i> constant
Z	= <i>CUSUM</i> parameter
ψ_k	= proof load factor

6 REQUIREMENTS

6.1 General

Stress-graded timber shall be deemed ‘verified’ where the structural properties and other properties or attributes assessed according to the requirements of Clause 6 are all determined to be ‘property verified’.

6.2 Structural properties

6.2.1 Verification method and relevant requirements

Structural properties shall be verified using one or more methods from Appendices A, B, C, D or E, as indicated in Table 6.1, and the relevant requirements of Clauses 6.2.2 to 6.2.5.

NOTE: This Standard has been formulated on the basis of random sampling and testing. It may be possible to use biased sampling and/or testing, or alternative evaluation and analysis methods, in such cases the analysis method will need to be modified and calibrated to demonstrate that it achieves the required confidence that the characteristic values for design have been achieved.

The verification method shall be updated in response to feedback from the check on verification methods of Clause 6.3.

6.2.2 Indicator properties

Where required for the selected verification method(s), indicator properties shall be—

- (a) for product produced in accordance with AS/NZS 1748.1, determined in accordance with AS/NZS 1748.2; *or*
- (b) for other products, obtained from Table 6.1.

TABLE 6.1
INDICATOR PROPERTIES AND VERIFICATION

	List A	List B
Indicator property	Modulus of elasticity	Bending strength, <i>or</i> Tension strength parallel to grain
Verification method	Appendix A, <i>or</i> Appendix C, <i>or</i> Appendix D, <i>or</i> Appendix E	Appendix A, <i>or</i> Appendix B, <i>or</i> Appendix C, <i>or</i> Appendix E

6.2.3 Indicator property target value

Where used as the basis for comparisons in the selected verification method, the indicator property target value shall be—

- (a) the value determined in accordance with AS/NZS 1748.2 for product produced in accordance with AS/NZS 1748.1; *or*
- (b) the characteristic value for design, for other products.

6.2.4 Sampling

Where sampling is required for the verification method, the sampling procedure shall ensure that the sample is representative of the batch from which it has been selected. Test specimens shall be selected at random from production to form the required sample. The number of specimens in the sample shall be determined by the producer.

The sample shall be inspected prior to testing to ensure that its characteristics appear similar to the characteristics of the production batch it represents. Where this is not the case, the sample will remain unchanged and a note shall be added to the results indicating the nature of the discrepancy. Where this note has been added to more than one sample in five, then the sampling method shall be reassessed to remove the cause of the discrepancy.

NOTE: Guidance on sampling is given in Appendix F.

6.2.5 Testing

All measurements, observations and testing of specimens selected from each sample shall be undertaken in a timely manner using well maintained, appropriately certified and calibrated equipment, trained staff and standard test procedures.

The test rig shall be calibrated at least annually. The calibration shall be performed by an independent laboratory or organization with experience in calibration.

The tests shall be in accordance with AS/NZS 4063.1, with the following exceptions:

- (a) If the testing is performed soon after production, then ambient conditions are acceptable.
- (b) Where sampled material has been stored under cover for some time, the moisture content at the time of testing shall be within the bounds defined for the condition of the product in the relevant product Standard.

6.3 Check of verification method

6.3.1 General

The structural property verification methods used shall be checked by sampling and testing verified timber at least once per year.

Where species mix and production methods are very similar for a number of producers, product may be pooled but, in such cases, the result from the check (pass or fail test) shall apply to all mills contributing to the sample.

NOTE: It is advisable that all of the structural properties be checked after a number of years of production to ensure that the verification method is delivering verified product that meets all of its structural properties.

6.3.2 Sampling

A sample comprising at least 100 specimens of a single high volume product (size and grade) shall be obtained for each verification method. The specimens shall be cumulatively drawn from the designated size and grade throughout the year. The specimens shall be drawn at random so that each sample is free of bias and represents the production.

Where a product contains a mix of species, the proportion of species in the sample shall be similar to that in normal production.

Where the sample has been stored, its moisture condition at the time of testing shall comply with the definition of seasoned or unseasoned timber in AS 1720.1 (for Australian end use), or NZS 3603 (for New Zealand end use), that applies to the product description.

NOTE: Where product is withdrawn due to non-verification, the specimens taken during the run that was withdrawn should be removed from the accumulated sample.

6.3.3 Testing

Timber shall be tested for modulus of elasticity (MOE) and either bending or tension in accordance with Clause 6.2.5 and AS/NZS 4063.1, using random position test locations.

There are two test stages as follows:

- (a) First stage, a minimum of 50 specimens shall be selected at random from the accumulated sample and tested. Test results shall be evaluated as described in Clause 6.3.4. Where both the evaluated properties exceed the characteristic values for design, there is no need to progress to the second stage.
- (b) Second stage, if the first stage testing gave a characteristic value for MOE or a characteristic value for strength that did not exceed the characteristic values for design for the properties, the remaining specimens in the sample shall be then tested. The results of the first and second stage tests shall be pooled to give a single data set.

Moisture content and density shall be recorded for all specimens.

6.3.4 Evaluation

6.3.4.1 Modulus of elasticity (MOE)

The MOE shall be evaluated on all tested specimens.

The mean MOE of the tested specimens shall be determined as the arithmetic average of the MOE values. The coefficient of variation of MOE shall be calculated as the standard deviation of all MOE results divided by the mean MOE.

The modulus of elasticity shall be evaluated as follows:

- (a) Where the mean MOE is greater than or equal to the characteristic value for design for the nominated stress-grade, the result is a 'pass' for MOE.
- (b) Where the mean MOE is less than the characteristic value for design for the nominated stress-grade, the result is a 'fail' for MOE.

6.3.4.2 *Strength property*

One strength property from either bending strength or tension strength shall be evaluated on all tested specimens. All specimens shall be loaded to destruction.

The fifth percentile strength of the test specimens shall be evaluated using a log-normal fit through all of the test data. The coefficient of variation of strength shall be calculated as the standard deviation of all strength results divided by the mean strength.

The strength property shall be evaluated as follows:

- (a) Where the fifth percentile strength ($R_{0.05}$) is greater than or equal to the characteristic value for design for the nominated stress-grade, the result shall be a 'pass' for strength.
- (b) Where the fifth percentile strength ($R_{0.05}$) is less than the characteristic value for design for the nominated stress-grade, the result shall be a 'fail' for strength.

6.3.5 *Results*

The result of the check of verification method shall be a 'pass' only if both MOE and strength give 'pass' results. Otherwise the result shall be a 'fail'.

A 'pass' result shall be interpreted as meaning that the verification method does not require modification.

A 'fail' result shall be interpreted as meaning that the verification method requires some modification and it shall be modified before further timber is classified as verified.

NOTE: A 'fail' result does not imply that verified timber produced during the period over which the sample for the check was taken is no longer verified.

6.4 **Other properties**

Other properties shall be verified using the method for sampling, testing and analysis specified in Appendix G. Compliance with the specified limits shall indicate a verified property or attribute.

6.5 **Records**

Records shall be maintained to support any claim that stress-graded timber has been verified to this Standard. This shall include documentation of the methods used, sampling and testing undertaken, results obtained and decisions made.

7 **DEMONSTRATION OF COMPLIANCE**

Timber marked or otherwise identified as complying with this Standard shall meet all of its relevant normative requirements.

NOTES:

- 1 A third party audit is a suitable means of demonstrating compliance.
- 2 Attention is drawn to legislation in Australia and New Zealand that protects consumers from false or misleading claims concerning a product. Manufacturers making a statement of compliance with this Standard on product, packaging or promotional material related to that product are advised to ensure that such compliance is capable of being verified.