
Structural timber — Machine strength grading — Basic principles

*Bois de structure — Classement par machine selon la résistance —
Principes de base*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 13912:2017](https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-08f1ee723a0a/iso-13912-2017)

<https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-08f1ee723a0a/iso-13912-2017>



iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 13912:2017

<https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-08f1ee723a0a/iso-13912-2017>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	1
5 General	1
5.1 Machine strength-graded timber.....	1
5.2 Machine strength-grading operations.....	1
5.3 Machine strength-grading quality procedures.....	2
5.3.1 Machine-controlled system.....	2
5.3.2 Output-controlled system.....	2
6 Resource and sawn timber input requirements	3
6.1 General.....	3
6.2 Input requirements.....	4
6.2.1 Resource.....	4
6.2.2 Sawn timber.....	4
6.3 Control of inputs.....	4
6.4 Reprocessing of previously graded material.....	4
7 Machine strength-grading requirements	4
7.1 Machine checking requirements.....	4
7.2 Machine acceptance criteria.....	4
7.3 Machine strength-grading requirements.....	5
7.4 Visual grading requirements.....	5
7.4.1 General.....	5
7.4.2 Automated visual grading.....	5
8 Machine strength-graded timber structural properties	5
8.1 General.....	5
8.2 Initial evaluation.....	5
8.3 Daily evaluation.....	6
9 Product identification	6
10 Documentation	6
Annex A (informative) Example of a machine strength-grading timber standard	7
Annex B (informative) Use of the CUSUM procedure for daily evaluation	20
Annex C (informative) Strength-grading machine acceptance considerations	24
Annex D (informative) Training, supervision and oversight of grading	26

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html. (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 165, *Timber structures*.

This second edition cancels and replaces the first edition (ISO 13912:2005), which has been technically revised.

The main changes compared to the previous edition are as follows:

- Annexes C and D have been added;
- Clauses 5 and 7 have been technically revised.

Introduction

The general principle of this document is that any type of machine strength-grading procedure is acceptable, provided it is defined, controlled, and documented to the extent required to reflect the degree of reliability intended for the structural application of the product.

The body of this document specifies the essential features common to all machine strength-grading operations. The requirements are minimal so as to ensure maximum scope and flexibility in the application of this document to the machine strength-grading process as applied to timber.

[Annex A](#) provides an example of a conformance standard reflecting the requirements of this document.

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 13912:2017

<https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-08f1ee723a0a/iso-13912-2017>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 13912:2017

<https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-08f1ee723a0a/iso-13912-2017>

Structural timber — Machine strength grading — Basic principles

1 Scope

This document establishes the basic principles for rules and procedures governing the machine sorting of timber for use in structural applications. This applies to conventional bending type strength-grading machines as well as more recent machines that use other properties for strength-grading purposes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12122-1, *Timber structures — Determination of characteristic values — Part 1: Basic requirements*

ISO 12122-2, *Timber structures — Determination of characteristic values — Part 2: Sawn timber*

ISO 13910, *Timber structures — Strength graded timber — Test methods for structural properties*

3 Terms and definitions (standards.iteh.ai)

For the purposes of this document, the terms and definitions given in ISO 13910 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO 13910 apply.

5 General

5.1 Machine strength-graded timber

Machine strength-graded timber is sawn wood that has been machine sorted according to selected criteria allowing for classification into structural grades. The machine criteria shall identify mechanical and/or physical properties that reflect the timber strength and can affect the utility of the product.

5.2 Machine strength-grading operations

A typical machine strength-grading operation shall be comprised of a grading machine that sorts an input resource into one or more grades (see [Figure 1](#)).

The data recorded by the machine shall be processed so as to produce a sorting criterion, and this sorting criterion shall be used as a basis for assigning a grade of machine strength timber.

Where applicable, visual requirements for the total piece of timber, the unscanned end portions, or both shall be specified to supplement the information obtained by the machine.

NOTE 1 The “grading machine” comprises one or more devices that can measure properties along the length of a piece of timber as it passes through the machine. For some machines, properties along the length of a piece of timber are not measured, but rather properties are measured that relate to the piece of timber considered in total as a single unit.

NOTE 2 Within the context of this document, the term “scanner” is used to denote the device used to measure a property of the timber, and the term “scanned length” is used to denote that portion of the timber for which measurements are made by the scanning device if it measures properties along the length of a piece of timber. For conventional bending type strength-grading machines, end portions of the timber are not scanned [see [Figure 2 a\)](#)].

NOTE 3 In the use of the conventional bending type of strength-grading machine, the only parameter that is measured (mechanically) along the length of each piece of timber (except for the unscanned end lengths) is the local modulus of elasticity on flat.

NOTE 4 For a machine using single or multiple scanners, the data obtained is commonly used to produce a prediction of strength along the length of a piece of timber [see [Figure 2 b\)](#)]. For this case, the minimum predicted strength value within the piece is usually taken to be the grade control criterion.

5.3 Machine strength-grading quality procedures

Machine strength-grading quality procedures include both qualification and ongoing quality control operations. The quality procedures related to the machine grading operation shall be undertaken by placing checks on the four components of the strength-grading operation: 1) the resource and sawn timber inputs; 2) the machine operation; 3) the visual requirements (when specified); and 4) the graded timber output (see [Figure 1](#)).

The qualification and quality control procedures shall establish that the production is in compliance with expected performance, taking into account the normal temporal variation of the input, as well as the machine, the machine settings, and any other procedure added to define the population.¹⁾

5.3.1 Machine-controlled system

Where quality is controlled through the resource inputs and machine operation, monitoring shall be done to ensure that the resource is similar to that initially used to establish the machine settings.

5.3.2 Output-controlled system

Where quality is controlled through output, the initial evaluation (see [8.2](#)) shall involve sample sizes larger than those normally used for daily evaluation (see [8.3](#)) to ensure that the 5th-percentile strength requirements are met.

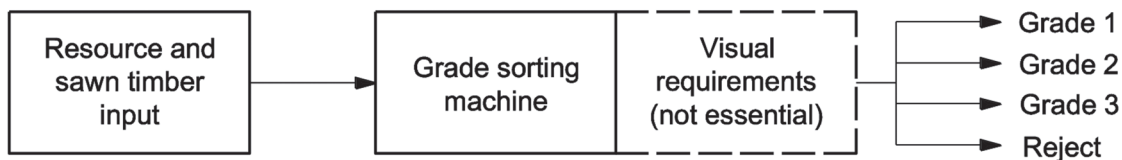
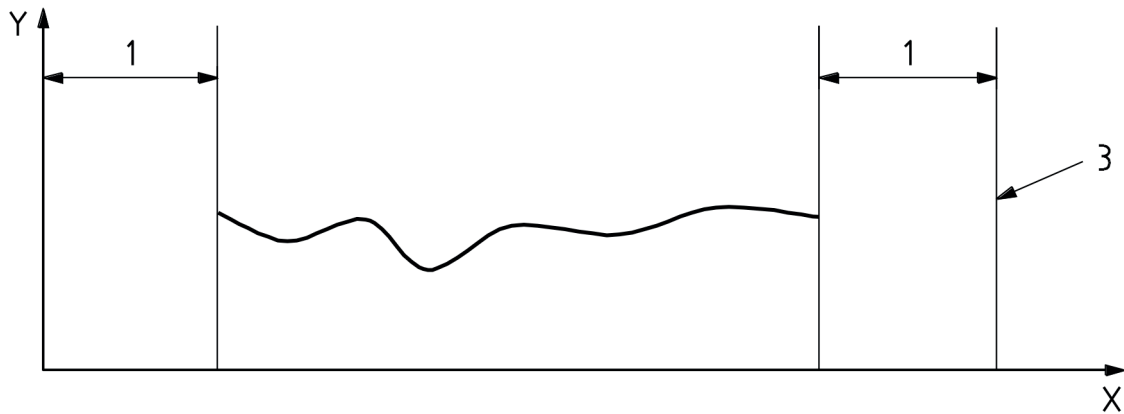


Figure 1 — Schematic of machine strength-grading operation

1) Quality control for products conforming to this document will include programmes for training, supervision and oversight of grading (see Annex D for further explanation).



a) Typical output of a scanner



b) Typical form of processed output

Key

- X distance from start of piece
- Y scanner output
- Y' parameter used to predict strength
- 1 unscanned length (if applicable)
- 2 value used to classify piece (e.g. low-point parameter as shown in figure)
- 3 end of piece

Figure 2 — Measurements made by a strength-grading machine

6 Resource and sawn timber input requirements

6.1 General

The input resources shall be identified in terms of all parameters that can affect the output of the machine grade sorting operation.

6.2 Input requirements

6.2.1 Resource

The parameter that shall be identified is the timber species or mixture of species.

Other parameters that shall be considered are

- a) silvicultural practices used,
- b) log source,
- c) log size,
- d) cutting pattern used to manufacture sawn timber from logs, and
- e) any other parameters deemed to be important.

6.2.2 Sawn timber

Parameters that shall be specified are

- a) condition (such as seasoned, unseasoned, etc.),
- b) moisture content, and
- c) any other parameters deemed to be important.

ITeH STANDARD PREVIEW
(standards.iteh.ai)

6.3 Control of inputs

A periodic check on the resource and sawn timber inputs shall be defined and specified.

<https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-087ee722a0c5/iso-13912-2017>

6.4 Reprocessing of previously graded material

If reprocessing of previously graded material is permitted, then any requirements for re-grading of the material shall be specified.

7 Machine strength-grading requirements

7.1 Machine checking requirements

In addition to verification of the calibration of the scanner, all machine checks specified by the machine manufacturer shall be undertaken.

7.2 Machine acceptance criteria

The introduction of new machine strength-grading processes shall be supported by testing of samples from at least two reference grades containing a random selection of the permitted features, resulting in data on the mean modulus of elasticity and the 5th percentile of at least one strength property. This data shall be permitted to be used to formulate the structural grade model including other grades and sizes, provided it shows a consistent relationship to the reference grades.

The framework for the grading system shall be supported by evidence that it can provide a stable basis for delivering graded products that achieve key characteristic properties.

NOTE The intent is to select reference grades and sample sizes that will serve best to represent the grades in the system, reflecting both the range and frequency of features that can appear in these grades and demonstrating that the grading system is robust enough to differentiate properties for the timber population. [Annex C](#) provides an example of grading machine acceptance considerations.

7.3 Machine strength-grading requirements

The machine grading process shall specify, at regular intervals, checks to ensure:

- a) **repeatability** – within prescribed limits, the scanners shall provide the same readings for repeated passes of the same piece of timber;
- b) **calibration** – within prescribed limits, scanners shall reproduce the original readings made on special pieces of timber set aside for calibration purposes or on non-timber calibration bars;
- c) **consistency** – within prescribed limits and where scanners provide readings along the length of timber, the data from scanners shall indicate a consistent calibration all along the length of a piece of timber.

Grading machines that use the same types of scanners shall be calibrated against the same check procedure.

NOTE Grading machines that are not identical but use the same types of scanners include a number of conventional strength-grading machines. This clause refers to the use of a common standard test method (e.g. ISO 13910) in such cases for calibration purposes.

7.4 Visual grading requirements

7.4.1 General

Where visual grading requirements are deemed to be important then rules to satisfy the strength requirements shall be specified and rules to satisfy relevant utility requirements shall be specified.

For the visual grading requirements that are specified, then a periodic check shall be made to assess the accuracy of the grading process. If a check indicates that the process is inadequate, then appropriate measures shall be specified to modify the process so that the process is adequate.

7.4.2 Automated visual grading

For visual-grading machines that are used to replace visual grading people, the repeatability and reproducibility identified in 7.3 shall be met.

NOTE An example of visual strength-grading requirements, as applied to rectangular timber for structural applications, is given in [Annex A](#).

8 Machine strength-graded timber structural properties

8.1 General

The structural properties shall be as defined and measured as specified in the test methods defined in ISO 13910.

The structural design properties shall be determined from tests on timber having a defined moisture content. If the tests are conducted on timber having a moisture content that differs from that specified by the procedure conforming to this document, the properties resulting from the tests shall be adjusted (using sound engineering principles) so that the structural design properties reflect the intent of these basic requirements and/or the applicable associated design codes.

8.2 Initial evaluation

Once the grading operation has been selected, evidence shall be provided that the resultant output grades have the structural properties stated for the material.

For cases where such evidence is not available or it is not appropriate to link the evidence to other mills, an initial test programme shall be specified. The requirements for this test programme shall be based on sound sampling principles and the tests for the structural properties shall be based on the test procedures specified in 8.1.

NOTE The objective is to involve multiple independent data sets when qualifying a machine for machine controlled operations. Alternatively, the test sample can be a sample representative of the global population that will be graded using the machine; in such cases, the evidence can be linked to other mills carrying out equivalent sorting procedures.

8.3 Daily evaluation

When specified in the quality control documentation, one or more structural properties shall be measured for each production shift on a limited sample of timber. The data obtained shall be applied to a statistical process control procedure and the results used to monitor the control of the strength-grading operation.

9 Product identification

A product identification mark shall be placed on the timber to indicate the standard on which the sorting is based, the grade and/or strength class, and the producer responsible. The product identification mark shall also include any other relevant information required to show suitability for end use.

Each piece of timber shall be marked except for high quality strength-graded timber intended for structural and appearance purposes. For this high quality appearance timber, each shipment shall be accompanied by documentation containing the product identification requirements specified in the standard.

10 Documentation

ISO 13912:2017

[https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-](https://standards.iteh.ai/catalog/standards/sist/31933883-a494-48d9-a908-08ffe723a0a/iso-13912-2017)

Documentation requirements shall include:^{08ffe723a0a/iso-13912-2017}

- a) the standard on which the machine strength-grading process is based;
- b) specifications for the timber grade criteria;
- c) specifications and control checks of the resource input where applicable to machine control operations;
- d) specifications and control checks for the machine grade sorting process;
- e) where applicable, specifications and control checks for the visual requirements;
- f) specifications and control checks of the structural properties;
- g) specifications for the identification of the product;
- h) methods for assigning and confirming a grade; and
- i) any other specifications or materials deemed to be important.