NZS 3622:2004
(Incorporating Amendment No. 1)

New Zealand Standard

Verification of Timber Properties

NZS 3622:2004

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COMMITTEE REPRESENTATION

Committee P 3622 was responsible for the preparation of this draft Standard and consisted of representatives from the following nominating organizations:

Building Industry Authority
Building Research Association of New Zealand
Forestry Industries Council
Frame and Truss Manufacturers' Association
Institution of Professional Engineers of New Zealand
Ministry of Consumer Affairs
New Zealand Institute of Architects
New Zealand Timber Industry Federation
New Zealand Forest Research Institute Ltd.
Timber Design Society
University of Auckland

Published by Standards New Zealand, the trading arm of the Standards Council, Private Bag 2439, Wellington 6020.
Telephone: (04) 498 5990, Fax: (04) 498 5994.
Website: www.standards.co.nz

AMENDMENTS

No.	*Date of issue*	*Description*	*Entered by, and date*
1	March 2005	Amends tables 5.1 and 5.2 and clauses 9.4, 9.4.1 and 9.4.2	Incorporated in this edition

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NEW ZEALAND STANDARD

VERIFICATION OF TIMBER PROPERTIES

ISBN 1-86975-017-9

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REFERENCED DOCUMENTS

NEW ZEALAND STANDARDS

NZS 3602:2003	Timber and wood-based products for use in building
NZS 3603:1993	Timber structures
NZS 3604:1999	Timber framed buildings
NZS 3631:1988	New Zealand timber grading rules
NZS ISO/IEC 17025: 1999	General requirements for the competence of testing and calibration laboratories

JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

AS/NZS 1748:1997	Timber–Stress-graded–Product requirements for mechanically stress-graded timber
AS/NZS 4063:1992	Timber – Stress-graded – In-grade strength and stiffness evaluation

LATEST REVISIONS

The users of this Standard should ensure that their copies of the above-mentioned New Zealand Standards and referenced overseas Standards are the latest revisions or include the latest amendments. Such amendments are listed in the annual New Zealand Standards *Catalogue* which is supplemented by lists contained in the monthly magazine *Standards Update* issued free of charge to committee and subscribing members of Standards New Zealand.

REVIEW OF STANDARDS

It is recommended that this Standard be reviewed within five years of publication. Suggestions for improvement of this Standard will be welcomed. They should be sent to the Chief Executive, Standards New Zealand, Private Bag 2439, Wellington 6020.

FOREWORD

The objective of this Standard is to specify requirements for the manufacture, structural characterization, evaluation and monitoring of stress graded sawn timber. It does not attempt to describe visual appearance or relate to fitness for purpose aspects of structural timber. It is written to relate to limit states design and to performance documents such as NZS 3603 and AS 1720.

NOTES

NEW ZEALAND STANDARD

VERIFICATION OF TIMBER PROPERTIES

1 SCOPE

1.1
This Standard describes procedures for the initial evaluation and daily quality control requirements necessary to verify that timber has the structural properties claimed for it. The procedures apply to timber that is both visually and machine stress graded.

A suitably qualified organization shall carry out the initial evaluation to establish the particular grades of timber a mill is capable of producing. The same, or another, suitably qualified organization shall undertake audits of the mill's daily quality controls to ensure timber continues to be produced to the claimed grades.

The adequacy of the suitably qualified organizations needs to be ascertained but is outside the scope of this Standard.

C1.1
This Standard does not apply to naturally round timber, glue-laminated timber, plywood, or to laminated veneer lumber (LVL). It provides a basis for verification that timber has the characteristic properties of the grade.

1.2
This Standard is intended for use by producers of verified stress graded sawn timber products. Assessment of compliance is to apply at the plant gate.

2 DEFINITIONS

BATCH — A quantity of structural timber of the same dimensions, moisture condition, finish, and strength grade produced and graded by the same process in a defined time period.

CHARACTERISTIC — Any natural variation, damage, missing fibre, irregularity or similar occurring in timber or wood products which may affect the appearance, strength, durability or utility of the material in use. It includes:

(a) Characteristics intrinsic to tree growth such as knots, gum veins, borer holes, termite galleries and similar; and

(b) Process related characteristics that may result from sawing, felling, drying and other manufacturing processes such as want, wane, cross-fractures and similar.

MOISTURE CONTENT — The mass of the water combined in wood expressed as a percentage of the mass of the oven dry wood substance.

➤

REFERENCE SAMPLE The timber used in the initial evaluation. As a minimum it shall include in its description:

(a) The forest region or source and nature of the saw logs;

(b) The processing description and moisture condition;

(c) The process of sorting the timber that will clearly identify it for future matching;

(d) The sampling plan for collecting the specimens tested.

STRESS GRADE (n) A classification system for structural timber or wood product which gives properties for design purposes. A piece of timber or a population of timber may be deemed to fall into a particular stress grade on the basis of visual, machine, mechanical or other method of assessment.

STRESS GRADE (v) To sort timber or wood products into different established classes according to indicators of material properties.

STRESS GRADED TIMBER Timber which has been assigned to a stress grade.

STRESS GRADING PROCEDURES Methods for stress grading include the following:

(a) Visual stress grading. Each piece of timber or wood product is inspected in its final size and assigned to 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. The stress grade is then given on the basis of the structural grade and the species, group of species or particular population of a species.

(b) Machine stress grading. Each piece is passed through a machine to assess its modulus of elasticity (MoE). This is then used as an indicator of the material properties. The piece must also meet specified limits on visual characteristics before it can be assigned to a stress grade.

TARGET VALUES For strength properties the target stress is an estimate of the property value determined with 75 % confidence that would be exceeded by 95 % of the product.

For stiffness properties the target mean modulus of elasticity value is an estimate of the mean property value. The target fifth percentile modulus of elasticity value is an estimate of the property value determined with 75 % confidence that would be exceeded by 95 % of the product.

3 INTERPRETATION

3.1
In this Standard, the word "shall" indicates a mandatory requirement in order to comply with the Standard. The word "should" indicates a recommended practice.

3.2
The full titles of referenced documents cited in this Standard are given in the list of Referenced Documents immediately preceding the Foreword.

3.3
Clauses prefixed by "*C*" are intended as comments on the corresponding mandatory clauses. They are not to be taken as the only or complete interpretation of the corresponding clause nor should they be used for determining in any way the mandatory requirements of compliance within this Standard. The Standard can be complied with if the comment is ignored.

4 NOTATION

E	The minimum average target modulus of elasticity parallel to the grain
E_{mean}	The mean modulus of elasticity of the sample
E_{target}	The target modulus of elasticity
$E_{0.05}$	The minimum target fifth percentile modulus of elasticity parallel to the grain
$E_{0.05,\ sample}$	The minimum target fifth percentile modulus of elasticity of the sample
f_b	The minimum target bending strength
f_c	The minimum target compressive strength, parallel to the grain
f_t	The minimum target tensile strength parallel to the grain
f_{target}	The target bending strength
$f_{0.05,\ sample}$	The fifth percentile bending strength of the sample.

5 GRADES, GRADE STRESSES AND MODULI FOR STRESS GRADED SAWN TIMBER

5.1
Minimum target stresses and elastic moduli shall be as given in table 5.1 and table 5.2 for the appropriate species, grades and moisture condition.

C5.1
For the derivation of minimum target stresses for timber refer to AS/NZS 4063. The minimum target stresses shown in table 5.1 and table 5.2 for Radiata pine and Douglas fir are representative of most exotic pine species.

Table 5.1 – Minimum target values for visually graded timber

Species	Grade	Bending strength f_b (MPa)	Compression strength f_c (MPa)	Tension strength f_t (MPa)	Modulus of elasticity E (GPa)	Fifth percentile modulus of elasticity (GPa)
Moisture Condition – Dry (m/c = 16 %)						
Radiata pine and Douglas fir	VSG10	20.0	20.0	8.0	10.0	6.7
	VSG 8	14.0	18.0	6.0	8.0	5.4
Moisture Condition – Green (m/c 25 %)						
Radiata pine	G8*	11.7	12.0	4.0	6.5	4.4
* G8 is a visual grade which has been verified in the green condition.						

Amd 1 Mar '05

Table 5.2 – Minimum target values for machine stress graded timber

Species	Grade	Bending strength f_b (MPa)	Compression strength f_c (MPa)	Tension strength f_t (MPa)	Modulus of elasticity E (GPa)	Fifth percentile modulus of elasticity (GPa)
Moisture condition – Dry (m/c = 16 %)						
Radiata pine and Douglas fir	MSG15	41.0	35.0	23.0	15.2	11.5
	MSG12	28.0	25.0	14.0	12.0	9.0
	MSG10	20.0	20.0	8.0	10.0	7.5
	MSG 8	14.0	18.0	6.0	8.0	5.4
	MSG 6	10.0	15.0	4.0	6.0	4.0

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5.2
A producer can offer other species or grades with different stresses and moduli subject to verification in accordance with this Standard.

6 GRADING METHODS

6.1 Production
The method of stress grading shall be at the discretion of the producer. Verification testing shall be undertaken on timber in final size and surface finish and in the moisture condition specified in table 5.1 and table 5.2.

6.2 Visual grading
For grades VSG10, VSG8 and G8 visual grading shall be in accordance with the provisions of NZS 3631.

6.3 Machine grading

Machine stress grading shall be in accordance with the provisions of AS/NZS 1748 except that the references in that Standard to AS/NZS 4490 shall be replaced by references to NZS 3622 and the upper level of moisture content in AS/NZS 1748 shall be 16 per cent.

7 INITIAL EVALUATION

7.1 Purpose

The purpose of an initial evaluation is to establish the stress properties of a reference sample and thus determine whether the proposed grades can be achieved and to determine E_{target} and f_{target} (refer to 9.4) for those grades.

C7.1

Monitoring of stress graded timber production is based on sampling and testing for bending strength and modulus of elasticity (MoE). Initial evaluation is necessary to determine target values of MoE and bending strength so that the properties not continuously monitored, i.e. strength in tension, strength in compression, can reliably be achieved. Initial evaluation should be the basis of threshold settings at machine stress grading sites and a reference for quality audits as well as the basis of adjustment to threshold settings to correct for out of grade trends in properties.

7.2 Properties to evaluate

The following strength and stiffness properties shall be the subject of the initial evaluation:

(a) Bending strength;

(b) Modulus of elasticity;

(c) Strength in tension; and

(d) Strength in compression.

All four properties shall be evaluated in the case of new proprietary grades.

Where manufacturers wish to produce the grades set out in Section 5, then the initial evaluation shall be on a minimum of bending strength and MoE.

7.3 Procedure

7.3.1

An initial evaluation procedure shall be developed in association with an independent suitably qualified organization. This procedure shall be identified in the producer's in-mill procedure manual and shall be endorsed as appropriate by the organization appointed to audit the producer's in-mill monitoring.

7.3.2

The initial evaluation shall:

(a) Identify the reference sample;

(b) Identify the sorting procedure;

(c) Identify the grades and sizes to which the procedure relates;

(d) Evaluate the properties of the sample according to the requirements of AS/NZS 4063 using appropriately calibrated equipment and appropriately trained staff under the supervision of an independent suitably qualified organization;

(e) State or derive target bending strength and modulus of elasticity values for the grade/size combinations that the producer proposes supplying;

(f) State or derive machine threshold values and visual characteristics where the grading method is machine grading;

(g) State or define visual characteristic where the grading method is visual grading; and

(h) Document the evaluation in a report, copies of which shall be held by the audit organization and the producer.

8 AUDIT ORGANIZATION

8.1
The producer shall appoint a suitably qualified organization to carry out audits of its in-mill monitoring on at least a twice yearly basis.

C8.1 Guidance for the appointment of a suitably qualified organization

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), through their Conformity Assessment Committee (CASCO) have jointly developed documents describing the rules, criteria or characteristics for conformity assessment activities. These documents are intended:

- *To be prescriptive;*
- *To determine an organization's competence to perform defined functions; or*
- *To provide equivalent results among organizations applying the document.*

It should be noted that:

(a) The competence of the suitably qualified organization in the audit role is an important part of the achievement of verification;

(b) The audit organization may or may not be the organization developing and supervising the initial evaluation (see Section 7);

(c) The audits should cover the following but this is not an exclusive listing. The producer will develop this listing in association with the audit organization and document it in the in-mill procedure manual.
- *Review of past monitoring data*
- *Compliance with the in-mill procedure manual*
- *Machine settings (grading machine and test equipment)*
- *Equipment calibration*
- *Recording equipment and reporting of results*
- *Training of staff*
- *Marking.*

9 IN-MILL MONITORING

9.1 Monitoring method

In-mill monitoring shall be on either a batch conformance basis or on a continuous monitoring basis.

9.2 Sampling

9.2.1 *Sampling for batch conformance of stress graded timber*

9.2.1.1

A batch shall be sampled and tested as a run of one cross-section and a single grading programme.

9.2.1.2

The minimum sample shall be 30 specimens with an additional 1 per 2000 boards after the first 30,000 boards. Sampling shall be evenly spaced over the batch.

C9.2.1.2

The sampling rate is based on batch size and additionally the need to provide a sample large enough to provide a statistically valid sample.

9.2.2 *Sampling where there is continuous monitoring*

A minimum of one board in every 1000 produced shall be taken for each grade and size being verified, with a minimum of one board, per size and grade per batch. To initiate production there shall be 30 specimens to establish the mill as a producer of continuously verified timber in any size and grade.

9.3 Test procedure

9.3.1 *General*

The specimens shall be tested in bending, on edge according to the procedure in AS/NZS 4063. Bending strength shall be assessed by either testing to destruction or by proof loading testing (refer to 9.4).

In order to ensure the integrity of the results the AS/NZS 4063 static bending test rig shall be calibrated annually. This calibration shall be performed by an independent laboratory/organization with experience in calibration.

9.3.2 *Product release*

Before any timber in a batch (batch monitoring) or run (continuous monitoring) is released from the mill, the specimens of that batch or run shall be tested and passed.

9.4 Acceptance criteria

C9.4

In order to demonstrate compliance to this Standard, manufacturers must produce timber that has the following properties:

$E_{mean} \geq E_{target}$

$E_{0.05,\ sample} \geq 0.67\ E_{target}$ ..... (VSG 8, VSG 10, G8, MSG 8, MSG 6 grades); or
$E_{0.05,\ sample} \geq 0.75 E_{target}$ ..... (MSG 10, MSG 12, MSG 15 grades)

$f_{0.05,\ sample} \geq f_{target}$

Small exemptions have been granted in order to give producers some protection against occasional rogue test results. It is the intent of this Standard that the exemptions only be used in isolated instances.

Amd 1
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9.4.1 *Requirements for batch conformance*

A batch shall be deemed to conform if the following stiffness and bending strength parameters are satisfied:

(a) The mean modulus of elasticity, E_{mean} of the specimens in the sample from grades VSG8, VSG10, G8, MSG8, MSG6 is equal to or greater than E_{target} ($E_{mean} \geq E_{target}$) excepting that if any batch has E_{mean} not less than 0.94 E_{target} then it shall be deemed to conform providing consecutive batches are not below E_{target}. If consecutive batches are below E_{target} then the second batch shall be retested in accordance with 9.5 and action shall be taken to restore average stiffness to above E_{target}.

And

the fifth percentile modulus of elasticity, $E_{0.05,\ sample}$ shall comply with $E_{0.05,\ sample} \geq 0.67\ E_{target}$.

Excepting that if any batch has $E_{0.05,\ sample}$ not less than 0.625 $E_{target,}$ then it shall be deemed to conform providing that consecutive batches are not below 0.67 E_{target}. If consecutive batches are below 0.67 E_{target} then the second batch shall be retested according to 9.5 and action shall be taken to restore $E_{0.05,\ sample} \geq 0.67\ E_{target}$.

$E_{0.05,\ sample}$ shall be determined by using table 9.1 and the ranked results of the sample testing.

(b) The mean modulus of elasticity, E_{mean} of the specimens in the sample from grades MSG10, MSG12, MSG15 is equal to or greater than E_{target} ($E_{mean} \geq E_{target}$) excepting that if any batch has E_{mean} not less than 0.94 E_{target} then it shall be deemed to conform providing consecutive batches are not below E_{target}. If consecutive batches are below E_{target} then the second batch shall be retested in accordance with 9.5 and action shall be taken to restore average stiffness to above E_{target}.

And

the fifth percentile modulus of elasticity, $E_{0.05,\ sample}$ shall comply with $E_{0.05,\ sample} \geq 0.75\ E_{target}$.

Excepting that if any batch has $E_{0.05,\ sample}$ not less than 0.70 $E_{target,}$ then it shall be deemed to conform providing that consecutive batches are not below 0.75 E_{target}. If consecutive batches are below 0.75 E_{target} then the second batch shall be retested according to 9.5 and action shall be taken to restore $E_{0.05,\ sample} \geq 0.75\ E_{target}$.

$E_{0.05,\ sample}$ shall be determined by using table 9.1 and the ranked results of the sample testing.

(c) Either:
the fifth percentile of the sample bending strength, $f_{0.05,\ sample}$ shall comply with:
$f_{0.05,\ sample} \geq f_{target}$

Excepting that if any batch has $f_{0.05,\ sample}$ not less 0.9 f_{target} then it shall be deemed to conform provided that consecutive batches are not below f_{target}. If consecutive batches are below f_{target} then the second batch shall be retested according to 9.5 and action shall be take to restore the fifth percentile bending strength to above f_{target}.

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The $f_{0.05,\ sample}$ shall be determined by using table 9.1 and the ranked results of the sample testing.

Or

if the pieces sampled are proof loaded to no more than their characteristic strength, then there shall be not more than one failure in that sample and none shall fail at less than 90 % of the characteristic bending strength.

Amd 1 Mar '05

Table 9.1 – Order ranking for the fifth percentile determination

Sample size	Order statistic (1)
28	1
53	2
78	3
102	4
125	5

NOTE –

1. The rank of the ordered observations, beginning with the smallest.
2. For sample sizes that fall between those tabulated in table 9.1, interpolation is allowed to determine $E_{0.05,\ sample}$; e.g. for a sample size of 70 where the first three ordered modulus of elasticity values (lowest to highest) are $E_{(1)} = 5.45$, $E_{(2)} = 5.61$, $E_{(3)} = 5.65$, the 5th percentile would be the interpolated value of between 53 and 78 and is calculated using:

$$E_{0.05} = \left(\frac{70-53}{78-53}\right) \text{x } \left(E_{(3)} - E_{(2)}\right) + E_{(2)}$$

$$= \left(\frac{70-53}{78-53}\right) \text{x } (5.65 - 5.61) + 5.61$$

$$= 5.64$$

9.4.2 *Requirements for continuously monitored conformance*

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Production is deemed to conform if the following stiffness and bending strength parameters are satisfied:

(a) The mean modulus of elasticity, E_{mean} of the last 30 specimens tested from grades VSG8, VSG10, G8, MSG8, MSG6 shall be greater than or equal to E_{target}

$E_{mean} \geq E_{target}$

It shall be permitted in isolated instances for E_{mean} to approach 0.94 E_{target} but when E_{mean} is below E_{target} corrective action must be taken to restore E_{mean} above E_{target}.

And

the fifth percentile modulus of elasticity of the last 30 specimens shall comply with:

$E_{0.05,\ sample} \geq 0.67\ E_{target}$ where $E_{0.05,\ sample}$ is taken as the minimum modulus of elasticity of the last 30 specimens.

➤

It shall be permitted in isolated instances for $E_{0.05,\ sample}$ to approach 0.625 E_{target} but when $E_{0.05,\ sample}$ is below 0.67 E_{target} then corrective active action must be taken to restore $E_{0.05,\ sample} \geq 0.67\ E_{target}$.

(b) The mean modulus of elasticity, E_{mean} of the last 30 specimens tested from grades MSG10, MSG12, MSG15 shall be greater than or equal to E_{target}

$E_{mean} \geq E_{target}$

It shall be permitted in isolated instances for E_{mean} to approach 0.94 E_{target} but when E_{mean} is below E_{target} corrective action must be taken to restore E_{mean} above E_{target}.

And

the fifth percentile modulus of elasticity of the last 30 specimens shall comply with:

$E_{0.05,\ sample} \geq 0.75\ E_{target}$ where $E_{0.05,\ sample}$ is taken as the minimum modulus of elasticity of the last 30 specimens.

It shall be permitted in isolated instances for $E_{0.05,\ sample}$ to approach 0.70 E_{target} but when $E_{0.05,\ sample}$ is below 0.75 E_{target} then corrective active action must be taken to restore $E_{0.05,\ sample} \geq 0.75\ E_{target}$.

(c) Either:

the fifth percentile bending strength of the last 30 specimens, $f_{0.05,\ sample}$ shall comply with $f_{0.05,\ sample}$ where $f_{0.05,\ sample}$ is taken as the minimum bending strength of the last 30 specimens.

It shall be permitted in isolated instances for $f_{0.05,\ sample}$ to approach 0.91 f_{target} but when $f_{0.05,\ sample}$ is below f_{target} corrective action must be taken to restore $f_{0.05,\ sample}$ above f_{target}.

Or

if the pieces sampled are proof loaded up to no more than their characteristic strength, there shall be not more than one failure in that sample and none shall fail at less than 90 % of the characteristic bending strength.

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Mar '05

9.5 Retesting

If the monitoring, described in Section 9, shows that the material fails the acceptance criteria, then the data for the pieces sampled from that batch (batch monitoring) or shift (continuous monitoring) shall be retained and a second sample shall be drawn at random from the batch and tested. If the material still fails the criteria, then all the material for that batch or shift or size run produced shall be rejected for that grade.

Rejected material may be sold as verified for a lower grade if it satisfies the requirements of 9.4 for that lower grade and the original grade markings have been removed, obscured or overwritten with the new grade markings clearly denoting the lower grade.

10 MARKING

10.1 Information to be marked

Timber verified in accordance with this Standard shall be marked with a grade designation that applies to the whole piece. The timber shall be legibly and indelibly marked with the following information:

(a) Name or identification mark of the organization grading the timber;

(b) The stress grade at not more than 1500 mm centres;

(c) The grading Standard used to produce the grade.

The date of production should be marked on each piece of timber.

C10.1

(1) Timber that is to be exported to Australia will be required to comply with the marking specified in AS/NZS 1748.

(2) Marking may be by ink-marks, stamps, labels or imprints. If colour marks (see Appendix A) are present in conjunction with a grade by number then the grade by number mark takes precedence. This information should be on the same face.

(3) While grade can be indicated by colours only (see Appendix A) this is not a recommended procedure. It may happen from time to time and there may be no stress grade number on the piece.

10.2 Marking of grade for machine stress graded timber

If colour is used to identify the grade thresholds then the following colours shall be used:

Grade	Colour
MSG 6	Blue
MSG 8	Black
MSG 10	Green
MSG 12	Purple
MSG 15	Orange

The colours to identify the grade to which timber is verified shall be such that these colours can be readily distinguished from any colour scheme used to identify the hazard class for which the timber has been preservative treated.

APPENDIX A
COLOUR MARKS AND GRADE IDENTIFICATION OF MACHINE STRESS GRADED TIMBER

(Informative)

A1. Colour marks

Machine stress graded timber can be colour marked at intervals along its length by the grading machine. The grading machine is measuring the modulus of elasticity over short (or on some machines) long spans. The machine puts a local mark on the face of the timber indicating the result of the evaluation. The marks enable the producer to sort the timber into stress grades. The colour marks and the associated grades are given in 10.2. The marks are the indicator to the producer that the timber locally is at the threshold modulus of elasticity for the associated grade. The actual value measured will be near to or above the fifth percentile modulus of elasticity. The producer from the initial evaluation and knowledge of the wood resource will determine the actual threshold levels associated with the colour marks. Because the marks are indicative of the lower end of the grade range it is normal for timber to have two or more colours on each piece.

Grade can be indicated by colours. The lowest grade indicated by the colour applies to the whole piece. Where a piece is cut in plant the lowest grade marked on each new piece applies to that new piece. This procedure is verified by the producers in in-mill monitoring. Where the regular sequence of colour marking is not continuous along the piece the portion that is not colour marked cannot be assigned a stress grade.

Where colours are used to indicate grade this should be clearly stipulated in the producer's literature.

A2. Identification of grade

Grade identification may be by face or edge stamps, brands, labels or by the colour markings. Where stamps, brands or labels are used on a single piece it will indicate a single grade for the piece, and the colours on the piece cannot be taken by the user to indicate the stress grade of the piece. That is, the grade indicated by the stamp brand or label takes precedence.

NOTES

NOTES

Approved by the Standards Council on 29 October 2004 to be a New Zealand Standard pursuant to the provisions of section 10 of the Standards Act 1988.

First published: 29 October 2004
Reprinted incorporating Amendment No. 1: April 2005

The following SNZ references relate to this Standard:
Project No. P 3622
Draft for comment No. DZ 3622
Typeset and printed by: Standards New Zealand